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Carcass and organ characteristics of broiler finisher chickens fed dietary inclusion levels of *Telfairia occidentalis* leaf meal

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Abstract

Searching for a non-conventional and less competitive plant feed sources such as Telfairia occidentalis leaf meal to serve as an alternative in poultry nutrition will solve the problem of scarcity and high cost of convectional feed sources facing poultry production today. The objective of this study was to investigate the effect of dietary inclusion levels of Telfairia occidentalis leaf meal (TOLM) on the carcass and organ characteristics of finisher broiler chickens. A total of 120 Anak strain broiler birds at 28 days of age of mixed sexes were used. The birds at the completion of their fourth (4) weeks of brooding were randomly assigned to four dietary treatments, with 30 birds per treatment. Each treatment was replicated thrice with 10 birds per replicate. The TOLM was included in feed and fed ad libitum to the birds in a completely randomized experimental design. The inclusion levels of TOLM in the feed were: T_1 (control diet) = 0 % TOLM. T_2 = 0.5 % TOLM. T_3 = 1 % TOLM and T_4 = 1.5 % TOLM. The following carcass and organ parameters were measured: dressed carcass, breast muscle, thigh muscle, wing, shank, head, neck, visceral, liver, intact gizzard, and empty gizzard and heart weights. Lengths of small intestines of the birds were also measured. The results obtained showed significant ($p<0.05$) differences in the mean values for dressed carcass weight, shank weight, breast muscle weight, thigh muscle, weight of head and neck. For organ parameters measured, visceral, liver, intact gizzard and heart weights values were not significant ($p>0.05$), while values for small intestine length and empty gizzard weights among the treatments were significant ($p<0.05$). Birds on TOLM diet improved significantly ($p<0.05$) in carcass and organ parameters measured compared with the control birds, while among the treatment groups, T_4 birds recorded the highest($p<0.05$) values in all the carcass and organ parameters measured followed by T_3. Generally, there was an observed increase in carcass and organ parameters as TOLM level in the diets increased. In conclusion 1.5 % level of Telfairia occidentalis leaf meal was recommended due to its positive influence on carcass and organ parameters.

Keywords: *Telfairia occidentalis,* Anak broiler, carcass, organs, leaf meal

Caractéristiques de la carcasse et des organes des poulets de finition nourris avec des niveaux d'inclusion alimentaire de farine de feuilles de Telfairia occidentalis

Résumé

La recherche de sources d'alimentation végétales non conventionnelles et moins compétitives telles que la farine de feuilles de Telfairia occidentalis pour servir d'alternative à la nutrition de la volaille résoudra le problème de la rareté et du coût élevé des sources d'alimentation par convection auxquelles la production de volaille est confrontée aujourd'hui. L'objectif de cette étude était d'étudier l'effet des niveaux d'inclusion alimentaire de la farine de feuilles de Telfairia occidentalis (FFTO) sur les caractéristiques de la carcasse et des organes des poulets à griller en finition. Un total de 120 poulets à griller de souche Anak âgés de 28 jours de sexes mixtes ont été utilisés. Les oiseaux à la fin de leur

quatrième semaine ont été assignés au hasard à quatre traitements diététiques, avec 30 oiseaux par traitement. Chaque traitement a été répété trois fois avec 10 oiseaux par répétition. Le FFTO a été inclus dans les aliments et distribué ad libitum aux oiseaux dans une conception expérimentale complètement randomisée. Les niveaux d'inclusion de FFTO dans l'aliment étaient : T_1 (régime témoin) = 0 % de FFTO. T_2 = 0,5 % FFTO. T_3 = 1 % FFTO et T_4 = 1,5 % FFTO. Les paramètres suivants de la carcasse et des organes ont été mesurés : carcasse habillée, muscle de la poitrine, muscle de la cuisse, aile, jarret, tête, cou, viscéral, foie, gésier intact et poids du gésier et du cœur vides. La longueur des intestins grêles des oiseaux a également été mesurée. Les résultats obtenus ont montré des différences significatives ($p<0,05$) dans les valeurs moyennes du poids de la carcasse habillée, du poids du jarret, du poids du muscle de la poitrine, du muscle de la cuisse, du poids de la tête et du cou. Pour les paramètres d'organes mesurés, les valeurs de poids des viscères, du foie, du gésier intact et du cœur n'étaient pas significatives ($p>0,05$), tandis que les valeurs de longueur de l'intestin grêle et de poids du gésier vide parmi les traitements étaient significatives ($p<0,05$). Les oiseaux sous régime FFTO ont amélioré de manière significative ($p<0,05$) les paramètres de la carcasse et des organes mesurés par rapport aux oiseaux témoins, tandis que parmi les groupes de traitement, les oiseaux T_4 ont enregistré les valeurs les plus élevées ($p<0,05$) pour tous les paramètres de la carcasse et des organes mesurés, suivis de T_3. En général, on a observé une augmentation des paramètres de la carcasse et des organes à mesure que le niveau de FFTO dans les régimes augmentait. En conclusion, un niveau de 1,5 % de farine de feuilles de Telfairia occidentalis a été recommandé en raison de son influence sur les paramètres de la carcasse et des organes.

Mots-clés : Telfairia occidentalis, poulet à griller d'Anak, carcasse, organes, farine de feuilles

Introduction

Poultry is the most inexpensive source of farm animal protein, contributing meaningfully to the rising demand for animal food products globally (Farrell, 2013). Demand for poultry meat such as broiler is growing more mostly in developing nations owing to the rising global human populace. Despite the contribution of poultry to global meat demand, poultry production is still faced with a lot of challenges such as high cost, scarcity and poor performance of birds. It is also well documented in the literature that poultry production has been set back by the shortage and elevated cost of protein feed sources (Melesse *et al.,* 2011). In the contemporary poultry production such as broilers, feed has been a major cost, accounting about 70% of the total production cost (Sugiharto, 2019). Currently, there is a continuous increase in prizes and scarcity of conventional feed ingredients used in poultry feed production. This can be as a result of negative effects of climatic factors on crops and total human dependence on these feed ingredients for consumption. Therefore, there is a need to search for a non-conventional and less competitive plant protein sources that will serve as alternative in poultry production. Such alternative is leaf meal. When juxtaposed with agro-industrial by-products, the crude protein constitution of leaf meal is higher (Sugiharto *et al.,* 2018a; Tesfaye *et al.,* 2013). One of the widely cultivated vegetable in the tropics which has been used as leaf meal in broiler chicken nutrition is *Telfairia occidentalis* (fluted pumpkin). According to (Adegbenro, 2015) *T. occidentalis* is rich in vitamins, minerals and protein. It has been reported that *T. occidentalis* leaves contains 8.4% total ash, 3.0% crude lipid, 30.5%

crude protein and 87.3% crude fibre (Ladeji *et al.,*1995). The nutritional effect on carcass traits and muscles of the chest and hind limbs in avian species is well documented (Agbede and Aletor, 1997). Earlier report on carcass characteristics by (Fasuyi, 2007) broilers fed *Telfairia occidentalis* leaf meal (TOLM) had better nutrient intake and utilization when incorporated in their diets at 1.5% inclusion level. Also, from the work of (Fasuyi, 2007) the carcass characteristics and organ weights in broiler all showed evidence of uniform tissue buildup and muscles development particularly in those fed diet containing TOLM. The values for kidney, gizzard and intestinal lengths were significantly higher ($P<0.05$) in broilers fed TOLM diets (Fasuyi, 2007). But, Imasuen *et al.* (2014) supplemented the diet of broilers with TOLM and observed no significant differences ($p>0.05$) among the treatment groups with respect to all the internal organs measured with the exception of the small and large intestines. Considering the low cost and nutritional qualities of *T. occidentalis* leaves as possible alternative for protein source in broiler nutrition, this study was designed to evaluate the carcass and organ characteristics of broiler finisher chickens fed varying dietary inclusion levels of *T. occidentalis* leaf meal.

Materials and methods

Location and duration of study

The study was carried out at the Department of Animal Science Teaching and Experimental Farms, Poultry Section of the University of Nigeria, Nsukka Enugu State. It is located on latitude on $6^0$25N and $07^0$24E and altitude (Okonkwo and Akubuo, 2007) and at an altitude of 430m above sea level (Breinholt *et al.,*1981) in the derived savanna region of south Eastern Nigeria. The climate of the study area is a typical humid tropical type with a relative humidity range of 56.01-103.83%. Average diurnal minimum temperature ranges from 22^0C -24^0C. The average maximum ambient temperature ranges from 33^0C and 37^0C (Ofomata, 1975). The annual rainfall ranges from is 1567.05mm-1846.98mm (Metrological Center, Crop Science Department, University of Nigeria, Nsukka Enugu State). The study lasted for 4 weeks.

Experimental materials and processing

The *Telfairia occidentalis* leaves used in this research were obtained from Mmuogbunam farm Nimo, Njikoka Local Government Area of Anambra State. Freshly harvested *Telfairia occidentalis* leaves were harvested and spread on a clean concrete floor and allowed to sundry gradual until a constant moisture content of 10% was attained. The material was sun-dried for 5-7 days, after which it was grounded at the mill. The milled sun-dried leaves retained their green color implying that necessary pigments, vitamins, protein and mineral were adequately preserved. The milled material was collected in jute bags and tied air-tight to prevent insect attack. The material was also stored in clean, well ventilated room before feed formulation to ensure nutrient preservation. The material (TOLM) was analyzed to obtain its proximate composition before its application in feed formulation. Other feed ingredients such as maize, groundnut cake, fishmeal, lysine, vitamin premix and methionine were purchased from Chidera feedmill limited, Nsukka, Nigeria.

Experimental animals and management

One hundred and twenty day old Anak broiler strains were purchased from Fidan Breeders, Ibadan, Nigeria. The chicks were brooded for 4-weeks periods and transferred to deep-littered pen bedded with wood shavings to start the study. The birds were randomly assigned to four dietary treatments, having 30 birds per treatment and replicated thrice with 10 birds per replicate. Water and feed were served *ad libitum*.

Table 1: Percentage ingredients composition of broiler finisher diet

Ingredients (%)	Treatments			
	T_1	T_2	T_3	T_4
Maize	38.00	38.00	38.00	38.00
Groundnut cake	16.00	16.00	16.00	16.00
Soybean meal	13.00	12.50	11.50	11.50
Wheat offal	26.00	26.00	26.50	26.00
Fish meal	2.00	2.00	2.00	2.00
Oyster shell	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
TOLM	-	0.50	1.00	1.50
Total	**100**	**100**	**100**	**100**

Table 2[b] Proximate compositions of experimental diets containing *Telfairia occidentalis* leaf meal (TOLM)

Compositions (%)	Treatments			
	T_1	T_2	T_2	T_4
Crude protein	21.00	21.19	21.89	21.99
Crude fiber	6.55	7.20	8.05	9.40
Ether extract	3.10	3.26	3.90	4.40
Ash	6.11	9.90	11.80	13.98
Moisture	15.38	15.00	15.02	14.87
Met. energy Kcal.kg[1]	2770.00	2799.00	2828.00	2900.00

Parameters measured

Carcass and organ characteristics

At the end of the experiment, three birds from each replicates were randomly selected, starred for 24 hours, but not without water, weighed, and slaughtered by severing the jungular vein. The birds were bled, immersed in hot water, de-feathered and separated into head, neck and feet and visceral organs. The wings were removed by cutting anteriorly severing the humeo-scapular joints. The cuts were made through the rib hind to the shoulder girdle and the back was detached intact by pulling anteriorly. Thighs and drum sticks were dissected from each carcass and weighed separately. The internal organs (gizzard, heart, liver and intestine) were isolated and weighed.

Statistical analysis

Data generated were subjected to the analysis of variance (ANOVA) in CRD using statistical package (SPSS, 2003) Windows version 8.0. Mean differences were separated using Duncan's New Multiple Range Test (Duncan, 1955) as outlined by Obi (2002).

Results

Table 3 shows the carcass characteristics of finisher broiler chickens fed varying dietary inclusion levels of *Telfairia occidentalis* leaf meal (TOLM). From the results, it was observed that the inclusion of TOLM to the diet of broiler finishers significantly ($p<0.05$) influenced the values for dressed carcass weight, breast muscle weight, thigh muscle weight, wing weight, shank weight and weight of heads and necks. Values of the above mentioned parameters were significantly higher in treatment group when compared with the control, but among the treatment groups, dressed carcass weight, breast muscle weight, thigh muscle weight, wing weight, shank weight, head and neck weight values were significantly higher in T_4 followed by T_3. Dressed carcass values recorded in T_1 (control) and 2 were statistically ($p>0.05$)

similar, but significantly differed and lower than the value observed for treatment 3 and 4. Breast muscle weight values of treatment 1 (control), 2 and 3 were similar ($p>0.05$), but differed significantly and lower than the value recorded in treatment 4. Values of thigh muscle, wing, shank, head and neck weight followed the same trend among the treatments. Weights of carcass parameters measured increased as the level of TOLM in the diet increased. Among the treatment groups, weights of carcass traits measure were higher ($p<0.05$) in treatment 4 followed by treatment 3.

Table 4 shows the organ characteristics of finisher broiler chickens fed varying dietary inclusion levels of *Telfairia occidentalis* leaf meal (TOLM). From the results, it was observed that the inclusion of TOLM to the diet of broiler finishers significantly ($p<0.05$) influenced the values recorded for empty gizzard weight and length of small intestine, while there was no significant difference among the treatments means on the visceral, liver, intact gizzard and heart weights. Values for empty gizzard for treatment 2 and 3 were similar ($p>0.05$), but significantly higher than the value recorded in treatment 1 and lower than value recorded in treatment 4. Length of small intestine values among the treatment followed the same trend as observed for the empty gizzard weight values. Length of small intestine and weights of the empty gizzard increased as the level of TOLM increased in the diet.

Table 3[b] Carcass characteristics of finishing broilers fed varying dietary inclusion levels of *Telfairia occidentalis* leaf meal (TOLM)

Parameters(g)	Treatments				
	T_1	T_2	T_3	T_4	SEM
Dressed carcass weight	1370.00[c]	1350.00[c]	1550.00[b]	1910.00[a]	98.49
Breast muscle weight	445.00[b]	455.00[b]	500.00[b]	645.00[a]	33.40
Thigh muscle weight.	230.00[c]	240.00[c]	276.00[b]	320.00[a]	15.20
Wing weight.	175.00[c]	185.00[c]	218.00[b]	245.00[a]	11.61
Shank weight	61.00[C]	65.00[c]	90.00[b]	125.00[a]	9.44
Weight of head and neck	165.10[c]	172.0[c]	188.78[b]	199.86[a]	12.67

SEM=Standard Error of mean.

Table 4: Effect of organ characteristics of finishing broilers fed varying dietary inclusion levels of *Telfairia occidentalis* leaf meal (TOLM)

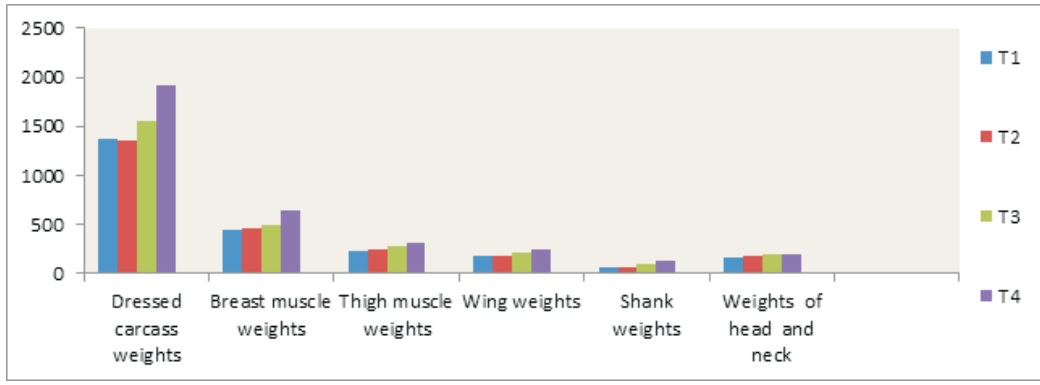
Parameters(g)	Treatments				
	T_1	T_2	T_3	T_4	SEM
Visceral weight	215.00	222.00	225.00	230.00	9.34
Liver weight	39.10	44.00	45.00	48.00	3.34
Intact gizzard weight	63.50	65.00	68.00	70.00	3.71
Empty gizzard	46.50[c]	53.50[b]	57.00[b]	63.00[a]	2.74
Heart weight	11.00	10.50	11.10	12..00	1.82
Length of small intestine (cm)	151.00[c]	169.00[b]	171.00[b]	190.00[a]	4.51

[abc]Row means with different superscript are significantly different ($p<0.05$),**SEM**=Standard Error of Mean

Discussion

Birds on TOLM diets recorded the highest ($p<0.05$) values in carcass and organ traits measured. This could be attributed to the relative increase in nutrient metabolism caused by increased vitamins and minerals contributed by TOLM in the diet. Generally, increase in nutrient metabolism brings about increase in the rate feed digestion, nutrient absorption and utilization in the body of an animal. Vitamins and minerals enhance feed digestion, nutrient absorption and utilization in form of co-enzymes and co-

factors. Co-enzymes and co-factors acts as help molecules to the various body enzymes that are involve in the generation of energy, compounds catabolism, anabolism and inter-conversion of materials in the body of animals for effective growth and development. Earlier report on carcass characteristics by (Fasuyi, 2007) broilers fed TOLM had better nutrient intake and utilization when TOLM was incorporated in the diets at 1.5% inclusion level. Therefore, increase in nutrient absorption and utilization will culminate into better carcass and organ yield. It is well documented in the literature that nutrition has positive effect on carcass traits; muscle of chest and hind limbs (Agbede and Aletor, 1997).According to (Adegbenro, 2015) *Telfairia occidentalis* plant is rich in vitamins, minerals and protein. From the work of (Fasuyi, 2007) carcass characteristics and organ weights in broiler all showed evidence of uniform tissue buildup and muscles development particularly in those fed diet containing TOLM. Improvement recorded among the treatments groups with regards to carcass and organ parameters measured indicates that TOLM did not present any deleterious effect on the birds. The improvement in the length of small intestine and empty gizzard weight observed in this work agrees with (Fasuyi, 2007) who fed TOLM to broilers and recorded increase in the values for gizzard and intestinal lengths of the birds. No significant differences recorded among the treatment means for the internal organs measured such as weight of liver, intact gizzard and heart weight agrees with (Imasuen, 2014) who supplemented diets of broilers with TOLM and observed no significant differences ($p>0.05$) among the treatment groups with respect to all the internal organs measured except the length of intestines which the result of this current study also agrees with.



Conclusion

In conclusion, higher inclusion level of 1.5% *Telfairia occidentalis* leaf meal was observed not to have any deleterious effect on birds, therefore T_4 (1.5%) was recommended because of highest significant values of carcass and organ indices recorded. The better performance of birds on diets with TOLM in terms of improved carcass and organ traits suggests that *Telfairia occidentalis* leaf meal can be used by farmers to enhance poultry production.

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