Trop. Anim. Prod. Invest. 18 (1): 60-67 (2015)
ISSN: 1115-2540
http://animalsci.agric.ui.edu.ng/TAPI/index.php/tapijournal/index

ORIGINAL RESEARCH ARTICLE

Effects of graded levels of *Calapogonium muconoides* leaf meal on the performance of broiler finisher birds

***[1]Anyanwu N. J., [1]Ibeh C. E, [2]Ekpe I.I and [3]Etela. I.**

**[1]Dept. of Animal Science and Technology, Federal University of Technology, Owerri, Nigeria*
[2]Dept of Soil Science and Technology, Federal University of Technology, Owerri
[3]Department of Animal Science and Fisheries, University of Port Harcourt, Port Harcourt

ABSTRACT

Readily available and local sources of protein is a major limitation to broiler production for small holder production systems of southeast Nigeria. Soybean, groundnut cake, fishmeal and other conventional sources are used but expensive. Calapogonium muconoides leaf meal is commonly grazed by ruminants while the information on its nutritive value in poultry has not been well documented. Thus the effects of levels of inclusion of Calapogonium muconoides leaf meal on the performance of broiler finisher was evaluated. The proximate composition some antinutrirional factors and minerals (calcium and phosphorus) in the leaf meal of Calopogonium mucunoides were analysed. Also, in a 28-day feeding trial using 4 week old broiler finisher birds, varying levels of inclusion of Calopogonium mucunoides leaf meal was incorporated at 0% (D1), 5% (D2), 10% (D3) and15% (D4) as a replacement for soybean meal and were fed to one hundred (100) Arbor Acres type broilers in a completely randomised design with three replicates to determine the feed intake and weight gain. After the end of the feeding trial, some birds were analysed for carcass characteristics Result of proximate analyses on a dry matter basis, revealed that C. mucunoides contained 20.0% crude protein, 18.77% crude fibre, 4.88% ether extract, 6.73% ash, and 40.93% NFE. Calopogonium mucunoides leaf meal had high levels (mg/g) of calcium (116) and phosphorous (331.6 tannins (0.71%), saponin (0.53%), alkaloids (1.05%), phenols (0.63%), phytate (0.32%), oxalate (0.12%) and hydrocyanic acid HCN (6.70mg/Kg). The performance result showed no significance differences for all the parameters measured (p>0.05) except for daily feed intake (p<0.05). The final average body weight (grams) of 2089.1, 2468.9, 2465.7 and 2442.2 ±197 were noticed for the broilers on D1, D2, D3 and D4 respectively. The average daily body weight gains were 35.4, 43.9, 45 and 42.5g ± 5.3 for birds on D1, D2, D3 and D4 respectively. Average daily feed intakes for birds on D1 to D4 were also 160.18, 145.1, 150.1 and 134.7g ± 14.98 respectively. Feed conversion ratio were 4.5, 3.4, 3.3 and 3.2g± 0.23 for birds on D1, D2, D3 and D4 respectively. There were significant differences observed for daily feed intake, being lower with high percentage of C. mucunoides leaf meal inclusion. The carcass and organ characteristics showed no significant difference (p>0.05) among the four diets, except for the shank 3.68, 3.34, 4.30, 3.55 ± 0.21% and liver 2.1, 2.48, 1.80, 1.78 ± 0.19 % which were significantly different (p<0.05). It is therefore concluded that C. mucunoides leaf meal can be safely incorporated into broiler finisher diets up to 15% level with superior feed conversion ratio and without any harmful effects.

INTRODUCTION

Small scale poultry production has been identified as a viable pathway out of poverty for majority of rural households in south eastern Nigeria. In Nigeria, despite the prevalence of smuggled frozen poultry in the market, consumers have preference for locally produced poultry. In addition, recent health concerns have led to preference for white meat over red ones. This is accentuated by the

increase in the number of households engaged in the business as well as the choice of poultry business in Nigeria by government's supported empowerment and poverty reduction programmes such as National Poverty Alleviation Programmes (NAPEP) and Second National Fadama Development Project (FADAMA II). However, the prospect of this profitable venture is threatened by the high cost of feeds which significantly reduces the profit margins. The supply of traditional energy and protein feed ingredients has been severely affected by the internal crises and insurgency which has displaced a significant proportion of farmers producing grains and protein feedstuff from northern Nigeria (Cambel, 2014). The displacement of farmers means that land is not being cultivated for the growing season. National Emergency Management Agency (NEMA) estimates that more than 60 percent of the farmers in the food basket near Lake Chad have fled (Cambel, 2014). This has resulted to astronomical increases in feed prices and severe scarcity as feed millers are experiencing acute shortage of major feed ingredients. In order to reverse this trend, alternative ingredients which are readily available and cheap and capable of providing the required nutrients in terms of protein are needed.

In the recent times, many studies have suggested the use of leaf meals in broiler diets as a possible source of cheap protein because they not only serve as a protein source but also provides some necessary vitamins, minerals and oxycarotenoids which provides the yellow colour of broiler skins, shank and egg yolk (D'Mello *et al.*, 1987, Opara 1996). Utilization of leaf meals such as *Gliricidia sepium* (Ige *et al.*, 2006), Wild sun flower (Odunsi *et al.*, 1996), mimosa leaf meal (Nworgu and Napohinda, 2002), *leucaena* leaf meal (D'Mello *et al.*, 1987), *Microdesmis puberula* leafmeal (Esonu *et al.*, 2002), neem leaf meal (Esonu *et al.*, 2005), oil palm leaf meal (Esonu *et al.*, 2008), *Calopogonium mucunoides* (Asongwed *et al.*, 2003) and *Vernonia amygdalina* leaf meal (Anachunam, 2010) have all been reported.

Calopogonium mucunoides is a trailing or twining perennial legume that is propagated from seeds and grows well in south east Nigeria. It is a medicinal plant popularly known as 'Oru-agbara' in Oba, Anambra state. It is not an edible plant but the natives in some villages in Imo, Abia and Lagos States, claim by oral tradition, that its leaf decoction is used as blood tonic. Also some villages in Anambra State (Oba, Ojoto, Obosi, and Oraifite) traditionally supply the fresh leaves to chicken in control of pecking and cannibalism.

In most of these places, it is considered as a weed in farms and fallow lands. So far, not much work has been done on the use *of Calopogonium mucunoides* leaf meal as feed ingredient in broilers diet in south east Nigeria. Again, the nutritive value and anti-nutritional compounds present in *Calapogonium mucunoides* leaf meal have rarely been reported. It is mainly used as cover crop, alone or in mixture with other legumes, especially in rubber, oil palm or in young forest plantations (Cook *et al*., 2005**).** Calopo is used as green manure (Chin Chen Peng *et al*., 1997). It also provides a check against soil erosion, reduces soil temperature, improves soil fertility and controls weeds (Cook *et al*., 2005; *Calopogonium mucunoides* can be grazed and made into hay or silage.This research, therefore, was designed to examine the nutritional value of *Calopogonium mucunoides* leaf meal, and also to determine the optimum inclusion level of the leaf meal when incorporated in a diet for the performance and carcass characteristics of broiler finisher birds.

METHODOLOGY

The research was carried out at the Poultry section of the School of Agriculture and Agricultural Technology (SAAT) Teaching and Research Farm, Federal University of Technology, Owerri. The laboratory analyses were done at the National Root Crops Research Institute (NRCRI) Umudike. The leaves of *Calopogonium mucunoides* used for this research were collected from fallow farmlands at Ukome Farm Settlement in Umuahia North Local Government Area, Abia state. They were harvested in a fresh state and authenticated by a taxonomist of the Department of Forestry and Wild life Technology, Federal University of Technology Owerri, Imo state. The leaves of the *C. mucunoides* were plucked out from the vines and chopped into smaller bits for faster and effective drying. The chopped leaves were air-

dried during the dry months of January and March, which represented the harmattan season, until they became crispy while still retaining the greenish colour.

The dried leaves were then milled in a hammer mill to produce leaf meal comprising of ground leaf materials of variable particle sizes. A sample of the leaf meal was subjected to proximate analysis according to AOAC, (1990). Mineral and anti-nutritional factor analysis was also carried out according to AOAC, (1990). The variety of other feedstuffs used to compound the experimental diets were purchased from a commercial feedstuff dealer.

One hundred Arbor Acres of 4 weeks old broiler finisher birds were used for the study. The birds were divided into four groups of twenty-five birds each and randomly assigned to four treatment diets in a completely randomised design. Feed and water were provided *ad libitum* while the experiment lasted for 28 days.

The experimental diets were formulated to contain three levels of inclusion of the *Calapogonium mucunoides* leaf meal at 0% (D1) as control, 5% (D2), 10% (D3), and 15% (D4). Tables 1 and 2 show the composition of experimental diets and calculated chemical composition respectively.

Initial weight, final body weight, weekly body weight gain, average daily body weight, average daily feed intake and feed conversion ratio, were measured. Each bird was individually weighed at the beginning of experiment and at the end of each week and the weight recorded. The average weight per treatment was obtained by dividing the total weight of birds in the treatment by the number of birds in that treatment group.

All data obtained were subjected to analysis of variance using a completely randomized design using the Proc GLM procedure of SAS (2002). Differences between means were separated using Duncan Multiple Range F-test SAS (2002).

Table 1: Composition of the experimental finisher diet

	Dietary level of *Calopogonium mucunoides* leaf meal (%)			
Feed materials	**D1 (Control)**	**D2**	**D3**	**D4**
Maize	60	60	60	60
Leaf meal	0	5	10	15
Soybean meal	28	23	18	13
Fish meal	2	2	2	2
PKC	4	4	4	4
Wheat offal	2	2	2	2
Bone meal	1.4	1.4	1.4	1.4
Limestone	1.6	1.6	1.6	1.6
Salt	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
TOTAL	**100**	**100**	**100**	**100**

RESULTS AND DISCUSSION

The results of the proximate and phytochemical analyses are as presented in tables 3 and 4 respectively. The proximate composition of CMLM is in line with those reported for some tropical forage crops (D'mello and Devandra 1995) and the anti-nutritional factors present were within the acceptable range.

The result of the weight performance of the broiler finisher birds is presented in table 5. The average final body weight of the experimental diet groups were numerically higher than the control group, although not significant ($p>0.05$). The average final body weight recorded in this study among the experimental diets were within the range reported by Ani *et al*., (2013). However, the trend is not in line with general observation that at a high level of leaf meal inclusion in poultry diets, growth is depressed (D'mello and Acamovic 1989, Opara 1996; Ash *et al.*, 1992). The birds on control diet consumed higher feed than the birds on CMLM diet. The higher feed intake recorded on birds on control group over the experimental diet agrees with earlier reports that diets containing high levels of leaf meal results in low feed intake, (D'mello and Acamovic 1989, D'mello *et al.,*1987). There was no significant difference for daily feed intake between control diet and diets 2 and 3, but there existed a significant difference between control and diet 4. Although the birds on the control group consumed higher feed, their daily weight gain was lower without any significant difference. This could imply that the experimental diets were richer in terms of quality since birds are known to consume more feed of poorer quality than one of higher nutritional quality, in order to meet their nutritional requirements for growth and development (Esonu *et al*., 2005). In addition, the inclusion of *C. muconoides* leaf might have resulted in better and overall health status, more efficient nutrient utilization and better growth responses than the control diet (Ani *et al*., 2013) The result from the feed conversion ratio indicate that the birds on experimental diet utilized their feed more than the birds on control diet.

Table 2: Calculated chemical composition of experimental diet

Parameters	D1	D2	D3	D4
Crude protein	19.98	18.79	17.59	16.39
Ether extract	3.92	3.98	4.05	4.12
Crude fibre	4.10	4.72	5.33	5.94
Ash	3.12	3.16	3.19	3.23
Calcium	1.25	1.82	2.39	2.96
Phosphorous	0.67	2.3	3.9	5.56
ME(Kcal/Kg)	2927.56	2920.62	2913.67	2906.73

Table 3: Proximate composition of *Calopogonium mucunoides* leaf meal (% DM basis)

NUTRIENTS	VALUE
Moisture	8.69%
Dry matter	91.31%
Crude protein	20.00%
Crude fat	4.88%
Crude fibre	18.77%
Ash	6.73%
NFE	40.93%
Minerals	
Calcium	116.0mg/100g
phosphorus	331.6mg/100g

The result from the organ and carcass characteristics is presented in Table 6. In all the parameters considered for both carcass characteristics and organ performance, birds on experimental diet compared favourably and performed better than birds on control diet. The organ performance confirmed that the anti-nutritional factors present in the leaf meal are below the toxicity level. This is because there was no noticeable inflammation of the internal organs like the kidney and the liver. In addition, the yellow colouration observed on the shank and body of the bids on experimental diet shows that CMLM contains a high level of carotene and xanthophylls which can be extracted and made into commercial preparations as additives in broiler diets. Further trial is recommended to conclusively confirm the above observations.

Table 4: Phytochemical composition of *Calopogonium mucunoides* leaf meal

Tannin	0.71%
Saponin	0.53%
Alkaloid	1.05%
Phenols	0.63%
Phytates	0.32%
Oxalates	0.12%
HCN	6.70mg/kg

Table 5: Performance of broiler finisher birds fed different levels of *Calopogonium mucunoides* leaf meal

Parameters	**D1**	**D2**	**D3**	**D4**	**SEM**
Average Initial body weight(g)	1099	1238	1205	1253	
Average final body weight(g)	2089.1	2468.9	2465.7	2442.2	197
Average weight gain(g)	989.9	1230.6	1260.8	1188.6	150
Average daily weight gain(g)	35.4	43.9	45.0	42.5	5.3
Daily feed intake(g)	160.18 [a]	145.1 [ab]	150.1 [ab]	134.7 [b]	14.99
Feed conversion ratio	**4.5 [a]**	**3.4 [b]**	**3.3 [b]**	**3.2 [b]**	**0.23**
Mortality (no)	2	4	1	3	

SEM= standard error of mean
abc=Means with different superscript on the same horizontal row are statistically different at $p<0.05$

Conclusion

The results of this study showed that *Calopogonium mucunoides* leaf meal could be used in broiler finisher diets without any deleterious effects on performance, carcass and internal organ weights. It is also rich in carotene and the anti-nutritional factors present are within the range of acceptable limits. It is readily available in south east Nigeria and can be processed into leaf meals during the dry season. Although the cost benefit analysis was not considered in this study, it is expected that the utilization of CMLM would lead to significant reduction in the cost of feed, thereby enhancing the profit margin of small holder.

Table 6. Carcass and organ characteristics

CARCASS CHARACTERISTIC	D1	D2	D3	D4	SEM
Live weight g	1869 [a]	2149 [a]	2253.3 [a]	2394 [a]	154
Carcass weight g	1765.7 [a]	2047.0 [a]	2133.7 [a]	2266.3 [a]	155
Dressed %	79.66 [a]	80.02 [a]	81.81 [a]	80.99 [a]	2.53
Breast muscle %	21.81 [a]	21.80 [a]	21.28 [a]	22.67 [a]	0.98
Shank %	3.68 [ab]	3.34 [b]	4.30 [a]	3.55 [b]	0.21
Thigh %	10.14 [a]	10.06 [a]	11.89 [a]	10.69 [a]	0.70
Wings %	8.28 [a]	7.74 [a]	8.53 [a]	8.39 [a]	0.38
Drum stick %	10.41 [a]	9.95 [a]	11.06 [a]	10.49 [a]	0.55
Head %	2.28 [b]	2.21 [b]	2.64 [a]	2.23 [b]	0.10
Neck %	4.11 [a]	4.20 [a]	3.69 [a]	3.79 [a]	0.22
Back %	16.77 [a]	18.21 [a]	17.13 [a]	17.70 [a]	1.51
Organ performance					
Liver %	2.1 [ab]	2.48 [a]	1.80 [b]	1.78 [b]	0.19
Gizzard %	2.66 [a]	2.09 [a]	2.00 [a]	2.13 [a]	0.24
Intestine %	3.96 [a]	3.56 [a]	3.61 [a]	3.42 [a]	0.53
Spleen %	0.13 [a]	0.14 [a]	0.10 [a]	0.13 [a]	0.03
Lung %	0.65 [a]	0.55 [a]	0.47 [a]	0.61 [a]	0.04
Heart %	0.44 [a]	0.40 [a]	0.41 [a]	0.45 [a]	0.05
Abdominal fat %	1.02 [a]	1.20 [a]	0.97 [a]	1.20 [a]	0.26

SEM= standard error of mean

Means with different superscript on the same horizontal row are statistically different at $p<0.05$

ACKNOWLEDGEMENT

The authors are grateful to the Management of the FUTO Teaching and Research Farm for providing the space for the trial as well as the National Root Crop Research Institute (NRCRI) Laboratory, Umudike for the chemical analysis.

CONFLICT OF INTEREST

The authors declare that there is no known conflict of interest as regards the conduct of this study and the data reported in this work.

REFERENCES

A.O.A.C, 1990. Association of Official Analytical Chemists. Official method of analysis 15th ed. Washington D.C. 69 – 88.

Ash, A. J., Petaia, L. and Ako, H. 1992. Nutritional Value of *Sesbania gradiflora* leaves for monogastric and ruminants. Tropical Agriculture 69, 223 – 228.

Anachunam, C.C. 2010. Performance and Cost of production of broiler starter checks fed varying levels of *Vernonia amygdalina* leaf meal as feed ingredient. A project submitted to the Department of Animal Science and Technology, FUTO.

Ani, A. O., Ogbu C.C, Abakasanga I.U. and Ugwuowo L.C., 2013. Response of Broiler Birds to varying dietary levels of *Gongronema latifolium* leaf meal. Journal of Biology, Agriculture and Healthcare. ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)Vol. 3. No 14, 2013. www.iiste.org.

Asongwed-Awa, A., Abakar, O. and Vall, E., 2003. Intake and digestibility of

Calopogonium mucunoides based diets fed to draft donkeys during the dry season. Rev. Elev. Méd. Vét. Pays Trop., 56 (3-4): 205-221

Cambel J. 2014. *Refugees and Internally Displaced Persons in Northern Nigeria.* Africa in Transition. An online publication of the Council on Foreign Relations, Washington D.C.,US. www.cfr.org

Chen Chin Peng; Aminah, A., 1997. *Calopogonium mucunoides* Desv.. Record from Proseabase. Faridah Hanum, I & van der Maesen, L.J.G. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia

Cook, B. G., Pengelly, B. C., Brown, S. D., Donnelly, J. L., Eagles, D. A., Franco, M. A., Hanson, J., Mullen, B. F., Partridge, I. J., Peters, M. and Schultze-Kraft, R. 2005. Tropical forages. CSIRO, DPI&F (Qld), CIAT and ILRI, Brisbane, Australia

D'mello, J.P.F., Acamovic T. and Walter A.G. 1987. Evaluation of *Leucaena* leaf meal for broiler growth and pigmentation. Tropical Agriculture (Trinidad). 64:33-35.

D`Mello, J. P. F. and Acamovic, T. 1989. *Leucaena leucocephala* in Poultry Nutrition: A review. Animal Feed Science and Technology 26:1-28.

D'mello, J.P. F. and Devendra, C. 1995. Tropical Legumes in Animal Nutrition. CAB International, UK 247 – 283.

Esonu, B.O., Iheukwumere, F.C., Emenalom, O.O., Uchegbu, M.C. and Etuk, E.B.2002. Performance, nutrient utilization and organ characteristics of broilers fed *Microdesmis puberula* leaf meal. Livestock Research for Rural Development 14 (14).

Esonu, B.O., Emenalom, O.O., Udedibie, A B. I., Anyanwu, A. Madu, U. and Inyang, A.O. 2005. Evaluation of neem (*Azadirachta indica*) leaf meal on performance, carcass characteristics and Egg quality of laying Lens. Int. J. Agric. Rural Dev., 6:205 – 212.

Esonu, B.O. 2006. Animal Nutrition and Feeding. A functional approach, Publishers R and R Associates, Owerri. 2nd edition (2006)

F.A.O. 1997. Joint FUO/WHO food standard programme (ODEX), Alenentarius Commission x (1) Supplementary 4, FOA/WHO, Rore.

Ige A.O., Odensi A.A; Akanlade J.A.; Oje Dapo C.O., Aneen S.A., Adeerinolo O.A., Rafi T.A. 2006. *Glyricidia* leaf meal in Layers diet: Effect on performance, Nutrient digestibility and economy of production J. Anim. vet. Adv., 5, 483 – 486.

Nnadi, O. 2012. Photochemical screening of the Igbo medicinal plants: *Calopogonium mucunuides* and *Pier umbellatum*. A project submitted to the department of Biochemistry, Federal University of Technology Owerri,

Nworgu F.C. and Fapohinda J. B. 2002. Performance of broiler chicks fed mimosa (*Mimosa lavisa*) leaf measl supplements. In:proc. 28th ann.conf. NSAP., 128-131

Odunsi A.A.; Fariun G.O.; Akinola J.O. 1996. Influence of dietary wild sunsuoflower *Tithonia diversifloia*

(Henis-A.gray) leaf meal on layers performance and egg quality. Nig. J. Anim. Prod; 23: 26-32.

Opara C. C. 1996 Studies on the use of *Alchornia cordifolia* leaf meal as feed ingredient in poultry diets. MSc Thesis, Federal University of Technology, Owerri, Nigeria.

SAS 2002. Statistical Analysis Systems, Inc. Users Guide. Cary, N. C

Steel and Torrie J.H. 1986. Principles and procedures of statistics, 2nd edition, Mc graw Hill book. Co. Inc. New York.