Performance of broiler chickens fed jute mallow and waterleaf meal based diets as phytogenic feed

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Abstract

The study evaluated the growth performance of broiler birds fed diets containing varying levels of jute mallow, waterleaf and their combinations. Four diets tagged T1, T2, T3 and T4 were formulated such that T1 contained 0% of jute mallow and 0% waterleaf; T2 – 10% jute mallow, 0% waterleaf; T3 – 0% jute mallow, 10% waterleaf; T4 – 5% jute mallow and 5% waterleaf, respectively. The diets were fed to broiler chickens and their performance was compared. One hundred and sixty broiler chicks were randomly assigned to the treatments; each treatment had four replicates. The birds were weighed weekly and documented. The parameters measured were feed consumption, initial body weight, final body weight, body weight gain and feed conversion ratio. Data collection was carried out for a period of seven weeks. Statistical analysis was carried out on the data for initial body weight, final body weight, average daily weight gain, total feed intake, average daily feed intake, and feed conversion ratio. No significant difference (p>0.05) was recorded amongst the treatments for growth performance, the study indicated that the inclusion of jute mallow and waterleaf into broiler diets had no adverse effect on the growth performance of broiler birds. The experimental diets actually performed as good as the control in terms of growth indices numerically. As such both jute mallow and waterleaf could be successfully incorporated into poultry diets as additives.

Keywords: Jute mallow, performance, treatments and waterleaf

Running title: Growth attributes of broiler chickens fed dietary jute mallow and waterleaf

Performance des poules de chair nourries avec des régimes alimentaires à base de feuilles de jute et de feuille d'eau en tant qu'aliment phytogénique

Résumé

L'étude a évalué la performance de croissance des poules de chair nourries avec des régimes alimentaires contenant des niveaux variables de feuilles de jute, de feuille d'eau et de leurs combinaisons. Quatre régimes, désignés T1, T2, T3 et T4, ont été formulés de manière à ce que T1 contienne 0 % de feuilles de jute et 0 % de feuille d'eau ; T2 – 10 % de feuilles de jute, 0 % de feuille d'eau ; T3 – 0 % de feuilles de jute, 10 % de feuille d'eau ; T4 – 5 % de feuilles de jute et 5 % de feuille d'eau, respectivement. Les régimes ont été administrés aux poules de chair et leur performance a été comparée. Cent soixante poussins de chair ont été répartis aléatoirement entre les traitements ; chaque traitement ayant quatre répétitions. Les oiseaux ont été pesés chaque semaine et les données ont été documentées. Les paramètres mesurés étaient la consommation d'aliments, le poids corporel initial, le poids corporel final, le gain de poids corporel et le taux de conversion alimentaire. La collecte de données a été effectuée sur une période de sept semaines. Une analyse statistique a été réalisée sur les données concernant le poids corporel initial, le poids corporel final, le gain de poids quotidien moyen, la consommation totale d'aliments, la consommation quotidienne moyenne d'aliments et le taux de conversion alimentaire. Aucune différence significative (p>0,05) n'a été enregistrée entre les traitements pour la performance de croissance ; l'étude a indiqué que l'inclusion des feuilles de jute et de feuille d'eau dans les régimes des poules de chair n'a eu aucun effet négatif sur la performance de croissance des oiseaux. Les régimes expérimentaux ont en fait montré une performance

aussi bonne que celle du témoin en termes d'indices de croissance numériquement. Ainsi, les feuilles de jute et de feuille d'eau pourraient être intégrées avec succès dans les régimes avicoles en tant qu'additifs.

Mots-clés : Feuilles de jute, performance, traitements, feuille d'eau

Introduction

Of all livestock enterprises, poultry production is the most popular. In most countries, poultry production consists of a vital part of economic developments, food security and socio-cultural advancement (Alders, 2005; Dieye, *et al*., 2010). Broiler chicken production serves as an integral source of income; good source of protein and has a quick return on investments (Kekocha, 1994). With all these advantages, broiler production industry in the developing countries is not without its' challenges. The most notable of these challenges is the high price of feed ingredients resulting in an increase in the cost of feed and high feed to gain ratio (Abbas, 2013). Several efforts have been made to control this major challenge, and one of such efforts involves the use of feed additives. Feed additives, are feed ingredients that are added to chicken diets to improve their health, production efficiency and as well as reduce morbidity (FAC, 1998). Recently, additives derived from plants or the entire plant itself which are mostly known as phytogenic have been recommended to be used in broiler chicken feeds as they promote growth, more so, the fact that they do not result in residual effect and they are plenitude in our natural environment (Ndelekwute *et al*., 2015). According to Kohlert *et al*. (2000) feed additives have no residual effect because, the active ingredients of phytogenics are absorbed in the intestines of broiler chicken by enterocytes and are swiftly metabolized by the body. Phytogenics can improve weight gain, feed consumption, digestibility and feed conversion of broiler chickens (Cardoso *et al*., 2012).

In many West African countries, leafy green vegetables are not expensive, ample and are readily available sources of protein due to their capacity to synthesize amino acids from a wide variety of available primary raw materials (Fasuyi *et al.*, 2006). The green vegetables are also very rich in vitamins such as pro-vitamin A (Mbaegbu, 2012). Waterleaf (*Talinum triangulare)* is an herbaceous annual and perennial plant with a worldwide distribution range. Waterleaf (*Talinum triangulare)* is a very abundant source of calcium, vitamin C, vitamin E, soluble fibers, magnesium, potassium, protein, carotene and dietary fiber, as such it can also help prevent animals from internal organ damage caused by free radicals because of its vitamin C and E which are very effective in combating free radicals (Ezekwe *et al*., 2001).

The objective of this study was generating information on the effects of feeding diets containing jute mallow (*Corchorus olitorius)* and waterleaf (*Talinum triangulare)* meals and a combination of the two on the growth performance of broiler birds.

Materials and Methods

Experimental site

The experiment was conducted at the Poultry Unit Niger State Agricultural Mechanization Development Agency (NAMDA) , in Maitumbi Minna. Minna is the capital of Niger State and it is located at latitude $9^0$33' North and longitude $9^0$37' East, with a mean annual rainfall of between 1200mm and 1300mm and mean annual temperature of between 38ºC and 42ºC. Geographically, Minna is situated in the Southern Guinea Savanna vegetation belt of Nigeria and it is depicted by wet and dry seasons. (Niger State Agricultural Development Project, 2009).

Source of experimental materials

Fresh jute mallow and waterleaves were purchase from Kure Ultra Modern Market, Minna, Niger State, while other feed ingredients were purchased from Alkheri Animal Feeds opposite Gidan Matasa, Bosso, Minna, Niger State. Ross

308 broiler chicks strain of Agrited where purchased from Step by Step poultry store opposite Kure Ultra Modern Market Minna, Niger State.

Preparation of the test ingredients (jute mallow and waterleaf)

Fresh jute mallow (JM) and waterleaf (WL) were thoroughly washed with clean fresh water, without been squeezed to remove dirt and other extraneous matter. Subsequently they were air dried at room temperature (29 - 31^{o}C) for two weeks until they were dry and brittle, after which the dried leaves were milled using a hammer mill. The milled jute mallow and waterleaf were packed into different plastic bags and kept till when they were to be used. They were eventually used alongside other feed ingredients in the formulation of the experimental diets see Tables 1 and 2. The four formulated diets were T1 containing 0% of jute mallow and 0% waterleaf; T2 – 10% jute mallow, 0% waterleaf; T3 – 0% jute mallow, 10% waterleaf; T4 – 5% jute mallow and 5% waterleaf, respectively

Table 1: Gross composition of broiler starter containing jute mallow and waterleaf with their combinations

Ingredients	T1 Control	T2 Jute-Mallow (10%)	T3 Waterleaf (10%)	T4 JM/WL (5%/5%)
Maize	52.06	44.06	44.06	44.06
Soybean meal	12.25	12.25	12.25	12.25
Wheat offal	8.1	8.1	8.1	8.1
Groudnut cake	18.99	16.99	16.99	16.99
Fishmeal	5.00	5.00	5.00	5.00
Jute Mallow meal	-	10	-	5
Waterleaf meal	-	-	10	5
Bone meal	2.10	2.10	2.10	2.10
*Vitamin Premix	0.80	0.80	0.80	0.80
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Common salt	0.30	0.30	0.30	0.30
TOTAL	**100**	**100**	**100**	**100**
Crude protein (%)	23.14	23.32	23.32	23.32
M.E (kcal/kg)	2852.01	2729.21	2729.21	2729.21
Ether extract (%)	4.43	4.49	4.49	4.49
Ash (%)	3.41	3.20	3.20	3.20
Crude fibre (%)	4.06	5.22	5.22	5.22
Calcium (%)	1.16	1.17	1.17	1.17
Phosphorus (%)	0.76	0.75	0.75	0.75

[1]Premix: A – 12,000,000IU; Vitamin B_1 – 2,000mg; Vitamin B_6 – 3,500mg; Vitamin B_{12} – 20mg; Vitamin D_3 – 3,000,000IU; Vitamin E – 30,000mg; Vitamin K_3 – 2,500mg; Antioxidanrt – 125,000mg, Biotin – 80mg; Calpan – 10,000mg, Choline Chloride – 200,000mg; Cobalt – 250mg, Copper – 8,000mg, Folic acid – 1,000mg; Iodine – 1,200mg; Iron – 40,000mg; Manganese – 70,000mg; Niacin – 40,000mg; Selenium – 250mg; Zinc – 60,000mg.

Key:

ME= Metabolizable energy

T1 = control no jute-mallow and waterleaf

T2 = 10% of jute-mallow and 0 waterleaf meals

T3 = 0 % jute-mallow and 10 % of waterleaf meals

T4 = 5% jute-mallow and 5% waterleaf meals.
JM = Jute Mallow
WL = Waterleaf

Table 2: Gross composition of broiler finisher containing jute mallow and waterleaf with their combinations

Ingredients	T1 Control	T2 Jute-Mallow (10%)	T3 Waterleaf (10%)	T4 JM/WL (5%/5%)
Maize	54.66	46.66	46.66	46.66
Soybean meal	10.34	10.34	10.34	10.34
Wheat offal	10	10	10	10
Groundnut cake	17.40	15.40	15.40	15.40
Fishmeal	4.00	4.00	4.00	4.00
Jute Mallow meal	-	10	-	5
Waterleaf meal	-	-	10	5
Bone meal	2.10	2.10	2.10	2.10
*Vitamin Premix	0.80	0.80	0.80	0.80
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Common salt	0.30	0.30	0.30	0.30
TOTAL	**100**	**100**	**100**	**100**
Crude protein (%)	21.07	21.37	21.37	21.37
M.E (kcal/kg)	2855.34	2727.57	2789.13	2811.37
Ether extract (%)	4.32	4.39	4.39	4.39
Ash (%)	2.95	2.76	2.76	2.76
Crude fibre (%)	4.10	5.27	5.27	5.27
Calcium (%)	1.05	1.07	1.07	1.07
Phosphorus (%)	0.71	0.7	0.7	0.7

[1]Premix: A – 12,000,000IU; Vitamin B_1 – 2,000mg; Vitamin B_6 – 3,500mg; Vitamin B_{12} – 20mg; Vitamin D_3 – 3,000,000IU; Vitamin E – 30,000mg; Vitamin K_3 – 2,500mg; Antioxidanrt – 125,000mg, Biotin – 80mg; Calpan – 10,000mg, Choline Chloride – 200,000mg; Cobalt – 250mg, Copper – 8,000mg, Folic acid – 1,000mg; Iodine – 1,200mg; Iron – 40,000mg; Manganese – 70,000mg; Niacin – 40,000mg; Selenium – 250mg; Zinc – 60,000mg.

Key:
ME= Metabolizable energy
T1 = control no jute-mallow and waterleaf ; T2 = 10% of jute-mallow and 0 waterleaf meals ; T3 = 0 % jute-mallow and 10 % of waterleaf meals; T4 = 5% jute-mallow and 5% waterleaf meals.; JM = Jute Mallow ; WL = Waterleaf

Experimental design

A total of one hundred and sixty (160) day-old Ross 308 broiler chicks were used for the study. The birds were randomly allotted into four treatment groups T1, T2, T3 and T4, respectively. Each treatment had four replicates. There were ten birds per replicate, making a total of 40 birds per treatment. A complete randomized design was used. T1 (control) contained 0% jute mallow and waterleaf, T2 contained 10% jute mallow 0% waterleaf, T3 contained 0% jute mallow 10% waterleaf while T4 contained 5% jute mallow 5% waterleaf, as indicated in Tables 3.1 and 3.2.

Experimental birds and management

The birds were housed in a deep litter and were uniformly cared for and managed. The experiment lasted for seven weeks. Feed and clean wholesome drinking water were provided *ad-libitum* throughout the experimental trial period. The birds were raised in deep litre system.

The housing was an open sided wall house so as to provide proper cross ventilation while in the evening when the temperature normally drops the open sides are covered using tarpaulins to provide warmth. Before the arrival of the birds, the poultry house was rigorously scrapped, scrubbed and swept, after which it was then washed and disinfected. Newspapers were spread on the floor as litter material, so as to help prevent heat loss, during the brooding stage and as source of heat charcoal pots were used. On arrival, they were served water containing vitalyte to help cushion the effect of transportation stress. Feed and clean water were subsequently made available and this continued *ad libitum*. Vaccination routine was carried out as follows:

2nd week	-	Lasota 1st dose
3rd week	-	Gumboro 1st dose
5th week	-	Lasota 2nd dose

Medication was also made administered via drinking water. Glucose was often served to prevent stress and improve appetite. Virucine and Pox Proline were used for the control and treatment of fowl pox. Amprolium was administered to prevent coccidiosis.

Data collection

On arrival of the birds, their initial live weights were taken, marking the official commencement of the experiment. After which the weekly weight were taken, the weight of each bird in a replicate was taken and the total sum of the weights were divided by the number of birds in that replicate to get the average weekly weight. These weekly weight measurements were used to calculate the growth parameters of the birds viz-a-viz, daily weight gain, weekly weight gain and total weight gain. Data were also collected on feed intake, these were achieved by measuring the quantity of feed served and the quantity of feed leftover, and the difference between these two was the feed intake.

$$Average\ daily\ feed\ intake\ (g) = \frac{\text{quantity of feed served (g)} - quantity\ of\ feed\ leftover\ (g)}{\text{Number of birds}}$$

$$Average\ daily\ weight\ gain = \frac{\text{average final weight gain} - average\ initial\ weight}{\text{Number of dayss}}$$

$$Average\ feed\ conversion\ ratio = \frac{\text{average quantity of feed consumed (g)}}{\text{Average weight gain (g)}}$$

$$\text{Average \% weight gain} = \frac{\text{Average weight gain}}{\text{Average intial weight}}\ x\ 100$$

Data Analysis

Data collected on body weight gain, feed intake, feed conversion ratio of the chickens were analyzed by one-way analysis of variance using SAS (2015).

Table 3: Proximate composition of jute mallow (*C. olita* waterleaf (*T. triangulare*)

Nutrients%	Jute mallow	Waterleaf
Moisture content	4.40	8.55
Crude fibre	30.98	31.63
Crude protein	22.75	21.60
Ash	28.50	24.00
Fat	0.92	0.89
Nitrogen free extract	12.45	13.33

Results and Discussion

The results of growth performance of the birds showed that there were no significant ($p>0.05$) differences across all the treatment values. Numerically, birds in Treatment 3 had the highest value in total weight gain. It was higher than those in Treatment 2, which were subsequently higher than Treatments 4 and 1 respectively. Daily feed intake across the treatments revealed progressive growth pattern of the birds. Birds in Treatment 3 consumed the highest ($p>0.05$) feed, closely followed by Treatment 2 and 4, while birds in Treatment 1 had the lowest feed intake values, and this can be related to their body weight gain as it follows virtually the same curve. While the feed conversion ratio of the Treatment birds, were all numerically similar.

Table 4: Growth performance of broilers fed the experimental diets

Parameters	T1	T2	T3	T4	SEM
Average initial weight (g)	50.67	47.72	50.81	50.52	0.86
Average final weight (g)	1537.05	1658.05	1700.70	1642.52	38.40
Average weight gain (g)	1486.37	1610.32	1649.88	1592.00	38.18
Average daily weight gain (g)	30.92	33.55	34.37	33.17	0.79
Average feed intake (g)	2373.93	2532.77	2580.97	2501.88	386.06
Average daily feed intake (g)	49.45	52.76	53.80	52.31	8.06
Feed conversion ratio	1.59	1.57	1.56	1.57	0.38
Mortality (%)	5	7.5	5	7.5	0.18

^{abc} = means with different superscripts on the same row are significantly ($p<0.05$) different

SEM: standard error of mean

p value: probability value

T1 – control no jute-mallow and waterleaf ; T2 – 10% of jute-mallow and 0 waterleaf meals; T3 – 0 % jute-mallow and 10 % of waterleaf meals; T4 - 5% jute-mallow and 5% waterleaf meals

There was no significant difference ($p>0.05$) in the mortality recorded across the dietary treatments. The result obtained for growth performance in this study is in agreement with the results obtained by Siaboc (2018) when he fed broilers with different levels of fermented jute leaves. He observed that despite varying the levels of the inclusion of jute leaves in the diets of the broiler birds, no significance ($p>0.05$) differences were noticed in the average daily feed intake, average final feed intake, average daily weight gain, average weight gain, feed conversion ratio and feed efficiency ratio. However, it was in disagreement with Nworgu *et al.,* (2015) who reported significant ($p<0.05$) changes in the final body weight and total feed intake of broiler fed with varying levels of waterleaf. It is noteworthy though that this current study looked at inclusion of waterleaf at 10% and its combination with jute mallow, whereas that of Nworgu *et al.,*(2015) focused solely on the effect of varying levels of waterleaf on the growth performance of broilers.

Although no significant ($p>0.05$) difference was recorded in the growth parameters of the experimental birds, numerically, all the diets with the test ingredients outperformed the control diet. Siaboc (2018) reported same that birds fed with different levels of fermented jute leaves performed better than their control counterpart. This was further confirmed by Ndelekwute *et al.,* (2015) and Cardoso *et al.,*(2012) who stated that feed additives when used in broiler chicken feeds promote growth and also improve weight gain, feed consumption, feed digestibility and feed conversion of broiler chickens.

There were no significant ($p>0.05$) differences in mortality across the treatments. This showed that the possible presence of anti-nutritional factors in the test ingredients (jute mallow and waterleaf) had no lethal effects on the birds. This is supported Siaboc (2018) and Nworgu *et al.,* (2015), who reported in a similar study that there were no adverse effects in feeding broilers with diets in which jute mallow and waterleaf were used as additives. There were no significant ($p>0.05$) differences in the live weight of the birds across the treatment means though birds fed diet in treatment 3 were heavier in weight.

Conclusion and recommendation

From the results obtained from this experimental research, it can be concluded that, no significant ($p>0.05$) difference resulted from the use of jute mallow and waterleaf as additives in broiler diets. The inclusion of jute mallow and waterleaf in broiler diets had no negative effect on the broiler birds and the birds on the experiment diets performed as well as the control diet, hence the

lack of significant difference in all the diets. It is therefore recommended that either or both jute mallow and waterleaf could be incorporated in poultry diets if the farmer wants the birds to benefits from the various advantages of these leafy vegetables and further research work should be conducted on the utilization of jute mallow and waterleaf meal in the production of poultry birds.

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