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Centrosema (*Centrosema pubescens*) Leaf Meal as Protein Supplement for Pullet Chicks and Growing Pullets

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Abstract: The study was conducted to determine the optimum dietary inclusion rate of *Cetrosema pubescens* leaf meal (CLM) for pullet chicks (PC) and growing pullets (GP). Eighty four Black Nera pullet chicks were weighed and randomly allotted to four dietary treatments which contained 0, 2, 4 and 6% CLM for A, B, C and D, respectively in a completely randomized design. Treatment A served as control and each treatment was replicated 3 times. The PC experiment lasted for 6 weeks, while the GP experiment lated for 8 weeks i.e after 4 weeks of acclimatization after chicks experiment. The results revealed that inclusion of 2-6% CLM for PC did not have significant (P>0.05) effect on the mean body weight gain (MBWG), feed conversion ratio (FCR), protein efficiency ratio (PER) unlike feed and water intake. However, MBWG, FCR, PER and cost of feed per kilogram live weight gain (CFPKLING), for the GP were significantly (P<0.05) influenced by the dietary inclusion of 2-6%CLM over control. Dietary inclusion of 2-6% CLM for the PC reduced the MBWG averagely by 31.82% over the control, while its inclusion for the GP increased MBWG averagely by 4.61% with reference to control. The decreased in the MBWG for the PC was significance and progressive with the increased concentrations of CLM. Inclusion of 2-6% CLM for PC increased CFPKLWG by 34.38% over control, while for the GP, this parameter was reduced by 12.29% averagely. Hence it is not advisable to include 2-6% CLM in the diet of PC, while 2% CLM is recommended for the GP.

Key words: Centrosema leaf meal, protein supplement, chicken

Introduction

Poultry play significant role in the provision of animal protein required by man to meet his daily protein intake. Capital invested in poultry business is quickly returned, because birds reproduce quickly, highly prolific, efficient feed utilization and birds are not discriminated against both religiously and nutritionally. The feed crises facing poultry industry in Nigeria strongly indicate the need to investigate and utilize cheap and easily obtainable non-conventional feed resources. One of such non-conventional feed resources is leaf meal.

The protein from leaves may be recovered and be fed to farm animals as solution in form of leaf protein concentrates (Farinu *et al*., 1992). Leaf meal made from fodder shrubs is helping small-scale farmers in Tanzania to boost their income (WAC, 2006). The author noted that several hundred rural women in Tanzania collect *Leucaena spp* leaves from the wild, then dry and process them into meal cattle and package it into bags for sale. MDAIWM (1945) noted that pasture reduces the cost of rearing poultry and allows the farmer to use a cheap and simple growing ratio. Various leaf meals have been used in poultry diets, including those of leucaena (Udedibie and Igwe, 1989), amaranthus (Frages *et al*., 1993), centrosema (Ngodigha, 1994 and Nworgu, 2004), cassava (Ogbnna and Oredein, 1998), among others. D'Mello (1995) recommended 5.0 and 10.0% dietary inclusion levels of leaf meals for broiler chicks and laying hens, respectively. Nworgu (2004) recommended 2% *Mimosa invisa* and *Puerairia phaseoloides* leaf meals for broiler chickens and 2.5% *Centrosema pubescens* for broiler starters and finishers. Nguyen *et al*. (2003) noted that in diet for laying hens and quails, maize grain can be replaced by rice by-products supplemented with 6% of *Trichantera gigantean* leaf meal, with positive effects on egg quality and no change in egg production. Ademola and Farinu (2006) recommended dietary inclusion of *Tithonia diversifolia* in combination with either penicillin or streptomycin at 100 ppm in the diet of laying hens, while Odunsi (2003) recommended 100 and 150g/kg of *Lablab purpureus* leaf meal for laying hens. The importance of legume leaf meals in poultry has been recognized by farmers because of their relatively high content of protein, some minerals and vitamins (Topps, 1992; Nworgu, 2004). Leaf meal supplements have been included into the diets of poultry as a means of reducing high cost conventional protein sources and to improve profit margin (Topps 1992; D'Mello 1995; Odunsi *et al*., 1999; Nworgu and Fapohunda, 2002). Forage meals and yellow maize are the natural sources of carotenoid (D'Mello, 1995). However, the author noted that major constrains of leaf meal utilization in non-ruminants nutrition are relatively high fibre, low energy, anti-nutritional factors and reduced feed intake.

Centrosema pubescens is vigorous, trailing, twining and

Table 1: Gross composition of experimental diets

	Experimental Diets							
	Pullet chicks				Growing pullets			
Ingredients (%)	A	B	C	D	A	B	C	D
Maize	30.00	30.00	30.00	30.00	20.30	20.20	20.30	20.25
Wheat offals	21.00	21.00	21.00	21.00	-	-	-	-
Corn bran	-	-	-	-	23.40	23.40	23.30	23.35
Palm kernel cake	12.00	12.00	12.00	12.00	21.00	21.10	21.10	21.10
Cocoa pod husk	8.50	8.50	8.50	8.50	9.50	9.50	9.50	9.50
Soybean meal	14.60	13.60	12.15	10.50	11.00	9.50	8.00	6.50
Groundnut cake	6.55	5.55	5.00	4.65	6.50	6.00	5.50	5.00
Centrosome leaf meal	0.00	2.00	4.00	6.00	0.00	2.00	4.00	6.00
Fish meal	2.00	2.00	2.00	2.00	3.50	3.50	3.50	3.50
Bone meal	2.00	2.00	2.00	2.00	2.50	2.50	2.50	2.50
Oyster shell	1.00	1.00	1.00	1.00	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
*Vitamin-mineral premix**	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Methionine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Calculated Analysis								
Crude protein (%)	19.03	18.97	19.00	19.06	18.85	18.46	18.07	7.68
Crude fibre %	6.89	7.21	7.50	7.60	8.83	8.89	9.03	9.07
Metabolizable energy ($kcaL^{-1}kg$)	2640	2628	2618	2602	2526	2512	2498	2483
Determined analysis								
Crude protein (%)	20.50	20.55	21.11	21.15	20.69	20.49	20.39	0.24
Crude fibre (%)	8.17	8.88	8.98	9.90	6.85	7.18	8.82	8.88
Metabolizable energy ($kcaL^{-1}kg$)	2740	2764	2770	2758	2700	2724	2711	2718

* Vitamin-mineral premix. Provides per kg of diet: Vit. A = 10000iu; Vit D3 = 1500iu; Vit. E = 3iu; Vit K = 2mg, Ribofl = 3mg; Pantothenic acid = 6mg; Niacin = 15mg; chlorine = 3mg; Vit. B12 = 0.08mg; Folic acid = 4mg; Mn = 8mg; Zn = 0.5mg, Iodine = 1.0mg, Co = 1.2mg, Cu = 10mg and Fe = 20mg.

climbing perennial herb with trifoliate leaves and is fairly drought tolerant (Skerman *et al.*, 1988). The authors noted that green matter yield of *C. pubescens* varied from 13.5 to 40t/ha/year. Nworgu and Ajayi (2005) reported that biomass and dry matter yield of *C.pubescens* was 7.34-7.56 and 3.75-3.78t/ha/year, respectively. However, the information on the use of centrosema leaf meal (CLM) as protein supplement, in pullet chicks and growing pullets nutrition is limited, unlike other leguminous and non-leguminous leaf meals (*Gliricidia sepium, Leucaena leucocephala, Tridax procumbens and Manihot esculenta*). *Centrosema pubescens* is in abundance in humid tropical environment. Hence, the objective of the study was to evaluate the performance of Black Nera pullet chicks and growing pullets fed CLM supplement.

Materials and Methods

Eighty four Black Nera pullet chicks were weighed and randomly allotted to four dietary treatments which contained 0, 2, 4 and 6% *Centrosema pubescens* leaf meal (CLM) for treatments A,B,C and D, respectively in a completely randomized design. Treatment A served as control (Table 1). Each treatment was replicated three times. There were seven birds per replicate; The experiment lasted for 6 weeks. At the end of the sixth week, the birds were mixed together and fed commercial feed for 4 weeks redistributed to four dietary treatments as in the pullet chicks, but in a completely randomized black design. Each phase was fed its own diet (Table 1).

Feeds and water were served *ad – alibitum*. Routine management practices were duly carried out. Data on feed and water intake were recorded on daily basis, while weight gain was recorded on weekly basis and feed conversion ratio was calculated based on the data from feed intake and weight gain. The protein efficiency ratio (PER) was calculated by dividing mean body weight gain by the mean protein consumed. The leaves of *C.pubescens* were harvested from and around the paddocks in the Institute of Agricultural Research and Training (IAR&T), Ibadan. The leaves were detached from the vines and were air and sun-dried for 3 days to a moisture content of about 12% (D'Mello, 1995). The dried leaves were milled using a hammer mill with a screen size of 1.0 – 2.0mm. The CLM was used to replace soybean meal and groundnut cake weight for weight in both pullet chicks and growing pullet experiments. Samples were collected for proximate analysis according to AOAC (1990). The mineral elements were analyzed by the methods outlined by Boehringer (1979), while the gross energy of CLM was determined according to Peirette (2005) (4354 + 2.131CP ± 14). Data collected were subjected to analysis of variance (ANOVA), while Duncan's Multiple Range Test (Steel and Torrie, 1980) was used to assess the significant differences among the treatment means. Significance was accepted at 0.5 level probability. The errors were calculated as standard errors of means (SEM).

Table 2: proximate chemical composition of centrosome (*Centrosome Pubescens*) leaf meal

Fraction	Centrosome Leaf Meal (% on Dm basis)
Dry matter	88.00
Crude protein	22.45
Ether extract	3.00
Crude fibre	6.43
Ash	7.74
Nitrogen free extract	60.38
Gross energy ($kcaL^{-1}kg$)$^{+}$	4402
Phosphorus	0.53
Calcium	0.80
Potassium	0.72
Magnesium	0.30
Sodium	0.20

+Estimated by procedure of Peiretti (2005)

Results

The results of the proximate composition of centrosema (*Centrosema pubescens*) leaf meal (CLM) are presented in Table 2. The CLM is rich in crude protein (22.45%), phosphorous (0.53%), calcium (0.80%), potassium (0.72%) and magnesium (0.30%).

The performance indices of pullet chicks (PC) and growing pullets (GP) are presented in Table 3. The final body weight (FBW), mean body weight gain (MBWG), total feed intake (TFI), feed conversion ratio (FCR), daily protein intake (DPI), protein efficiency ratio (PER) were significantly (P<0.05) affected by the dietary inclusion of the CLM for PC and GP. The best of the aforementioned parameters for the PC was in control, while for the GP fed 2-6% CLM had the best of the parameters. The cost of feed per kilogram live weight gain (CFPKLWG) was increased averaged on the PC fed 2- 6% CLM by 34.38% over control, while the GP fed diets containing 2-6% CLM had reduced CFPKLWG of 12.29% averagely compared to control. Feed intake was significantly (P<0.05) increased for the PC fed diets containing CLM, while dietary inclusion of CLM for the GP resulted to significant reduction of fed intake with reference to control (Table 3).

Discussion

The diets of PC and GP used in the present study met the nutritional requirements of the birds and are similar to the standards of NRC (1994). The crude protein (CP) value of CLM in this study is higher than the report of Aletor and Omodara (1994) (12.50%), but similar to the submission of Nworgu *et al.* (2001) (19.60%), Rahaujo *et al.* (1986) (21.4%) and Nworgu 2004 (23.24%). Wilson and Lansburg (1959) reported that CLM contained 20.0% CP with 30.0% CF. However, Nworgu and Ajayi (2005) noted that CLM harvested at 12 weeks of age contained 18.7, 11.80, 6.98 and 4.42% of CP, CF, ash and EE, respectively. The gross energy (GE) of CLM (4402 kcal/kg) fall within the range reported by Raharjo *et al.* (1986) (4326-4802 kcal/kg) for tropical legumes and GE of Mediterranean forages (4558-5111 kcal/kg) as reported by Peiretti (2005). The calcium and phosporus concentrations for CLM in the present study are higher than that reported by Raharjo *et al.* (1986) whose values were 0.72 and 0.23% for calcium and phosphorus, respectively, but they are in harmony with the reports of Gohi (1981) and Leche *et al.* (1982) who reported 0.78-1.36% for calcium and 0.13-0.45% for phosphorus. Variations in the CP, CF, ash and the minerals could be attributed to the age of cutting, climatic conditions, methods of processing and analyses.

Dietary inclusion of CLM (2-6%) (20-60g/kg) for pullet chicks significantly depressed the MBWG, TFI, FCR and PER. Poor performance of these birds could be attributed to the presence of some anit-nutritional factors (Skerman *et al.*, 1988; D'Mello, 1995), which resulted to poor feed digestibility and utilization (D'Mello, 1992). The results of this trial tended to agree with earlier observations that dietary inclusion of leaf meals of *L.leucocephala, G. sepium, C cajan, S. sesban and M. esculenta* depressed growth, feed intake, FCR and growth rates of chicks at levels ranging from 75-100g/kg (D'Mello *et al.*, 1987; Raharjo *et al.*, 1988; Udedibie and Igwe 1989; Ogbonna and Oredein 1998). However, in the present study 2-6% of CLM resulted to depression of growth of the pullet chicks.

This result is contrary to that reported by Omeje *et al.* (1997) who concluded that 5.0-10.0% of CLM resulted to elevation of weight gain and Nworgu (2004) who recommended 2.5-5.0% CLM for broiler chicks and broiler finishers. Daghir (1995) recommended 2% *L.leucocephala* leaf meal (LLM) for broiler starters and chicks starters and 3% LLM for broiler finishers, while Donkoh *et al.* (1999) recommended 25g/kg *Cnidoscolus aconitifolius* leaf meal for broiler chickens optimal performance.

Dietary inclusion of 20-60g/kg CLM for Black Nera growing pullets significantly (P<0.05) and progressively reduced the feed intake due to the presence of anti-nutritional factors (Skerman *et al.*, 1988; D'Mello, 1995). Similar observations were made by Udedibie and Opara (1998) when growing broilers and laying hens were fed diets containing graded leaves of *Alchornia cordifolia* and Odunsi *et al.* (2002) who fed laying hens *Gliricidia sepium* leaf meal (GLM). Odunsi *et al.* (2002) concluded that inclusion of GLM in layers diets significantly (P<0.05) reduced feed consumption in a linear fashion. Average daily feed intake in this study is similar to the result of Odunsi *et al.* (2002) (116.60- 123.90g/bird), but lower than the submission of Udedibie and Opara (1998) (115-152.1g/bird), though higher than the result at Sobamiwa and Akinwale (1999) (67.3-68.0g/bird). The GP fed diets containing 2-6% CLM had significant (P<0.05) elevated MBWG, PER, FCR and reduced CFPKLWG. Similar observation was made by Omeje *et al.* (1997) when they fed broiler chickens 5-10%

Table 3: Performance of black nera pullet chicks and growing pullets fed experimental diets

Parameters	Experimental Diets A	B	C	D	SEM
Pullet Chicks					
Initial live weight (g bird)	36.00	35.00	37.00	36.00	-
Final body weight (g bird) in 0-6 weeks	375.00[a]	320.00[b]	271.00[d]	284.00[c]	5.00
Mean body weight gain (g bird) in 6 weeks	339.00[a]	285.00[b]	234.00[d]	248.00[c]	4.10
Average daily weight gain (g bird)	8.07[a]	6.78[b]	5.57[d]	5.90[c]	0.10
Total feed intake (g bird) in 6 weeks	963.74[d]	1010.02[a]	984.25[c]	997.53[b]	3.26
Average daily feed intake (g bird)	22.95	24.05	23.44	23.75	-
Daily protein intake (g bird)	4.16[b]	4.38[a]	4.37[a]	4.43[a]	014
Protein efficiency ratio	1.94[a]	1.55[b]	1.27[c]	1.35[c]	0.03
Feed conversion ratio	2.84[c]	3.55[b]	4.21[a]	4.02[a]	0.11
Total water intake (mL^{-1}bird) in 6 weeks	2148.44[a]	1840.85[c]	1879.20[b]	2131.33[a]	8.66
Average daily water intake (mL^{-1}bird)	51.15	43.83	44.74	50.75	-
Feed water ratio	1:2.23	1:1.82	1:1.91	1:214	
Cost of feed (N kg)	30.23	29.77	29.49	29.07	-
Cost of feed per kg live weight gain (N kg)	85.94	105.50	124.04	116.93	
Mortality (%)	0.0	0.0	0.0	0.0	-
Growing pullets					
Initial live weight (g bird)	609.33	610.00	608.75	615.75	0.02
Final body weight (g bird) in 10-18 weeks	1308.00[c]	1350.00[a]	1327.61[b]	1350.00[a]	6.10
Mean body weight gain (g bird) in 8 weeks	698.67[c]	740.00[a]	718.68[b]	734.00[ab]	2.50
Average daily weight gain (g bird)	12.48[b]	13.21[a]	12.84[b]	13.11[a]	0.11
Total feed intake (g bird) in 8 weeks	6348.30[a]	625.24[b]	6193.44[c]	6199.25[c]	8.0
Average daily feed intake (g bird)	113.36[a]	111.75[b]	110.60[c]	110.70[c]	0.50
Daily protein intake (g bird)	21.03[a]	20.24[b]	19.95[b]	19.83[b]	0.2
Protein efficiency ratio	0.59[b]	0.65[a]	0.61[ab]	0.66[a]	0.02
Feed conversion ratio	9.09[a]	8.46[b]	8.62[ab]	8.44[b]	0.11
Total water intake (mL^{-1}bird) in 8 weeks	11472[a]	11218[a]	11030[b]	11037[b]	24.0
Average daily water intake (mL^{-1}bird)	204.86[a]	200.32[ab]	196.96[b]	197.09[b]	5.0
Feed water ratio	1:1.81	1:1.79	1:1.78	1:1.78	
Cost of feed (N kg)	31.43	30.55	28.95	28.85	
Cost of feed (consumed N bird)	199.53	191.19	179.30	178.84	
Cost of feed per kg live weight gain (N kg)	285.59	258.36	249.49	243.65	
Mortality (%)	9.52(2)*	9.5(2)*	4.76 (1)*	4.76 (1)*	

abcd:Means with different superscripts on the same horizontal row differ significantly (p<0.05). ( )* = Number of bird that died

CLM and Nworgu (2004) who recommended 2.5 - 5.0% CLM for broiler chickens. However, Ngodigha (1994) reported that broiler chickens placed on 0.0% CLM had highest body weight gain, which was closely followed by those placed on 5.0% CLM though not significant. Odunsi (2003) reported that feeding *Lablab purpureus* leaf meal to layers at 100 and 150g/kg significantly reduced feed intake and egg production, while egg weight, FCR and body weight change were not affected significantly (P>0.05) by the dietary treatments.

The Black Nera chicks fed CLM supplements had better FCR (2.84-4.21) than the Black Nera GP (8.44- 9.09). This could be attributed to the fact that the GP ate more feed with low rate of feed utilization due to presence of anti-nutritional factors (D'Mello, 1995). The GP tolerated dietary inclusion of CLM more than the PC due to better developed organs. The PER in the present study is lower than the values reported by Nworgu (2004) when the author fed broilers diets containing CLM.

Dietary inclusion of CLM for the PC significantly (P<0.05) affected the water consumption at 6% CLM compared to 2-4% CLM, unlike GP. Water intake and feed water ratio in the present study are in harmony with the result of Oluyemi and Roberts (2000). Okeke and Oluremi (2003) reported that incorporation of dried amaranthus *(Amaranthus hybridis)* and lettuce (*Lettuce lactusa*) vegetables did not significantly (P>0.05) affect feed intake, weight gain, FCR, egg weight and egg shell thickness, but had significant effects on water consumption, egg production and yolk colouration. The mortality recorded was as a result of coccidiosis infection.

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