GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHER BROILERS FED *GomphrenacelosioidesMart*. LEAF MEAL.

***Ukpabi, U.H., Elvis-Chikwem, C.L. and Maduka, I.J.**
Department of Animal Science and Fisheries, Abia State University, Umuahia Campus.
P.M.B. 7010, Umuahia.
*Corresponding author: E-mail: uhukpabi@yahoo.com

ABSTRACT
A 28-day feeding trial involving 63, 4 weeks old finisher broilers was carried out in a completely randomized design (CRD) to evaluate the performance, carcass and organ characteristics of broilers fed *Gomphrena celosioides* leaf meal at dietary inclusion levels of 0%, 10% and 15%. Daily weight gains were 57.95g, 43.36g, and 45.14g for diets T_1 (0%), T_2 (10%) and T_3 (15%) respectively. Daily feed intake increased across the treatment groups with birds on T_2 (10% GCLM) having the highest value of 186.61g followed by birds on T_3(15% GCLM) 181.79g and least being birds on the control group (177.04g). There were significant differences ($p<0.05$) in the carcass characteristics of finisher broilers fed GCLM except in the breast muscle. Live weights and dressed weights of birds on the control group (T_1) were superior to those on T_2 and T_3 groups indicating a reduction trend across treatment groups. The weight of the organs of the experimental birds increased as the level of GCLM increased in the diets, indicating higher activities of these organs. In conclusion, GCLM could be used as a feed ingredient in finisher broilers ration up to 15% inclusion level without impairing performance, carcass and organ functions of finisher broiler, however, further research is needed to evaluate the nutritional, anti-nutritional factors and digestibility of this leaf meal for optimum utilization in non-ruminant animal nutrition.

Key words:Performance, carcass characteristics, *Gomphrena celosioides* leaf meal, finisher broilers

INTRODUCTION

Concerned professionals in the field of animal nutrition particularly in the developing countries had for long identified the cost of finished livestock feedas the most economically limiting factor in the industry (Fasuyi*et al*.,2005; *Ukpabi et al*., 2017). In Nigeria, the consumption level of animal protein is very low when compared with other countries of the world. An average Nigerian consumes only about a quarter of his minimum daily animal protein requirement and for this reason, Opara (1996) and Esonu*et al.*(2004) stated that poultry production represents one of the quickest means of correcting the anomaly of protein inadequacy. The animal protein deficit in the diets of Nigerians and people of most developingcountriesis nowa matter of urgent concern and measures to save people from imminent protein malnutrition should be taken (Ekenyem and Madubuike, 2006). However, poultry products have high potentials for bridging the animal protein gap considering the fact that high yielding exotic poultry adapt easily to our environment and the technology of production is relatively simple with high returns to investment (Madubuike, 1992). Esonu, *et al*. (2001) reported that more than 50% of Nigeria's poultry farms have closed downand another 30% forced to reduce their production capacity due to shortage of feed. The present shortage of monogastric animal feed has been blamedon the ever increasing cost of the feed ingredients especially the conventional feedstuffs. This phenomenon is sequel to the increasing competition between man and animals for available grains (Ekenyem and Madubuike, 2006). Leaf meal of tropical legumes and browse plants serve as potential sources of cheap and available animal feed resources (Esonu, *et al*., 2001). A good number ofleaf meals have been successfully evaluated and incorporated into poultry diets as sources of protein. These include*Microdermispuberula*(Esonu*etal*., 2004), *Ipomeaasarifolia*(Madubuike and Ekenyem, 2006), *Telferiaoccidentalis*(Fasuyi and Nonyerem, 2007; Ladokun*et al*., 2016), *Moringa oleifera* (Tesfaye*et al*., 2013; Nkukwana*et al*., 2015; Esonu*et al*., 2016), Cassava leaf meal (Abu *et al*., 2015) and *Azadirachtaindica* leaf meal (Ubua*et al*., 2018). Leaf meal does not only serve as protein source but also provides some necessary vitamins, minerals and also oxycaroteniods which cause the yellow coloration or pigmentation of broiler skin, shank and egg yolk (Opara, 1996).

Feed accounts for 70-80% of the production cost of poultry(Madubuike and Ekenyem, 2001). The bulk of the feed cost arises from protein concentrate such as groundnut cake, fishmeal and soybean meal. Prices of these conventional protein sources have soared so high in recent times that it is becoming uneconomical to use them in poultry feeds. There is need therefore to look for locally available cheap sources of feed ingredients particularly those that do not attract competition in consumption between human beings and livestock of which *Gomphrena celosioides* leaf meal is one of them. *Gomphrena celosioides* Mart, commonly known as soft khaki weed or *Gomphrena* weed is invasive and has become widespread in the Northwest of Australia in recent years (Tanner, 2007). It does not have annoying burrs unlike khaki weed; the soft flowers make the plant very easy to identify (Tanner, 2007). Research on performance and carcass responses of finisher broilers fed *Gomphrena celosioides* Mart is still scarce; this prompted this study to ascertain the optimal inclusion level of this feedstuff in finisher broiler ration.

MATERIALS AND METHODS

Experimental site

This research was conducted at the Poultry Unit of the Teaching and Research Farm of Abia State University, Umudike, Nigeria.Umudikeis on latitude 5°28¹ N and 7°31¹ E and, and lies at an elevation of 122 meters above sea level (Adiele, 2005).

Collection of test material (leaves)

The leaves of *Gomphrena celosioides* were harvested from the bush around Abia State University, Umudike Location, Abia State, Nigeria. The leaves were removed from the stem, air-dried on a concrete floor for 5-7 days until they became crispy while still retaining the greenish coloration. The dried leaves were then milled using hammer mill to produce leaf meal. The sample of the leaf meal was subjected to proximate analysis according AOAC (2006) and presented in Table 2

Management of birds

Sixty-three day-old Anak broiler chicks were bought from SinclarAgric Ventures at Umuahia, Abia State. The birds were housed in a deep litter system and brooded for 4weeks, the birds were given routine vaccination, proper management and good hygiene standard.

Experimental diets and design

Sixty-three (63) Anak finisher broilers aged 4 weeks were divided into 3 (three) groups of 21 birds each and randomly assigned to diets containing 0%, 10% and 15% levels of *Gomphrena celosioides* Mart, leaf meal (GCLM) respectively. Each treatment group having 21 birds was further divided into 3 replicates of 7 birds each in a completelyrandomized design (CRD). Feed and water were provided *ad libitum* throughout the period of the experiment which lasted 4 weeks (28days). The composition of the experimental diets is presented in Table 1.

Table 1. Composition of Experiment diets

Ingredients	Dietary levels of GCLM (%)		
	T_1 (0)	T_2 (10)	T_3 (15)
Maize grain	40.0	40.0	40.0
Soya bean meal	25.0	15.0	10.0
Groundnut cake	10.0	10.0	10.0
Leafmeal (GCLM)	0.0	10.0	15.0
Palm kernel meal	10.0	10.0	10.0
Wheat offal	8.0	8.0	8.0
Oyster shell	3.0	3.0	3.0
Lime stone	3.0	3.0	3.0
Salt	0.25	0.25	0.25
Lysine	0.25	0.25	0.25
Methionine	0.25	0.25	0.25
Premix*	0.25	0.25	0.25
Total	100	100	100.

*****Vitamin mineral premix provides per kg diet: vit. A, 13.340 iu, vit. D3 2680 iu, vit. E iu, vit. K, 2.68 iu, Calcium panthonate, 10.68 mg, vit. B12 0.022 mg; Folic acid, 0.668 mg; Choline chloride 400 mg; Chlorotetracycline, 26–28 mg; Manganese, 133.34 mg; Iron, 66.68 mg; Zinc, 53.34 mg; Copper, 3.2 mg; Iodine, 1.86 mg; Cobalt, 0.268 mg; Selenium, 0.108 mg.

Data collection

The experimental animals were weighed individually at the beginning of the experiment. Subsequent weights were taken weekly until the end of the experiment. Feed intake, which is the difference between feed offered and feed left over was weighed and recorded.

Carcass evaluation

At the end of the experiment, nine birds were randomly selected from each treatment (3 per replicate) and used for evaluation of carcass and internal organ weights. They were starved of feed for 12 hours, weighed and slaughtered by severing the jugular vein with sharp knife. They were de-feathered, using hot water (below 72°C) and separated into head, neck, feet and visceral organs. The wings were removed by cutting anteriorly severing at the humero-scapular joint. The cuts were made through the rib head intact by pulling anteriorly. Thighs and drumstick were dissected from each carcass and weighed separately.

Data Analysis

Data obtained were subjected to statistical analysis using one-way analysis of variance (ANOVA) as outlined in (Steel and Torrie, 1980). Duncan multiple range test was used to separate significant treatment means where they occurred (Obi, 1990).

RESULTS

The proximate composition of the experimental diets and *Gomphrena celosioides* are presented in Table 2. Growth performance, carcass characteristics and organ weights are presented in Tables 3, 4 and 5 respectively. There were significant differences ($p<0.05$) in all the performance parameters except in the initial weight of the birds. The final body weight and daily weight gain decreased as the test ingredient increased across treatment groups with the control (T1) having the highest final body weight of 2404.76g and daily weight gain of 57.95g. The daily feed intake recorded in this study were 177.04g for T_1 (control), 186.61g for T_2 (10% GCLM) and 181.79g for T_3 (15% GCLM). The feed conversion ratio recorded were 3.08, 4.47, and 4.03 for T_1, T_2 and T_3 respectively. In carcass parameters, live weight, dressed weight and dressing % values for birds on diets T_2 (10% GCLM) and T_3 (15% GCLM) were significantly ($p<0.05$) lower than those that were fed T_1 (0% GCLM). There were significant ($p<0.05$) differences in all the cut parts measured except in the thigh muscle. The wing, back and drumstick weights increased significantly ($p<0.05$) across the treatment groups.

There were significant increases in the organ characteristics of the birds across the treatment groups, the values of liver for birds fed on 0% and 10% were significantly ($P<0.05$) lower than those that were fed diet 15%. Heart was similar ($p>0.05$) between 10% and 15% but they differed significantly ($P<0.05$) from T_1 (control). Gizzard showed no significant ($p>0.05$) difference between 0% and 10% but they were significantly ($P<0.05$) lower than values obtained in birds fed T_3 (15%) diet.

Table 2: Proximate composition of experimental diets and *Gomphrena celosioides* (Mart.) leaf meal based on dry matter.

Parameters	Dietary levels of GCLM (%)			
	T_1(0)	T_2(10)	T_3(15)	GCLM
Dry Matter	90.86	91.03	90.76	90.72
Crude Protein	21.55	20.03	20.85	9.99
Ether Extract	2.08	1.94	2.45	4.64
Crude Fibre	8.71	8.75	8.29	10.55
Ash	8.36	7.29	7.45	10.26
NFE	50.16	53.02	51.72	55.28
ME* (MJ/kg)	12.35	11.48	11.95	12.95

NFE: Nitrogen-free extract, ME: Metabolizable energy, GCLM: *Gomphrena celosioides* leaf meal, *ME = Metabolizable energy, calculated according to Pauzenga (1985) as ME (MJ/kg) = 37 × % CP + 81 × % EE + 35.5 × % NFE (Folorunso *et al*., 2016)

Table 3: Effect of different dietary levels of *Gomphrena celosioides* leaf meal on the performance of finisher broilers.

	Dietary levels of leaf meal (%)			
Parameter	**T1(0)**	**T2(10)**	**T3(15)**	**SEM**
Initial body weight (g)	782.14	781 .05	779.62	29.29
Final body weight (g)	2404. 76[a]	2004.38[b]	2043.43[a]	41.26
Total weight gain (g)	1622.62[b]	1223.33[b]	1263. 81[b]	19.1
Daily weight gain (g)	57.95[a]	43.36[b]	45.14[b]	2.13
Total feed intake (g)	4957.14[b]	5225[a]	5090[ab]	52.15
Daily feed intake (g)	177.04[b]	186.61[a]	181.79[ab]	1.79
Feed conversion ratio	3.08[b]	4.47[a]	4.03[a]	0.16

SEM Standard error of mean, [abc]Means in the same row with different superscript are significantly ($P<0.05$) different.

Table 4: Carcass evaluation of finisher broilers fed diets containing different levels of *Gomphrena Celosioides* (Mart.) leaf meal.

Dietary levels of leaf meal (%)				
Parameter	**T1(0)**	**T2(10)**	**T3(15)**	**SEM**
Live weight (g)	2326.67[a]	1933.33[b]	2000[b]	34.1
Dressed weight (g)	1700.33[a]	1377.80[b]	1383.33[b]	14.11
Dressing %	73.14[a]	71.31[a]	69.20[b]	0.55
Wing (%)	I3.24[b]	13.89a	13, 86a	0.06
Breast (%)	32.34[a]	30.34[b]	30.12[b]	0.14
Back (%)	21.56[b]	22.50[a]	22.29[a]	0.06
Thigh (%)	16.66	16.33	16.27	0.18
Drumstick (%)	16.18[C]	16.90[b]	17.47[a]	0.07

SEM Standard error of mean, [abc] Means in the same row with different superscript are significantly ($P< 0.05$) different.

Table 5: Organ composition of finisher broilers expressed as percentage of live weight (%)

	Dietary Levels of GCLM (%)			
Parameters	**T1(0)**	**T2(10)**	**T3(15)**	**SEM**
Liver	2.87[b]	3.02[b]	3.75[a]	0.08
Heart	1.07[b]	1.30[a]	1.25[a]	0.04
Gizzard	3.94[b]	3.75[b]	4.15[a]	0.06

SEM Standard error of mean, [abc] Means in the same row with different superscript are significantly ($P<0.05$) different.

DISCUSSION

The significant ($p<0.05$) differences observed in performance parameters in this study agreed with the reports of (Dada *et al*., 2000; Esonu, *et al*., 2001; Olowu, *et al*., 2013), who reported significant differences in performance parameters of finisher broilers fed different kinds of leaf meals. The significant difference ($p<0.05$) in feed conversion ratio among treatments in this study, agreed with the report of (Okonkwo *et al.*,1995) who reported significant difference in feed conversion ratio as *Leucaenaleucocephala*leaf meal (LLLM) increased up to 10% in broiler finisher diets. It however, differed from the report of Dada *et al.* (2000) who reported non-significant ($p<0.05$) difference in feed to gain ratio in birds fed three dietary levels (5%, 10%, 15%) of *Leucaenaleucocephala*leaf meal (LLLM). The depression in performance with the 10% and 15% levels of *Gomphrena celosioides*leaf meal agreed with the general observation that at higher levels of inclusion of leaf meals in poultry diets the growth is depressed (Ash *et at.,* 1992;

Opara, 1996). The depressed body weight gains of the birds fed 10% and 15% GCLM might be due to high bulk or fibre content of the leaf meal resulting in insufficient consumption of digestible nutrients particularly protein and energy required to sustain rapid growth (Esonu*etal*., 2001). The result is also in line with earlier observations of Ash and Akoh (1992), that leaf meal from *Sesbaniasesban* and *Sesbania grandiflora* depressed feed utilization efficiency in chickens. Birds on 10% and 15% GCLM showed poor feed conversion efficiency compared to birds on the control group, this might be a resultant effect of increased intake and lower weight gains, possibly due to increased fibre content of the diets (Esonu*et al.,* 2004). The depression in live weight, dressed weight and dressing % of birds fed 10% and 15% GCLM may equally be as a result of the depressed weight gains observed in birds on these groups. The result of liver weight showed a consistent trend of higher values with increasing levels of GCLM. This trend may be attributed to the fact that the leaf meal may contain toxic materials which increased the liver weight as the leaf meal was increased up to 15%. An increase in the size of the liver is usually associated with an increase in metabolic activities during detoxification (Akinmutimi*et al.,* 2004). Birds on T_2 and T_3 had higher values for heart weight, which were similar but differed from birds on T_1 (control), this could be the effect of anti-nutritional factors present in the diets which affects the functioning of the heart (Szabo and Tebbet, 2002). However, the size of the heart could be affected by other factors such as stress and diseases (Carew *et al.,* 1998). The increase in the weight of the gizzardin birds fed T_3, may also be attributed to the extra muscular or secretory function required to process GCLM diet which was high in fibre than the control diet (Carew *et al.,* 2003).The trend in organ weights observed in the present study is similar to the findings of Olumide and Akintola (2018) as a result of the inclusion of scent leaf (*Ocimumgratissimum*) in the diets of broiler chickens.

CONCLUSION

The results of the study showed that *Gomphrena celosioides* Mart, leaf meal could be used as a feed ingredient in finisher broiler production up to 15% inclusion level without any deleterious effect on performance, carcass and organ functions of the animal, also, the use of this feed resource is regarded as being safe as there were no mortalities recorded during the trial.

More research studies are needed to further evaluate the nutritional and anti-nutritional factors of this leaf meal for its optimum utilization in monogastric animals considering its relative abundance and absence of competition for the leaves between man and livestock.

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