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Effect of feeding *Jatropha tanjorensis* leaf meal as a growth promoter on the performance, carcass characteristics and sensory properties of broiler chicken

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Abstract

144 day-old broiler chicks of the Oba Marshal strain were used to evaluate the effect of feeding Jatropha tanjorensis leaf meal as a growth promoter on the performance, carcass characteristics and sensory properties of broiler chicken. The birds were randomly allocated to four dietary treatments, after adjustment to the deep litter pens for one week. Each treatment was replicated three times with 12 chicks per replicate.The treatments were 0.0, 0.5, 1.0 and 1.5 % dietary inclusion level of Jatropha tanjorensis leaf meal (JTLM) tagged T_1, T_2, T_3andT_4 respectively. Feed and water were supplied to the birds ad libitum. At the end of the seven weeks feeding trial, one bird per replicate was randomly selected and fasted for 12 hours, and then slaughtered with a sharp knife through cervical dislocation. The slaughtered, plucked, eviscerated and dressed weights of the birds were then determined as well as the weights of the primal cuts. Part of the meat from the breast and drumsticks were cooked and used for sensory evaluation, using a semi-trained 20-man panelist based on a nine-point Hedonic scale. Data collected were analyzed using ANOVA based on the completely randomized design model; where means were significant ($p<0.05$), they were separated using Duncan Multiple Range Test. Results showed that the final body weight, total body weight gain, total feed intake, feed conversion ratio (FCR) and mortality were not significantly ($P>0.05$) affected by the dietary treatments at the starter phase However, at the finisher phase, the final body weight, total body weight gain as well as the average body weight gain of the birds increased incrementally as the dietary inclusion level of Jatropha tanjorensis leaf meal (JTLM) increased; with the values obtained for birds fed the 1.5 % JTLM being significantly ($P<0.05$) higher than those of the other treatments. Also, live weight, eviscerated weight and dressed weight were significantly ($P<0.05$) affected by the dietary treatments, with birds fed diet containing 1,5 % JTLM showing significantly ($P<0.05$) higher values than those of the other treatments.The sensory properties examined revealed that only appearance and overall acceptability were significantly ($P<0.05$) affected by the dietary treatments; with the meat from birds fed 1.0 % JTLM having significantly higher scores for appearance and general acceptability, but not for 1.5 % JTLM. Therefore, it can concluded that Jatropha tanjorensis leaf meal can be included in the diets of broiler chicken up to 1.5 %, especially at the finisher phase, for optimum growth performance, carcass characteristics and sensory properties of the meat of broiler chicken.

Keywords: *Jatropha tanjorensis* leaf meal, growth performance, carcass characteristics, broiler chicken

Effet de l'alimentation de la farine de feuilles de Jatropha tanjorensis en tant que promoteur de croissance sur les performances, les caractéristiques de la carcasse et les propriétés sensorielles du poulet à griller

Résumé

144 poussins à griller âgés d'un jour de la souche Oba Marshal ont été utilisés pour évaluer

l'effet de l'alimentation de farine de feuilles de Jatropha tanjorensis comme promoteur de croissance sur les performances, les caractéristiques de la carcasse et les propriétés sensorielles du poulet à griller. Les oiseaux ont été répartis au hasard entre quatre traitements diététiques, après ajustement aux enclos à litière profonde pendant une semaine. Chaque traitement a été répété trois fois avec 12 poussins par répétition. Les traitements étaient de 0,0, 0,5, 1,0 et 1,5 % d'inclusion alimentaire de farine de feuilles de Jatropha tanjorensis (FFJT) étiquetées T_1, T_2, T_3 et T_4 respectivement. La nourriture et l'eau ont été fournies aux oiseaux ad libitum. À la fin de l'essai d'alimentation de sept semaines, un oiseau par répétition a été sélectionné au hasard et a jeûné pendant 12 heures, puis abattu avec un couteau tranchant par dislocation cervicale. Les poids abattus, plumés, éviscérés et habillés des oiseaux ont ensuite été déterminés ainsi que les poids des coupes primaires. Une partie de la viande de la poitrine et des pilons a été cuite et utilisée pour l'évaluation sensorielle, à l'aide d'un panéliste de 20 hommes semi-formé sur la base d'une échelle hédonique en neuf points. Les données recueillies ont été analysées à l'aide d'une ANOVA basée sur le modèle de conception entièrement randomisé ; lorsque les moyennes étaient significatives ($p < 0,05$), elles ont été séparées à l'aide du test de gamme multiple de Duncan. Les résultats ont montré que le poids corporel final, le gain de poids corporel total, l'apport alimentaire total, l'indice de conversion alimentaire (ICA) et la mortalité n'étaient pas significativement ($P>0,05$) affectés par les traitements diététiques à la phase de démarrage. Cependant, à la phase de finition, le poids corporel final, le gain de poids corporel total ainsi que le gain de poids corporel moyen des oiseaux ont augmenté progressivement à mesure que le niveau d'inclusion alimentaire de farine de feuilles de Jatropha tanjorensis (FFJT) augmentait ; les valeurs obtenues pour les oiseaux nourris avec le FFJT à 1,5 % étant significativement ($P<0,05$) supérieures à celles des autres traitements. De plus, le poids vif, le poids éviscéré et le poids habillé ont été significativement ($P<0,05$) affectés par les traitements diététiques, les oiseaux nourris avec un régime contenant 1,5 % de FFJT montrant des valeurs significativement ($P<0,05$) plus élevées que celles des autres traitements. Les propriétés sensorielles examinées ont révélé que seules l'apparence et l'acceptabilité globale étaient significativement ($P<0,05$) affectées par les traitements diététiques ; avec la viande d'oiseaux nourris avec 1,0 % de FFJT ayant des scores significativement plus élevés pour l'apparence et l'acceptabilité générale, mais pas pour 1,5 % de FFJT. Par conséquent, on peut conclure que la farine de feuilles de Jatropha tanjorensis peut être incluse dans l'alimentation des poulets à griller jusqu'à 1,5 %, en particulier lors de la phase de finition, pour des performances de croissance, des caractéristiques de carcasse et des propriétés sensorielles optimales de la viande de poulet à griller.

Mots-clés : Farine de feuilles de Jatropha tanjorensis, performances de croissance, caractéristiques de la carcasse, poulet à griller.

Introduction

There is growing interest in the developing countries of the world to promote the production of fast-growing animals such as poultry, as a result of increasing demand for animal protein (Obinne and Okorie, 2008). Atteh (2004) noted that the protein from poultry meat is of high quality and is used as a standard against which other proteins are compared. Broiler chicken grows very fast and provides tender meat for human consumption. However, the cost of production keeps increasing as a result of the cost of feed ingredients, particularly protein sources such as soybean and fishmeal; and energy sources such as maize and millet. The rising cost of poultry feed is a major concern to the development of the

poultry industry in the developing countries (Hagan, 2013). According to Banson *et al* (2015), about 70 % of the total cost of production in poultry can be attributed to feeding cost.

The use of feed additives to improve the efficiency of growth andor eggs production, prevent disease and improve feed utilization is a strategy to improve the efficiency of the poultry industry (Pirgozliev *et al*., 2019). The European Feed Standard Agency (EFSA) describes feed additives as products used in animal nutrition for purposes of improving the quality of feed and the quality of food from animal origin, or to improve the animals' performance and health. EFSA recognizes five categories of feed additives including zootechnical (enzymes, probiotics, prebiotics and certain phytogenics), nutritional (vitamins and amino acids), technological (organic acids, antioxidants and pellet binders), sensory additives (flavours) and coccidiostats. Of recent, phytogenic feed additives have caught the attention of researchers. This is because antibiotics usage had been banned in Europe and many other countries of the world due to their negative effects of inducing drug resistance in man as a result of their leftover residues in the meat of farm animals (Kamal and Abo Omar, 2012). Phytogenics, also referred to as plant secondary metabolites, phytochemicals, phytobiotics or botanicals, are plant-derived products/extracts and include a wide range of substances such as herbs, spices, essential oils and oleoresins, reported to exhibit growth promoting and/or therapeutic properties (Windisch *et al*., 2008; Pirgozliev *et al*., 2015). The plant, *Janthropha tanjorensis,* belongs to the family of *Euphorbiaceae* with common names such as “Catholic vegetable”, "Hospital too far" and "Iyanapaja" in Yoruba, and Chaya leaves in English.It is grown in the tropics including India, Bahamas and Africa. It is a shrub, 6 m high, with spreading branches and stubby twinges and smooth grey bark, which gives off whitish coloured latex when cut. The leaves are deciduous alternate but with apical crowded, orate, acute to acuminate basally cordate, 3-5 lobe in outline, 6-40 cm broad, the petioles 3-8 cm long. The flowers are greenish cymes, bell-shaped, sepals broadly deltoid (Egbon*et al*., 2013). The leaves have been used for centuries to cure anemia, diabetes, and cardiovascular disorders. It has a long history of use as a medicinal plant in South-Eastern Nigeria, with many locals claiming that it has blood-replenishing powers. Jatropha leaf meal is high in beta blockers and anti-cancer compounds, with anti-anaemic, anti-microbial activities, as well as anti-plasmodial and anti-oxidant characteristics, which protect against oxidative stress caused by the malaria parasite (Omoregie and Sisodia, 2011). Therefore, this research study is aimed at evaluating the growth promoting properties of *Jatropha tanjorensis* leaf meal; especially its effects on the growth performance, carcass characteristics and the sensory properties of broiler chicken.

Materials and methods

Experimental location

This research study was conducted at the Poultry Section of the Department of Animal Production Teaching and Research Farm, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna, Niger State. Minna is located within latitude 9˚ 30' North and longitude 6˚ 33' East of the equator. The mean annual rainfall is between 1200-1300 mm, while temperature varies between 38˚C to 47˚C. The characteristic vegetation in Minna is Southern Guinea Savanna Zone (Post Graduate School Prospectus, Federal University of Technology, Minna, 2012).

Source and preparation of the test ingredient

Fresh leaves were plucked from the *Jatropha tanjorensis* plant found in Minna and environs, in Niger State of Nigeria. These leaves were oven dried at between 65-70˚C for 24 hours. The leaves were inspected thoroughly to avoid any foreign material mixing with it and then ground into fine particles using an attrition mill. The ground leaves were stored in an air tight polythene bag to prevent entrance of air and water to avoid spoilage. The powdered leaves were later incorporated into the experimental diets.

Table 1: Composition of the experimental diets for both the starter and finisher phases

Ingredients (%)	T_1	T_2	T_3	T_4
Maize	46.20	46.20	46.20	46.20
Full fat soya bean	27.40	26.90	26.40	25.90
Groundnut cake	9.90	9.90	9.90	9.90
Wheat offal	7.00	7.00	7.00	7.00
Palm oil	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00
Limestone	1.00	1.00	1.00	1.00
Fishmeal	2.00	2.00	2.00	2.00
Methionine	0.50	0.50	0.50	0.50
Lysine	0.50	0.50	0.50	0.50
*Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Jatropha leaf meal	0.00	0.50	1.00	1.50
Total	**100**	**100**	**100**	**100**
Calculated analysis				
Crude protein (%)	22.54	22.51	22.48	22.44
ME (Kcal/kg)	2994	2986	2971	2963
Crude fibre (%)	4.61	4.58	4.56	4.53
Ether extract (%)	9.70	9.61	9.52	9.43
Lysine (%)	1.52	1.51	1.50	1.49
Methionine (%)	1.08	1.07	1.06	1.06
Calcium (%)	1.38	1.38	1.38	1.38
Available phosphorus (%)	0.77	0.76	0.76	0.76

T_1= 0 % Jatropha leaf meal T_2= 0.5 % Jatropha leaf meal
T_3= 1.0 % Jatropha leaf meal T_4= 1.5 % Jatropha leaf meal

*Composition of the premix used: 0.25kg of premix contained vitamin A 30,000,000i.u, vitamin D 6000,000i.u, vitamin E 30,000i.u, vitamin K 2,000mg, vitamin C 20g, vitamin B_2 5,000mg, folic acid 1,000mg, zinc 30,000mg, iron 40,000mg, iodine 20,000mg, selenium 150mg, manganese 100,00mg, biotin 400mg, copper 1,200mg, antioxidant 1,250mg.

The experimental diets

Four experimental diets were used in this study. Diet 1 (T_1) served as the Control diet and contained no *Jatropha* leaf meal (JLM). Diet 2, 3 and 4 contained 0.50, 1.00 and 1.50 % JLM forming treatment T_2, T_3 and T_4 respectively. Single phase feeding regime was used in this experiment for both the starter and finisher phases and the diets were formulated to contain 22 % crude protein and 3000 Kcal/kg metabolizable energy. Table 1 shows the ingredients composition of the experimental diets.

Experimental birds and their management

A total of 144 Oba Marshal day-old broiler

chicks obtained from a branch of Agrited Company located in Minna, Niger State,***were used for this study. Before the arrival of the birds, t***he brooding house and its environment were thoroughly swept, washed and disinfected with Izal® disinfectant solution. ***Upon arrival, the birds were carefully unboxed and kept in the deep litter pens warmed with heat from charcoal pots, with wood shavings as litter material. G***lucose was supplied to the chicks in their drinking water for rapid energy supply and Vitalyte® administered as a stress reliever.After an hour, the Control diet was introduced to the birds, and they were acclimatized to this environment for one week before being randomly allotted to four (4) treatment groups; with each treatment made up of three replicates of 12 birds per replicate housed in a 2.5 m x 1 m deep litter pen, making a total of 36 birds per treatment. Feed and water were supplied *ad libitum*. Daily activities included weighing and removal of left over, uneaten feed, washing of drinkers, provision of clean drinking water and feed, and disposal of dead birds, if any. Administration of recommended medications such as antibiotics, coccidiostats and dewormers, as well as vaccinations were carried out. The experiment lasted for seven weeks, made up of three weeks for the starter phase and four weeks for the finisher phase. The protocols of animal welfare as enshrined in the recommendations of the Nigerian Institute of Animal Science (NIAS) were strictly observed.

Data collection

Feed intake was calculated by subtracting the left-over, uneaten feed from the initial feed given to the birds daily. Total feed intake was calculated by adding up all the daily feed intake. On arrival, the birds were weighed using a weighing scale. Subsequently, they were then weighted weekly to determine their weekly body weight gains. Feed conversion ratio (FCR) was calculated by dividing the total feed intake by the total body weight gain, using the procedure of Ayanwale *et al.* (2003).

At the end of the feeding trial, one bird per replicate (making a total of three birds per treatment) were randomly selected for carcass evaluation after their feed were withdrawn for 12 hours before slaughtering. The birds were then slaughtered by severing their jugular veins, left to bled for about 15 minutes to allow proper outward flow of blood, defeathered and cleaned. They were then eviscerated and their internal organs neatly removed. The weight of the cut-up-parts such as the breast, back, thighs, wings, shanks and drumsticks and internal organs were determined and expressed as percentage of the dressed weight while the weight of the internal organs were expressed as percentage of the live weight, based on the procedure of Jiya *et al.* (2014). Parts of the carcasses, (breast and drumsticks),were randomly selected from each treatment, sliced into uniform sizes and cooked for 10 minutes at 100^0C with a small amount of salt added to improve the taste. They were thenused for sensory evaluation by a 20-member panelist using the 9-point Hedonic scale, as described by Meilgaard *et al*. (2006). Data collected were analyzed based on a one-way analysis of variance (ANOVA) using SPSS statistical package (2012, Version 21). Where significant differences occurred among the treatment means, they were separated using the Duncan Multiple Range Test as contained in the Package.

Results and discussion

The proximate composition of *Jatropha tanjorensis* leaf meal is presented in Table 2.The crude protein (CP) value of 18.2 %, crude fibre (CF) of 5.50 %, ether extract (EE) of 8.50 %, nitrogen free extracts

(NFE) of 50.60 % and ash value of 10.00 % obtained in this study is similar to the result obtained by Bello *et al.* (2008) for raw but dried *Jatropha tanjorensis* leaf meal. The authors obtained CP of 24.60 %, CF of 9.70 %, EE of 4.50 %, NFE of 58.8 % and ash content of 8.10 %; but when the leaves were blanched and dried, blanching increased the CP, CF and EE by 24.6, 30.5 and 37.8 % respectively. This shows that the leaf meal of *Jatropha tanjorensis* has high CP and low CF value and hence could be a valuable feed resource for poultry.The results of the proximate composition of JTLM obtained in this study however contradicts the findings of Egbon *et al.* (2013) and Chigozie *et al.* (2018) who obtained 4.75 and 6.99 % for CP, 10.10 and 12.17 % for CF, and 0.02 and 11.73 % for EE respectively. The wide variation in composition may be due to differences in ecology, soil composition, method of harvesting and processing as well as varietal differences. The proximate composition of the experimental diets is shown in Table 3. These compositions meet the nutrient requirements of broiler chicken as recommended by Olomu (2011) for the tropical and subtropical regions of the world.

Table 2: Proximate composition of *Jatropha tanjorensis* leaf meal

Parameter	Composition (%)
Moisture	7.20
Dry matter	92.80
Crude protein	18.20
Crude fibre	5.50
Ether extract	8.50
Ash	10.00
Nitrogen free extract	50.60

Table 3: Proximate composition of the experimental diets

	Experimental Diets			
Parameter (%)	**T_1**	**T_2**	**T_3**	**T_4**
Moisture	3.00	3.60	3.60	3.40
Dry matter	97.00	96.40	96.40	96.60
Crude fibre	4.00	4.00	5.50	5.00
Ash	9.50	10.00	7.50	10.50
Ether extract	10.50	16.50	13.50	11.00
Crude protein	22.25	21.96	22.70	22.36
NFE	50.75	43.94	47.20	47.74

T_1: Jatropha leaf meal at 0 % inclusion level, T_2: Jatropha leaf meal at 0.5 % inclusion level
T_3: Jatropha leaf meal at 1.0 % inclusion level, T_4: Jatropha leaf meal at 1.5 % inclusion level
NFE = Nitrogen free extracts

The effect of *Jatropha tanjorensis* leaf meal as a growth promoter on the performance of broiler chicken at the starter phase is presented in Table 4. The results show that the final body weight, total body weight gain, total feed intake, feed conversion ratio (FCR) and mortality were not significantly ($P>0.05$) affected by the dietary treatments. However, at the finisher phase, the final body weight, total body weight gain as well as the average body weight gain of the birds increased as the dietary level of *Jatropha tanjorensis* leaf meal (JTLM) increased; with the values obtained for birds fed the 1.5 % JTLM being significantly ($P<0.05$) higher than those of the other

treatments.The total feed intake as well as the FCR were not significantly (P>0.05) different across the treatments (Table 5). This significant effect of JTLM on growth performance of broiler chicken at the finisher phase might be due to the special attributes of this plant as a phytogenic feed additive and growth promoter. It has been reported that many traditionally known phytogenics possess anticancer activity, antioxidant activity, anti-inflammatory, anti-diabetic, anti-bacterial, anti-fungal and hepato-protective activities (Mahdi *et al*., 2008). *Jatropha tanjorensis* especially, have been reported to have medicinal value, possessing significant anti-cancer, hepatoprotective and pesticidal activity (Anwar, 2007).

Table 4: Growth performance of broiler chicken fed diets containing *Jatropha tanjorensis* leaf meal at the starter phase

Parameters	T_1	T_2	T_3	T_4	SEM	P-value
INT WT(g)	78.87	79.18	78.14	77.16 2.66	0.77	
FIN WT(g)	322.23	311.00	319.55	301.11	26.32	0.70
TFI(g)	446.79	447.77	459.57	460.54	16.05	0.82
TBWG(g)	243.35	231.82	241.25	223.95	26.03	0.71
ABWG(g)	19.23	18.36	20.08	18.84	2.61	0.83
FCR	1.39	1.44	1.45	1.54	0.14	0.61
MOR (%)	0.00	0.00	5.13	2.78	5.40	0.57

T_1: Jatropha leaf meal at 0 % inclusion level, T_2: Jatropha leaf meal at 0.5 % inclusion level
T_3: Jatropha leaf meal at 1.0 % inclusion level, T_4: Jatropha leaf meal at 1.5 % inclusion level
SEM = Standard error of means MOR = Mortality, P-value = Probability value
INT WT = Initial body weight, FIN WT = Final body weight, TFI = Total feed intake
TBWG = Total body weight gain, ABWG = Average body weight gain, FCR = Feed conversion ratio

Table 5: Growth performance of broiler chicken fed diets containing *Jathropha tanjorensis* leaf meal at the finisher phase

Parameters	T_1	T_2	T_3	T_4	SEM	P-value
INT WT(g)	322.23	311.00	319.55	301.11	6.32	0.70
FIN WT(g)	1359.81^{c}	1439.97^{b}	1487.18^{b}	1566.41^{a}	55.67	0.03
TFI(g)	2307.25	2494.33	2527.35	2564.65	44.69	0.17
TBWG(g)	1047.59^{c}	1137.97^{b}	1167.63^{b}	1265.30^{a}	36.35	0.04
ABWG(g)	79.81^{c}	87.53^{b}	94.71^{b}	102.68^{a}	7.28	0.05
FCR	2.04	2.04	2.01	1.94	0.03	0.76
MOR (%)	0.00	8.12	3.03	5.59	1.63	0.37

^{abc}Means on the same row with different superscripts were significantly (P<0.05) different
T_1: Jatropha leaf meal at 0 % inclusion level, T_2: Jatropha leaf meal at 0.5 % inclusion level
T_3: Jatropha leaf meal at 1.0 % inclusion level, T_4: Jatropha leaf meal at 1.5 % inclusion level
SEM = Standard error of means MOR = Mortality, P-value = Probability value
INT WT = Initial body weight, FIN WT = Final body weight, TFI = Total feed intake
TBWG = Total body weight gain, ABWG = Average body weight gain, FCR = Feed conversion ratio
conversion ratio

The stem sap stops bleeding and itching of cuts and scratches. The root decoction is used as a mouth wash for treating bleeding gums, toothache, eczema, ringworm and scabies, and also for treating dysentery and veneral diseases; while the leaf extract is consumed as a blood tonic (Locket *et al.*, 2000). All these unique qualities and attributes of *Jatropha tanjorensis* must have impacted positively on the health and wellbeing of the broiler chicken fed the leaf meal, thereby producing the enhanced growth performance recorded in this research study. The high mortality recorded

in some of the treatments was due to some rampaging rodents that ate and disbowelled some of the birds before they were promptly curtailed during the starter and finisher phases. Table 6 shows the carcass characteristics and weight of the cut-up-parts of broiler chicken fed diets containing *Jatropha tanjorensis* leaf meal as a growth promoter. Live weight, eviscerated weight and dressed weight were significantly ($P<0.05$) affected by the dietary treatments, with birds fed diets containing 1,5 % JTLM showing significantly ($P<0.05$) higher values for live weight, eviscerated weight and dressed weight than other birds fed on diets containing the other levels (0.0, 0.5 and 1,0 %). There were no significant ($P>0.05$) differences in the weight of primal cuts or cut-up-parts (back, breast, head, drumsticks, neck, shank, thigh and wings) among the dietary treatments. These results are similar to the research findings of Abu *et al.* (2015) when they fed cassava peel and leaf meals as replacement for maize and soya bean meal (20 %) respectively, in the diets of broiler chicken. Live weight, slaughtered weight, fasted weight, dressed weight and hot carcass were significantly ($P<0.05$) influenced by the dietary treatments. Also, weight of breast, thigh, drumsticks, shanks, head and neck were significantly affected by the treatments. Similarly, the results agree with the conclusion of Ogbonna *et al.* (2017) when *Cymbopogon citratus* leaf meal (composed of 25.78 % CP and 4.95 % CF) was used as an alternative to mycotoxin binder in an aflatoxin-contaminated feed (at 0.01, 0.1 and 0.2 % dietary inclusion levels). The authors found that live weight, bled weight, defeathered weight, eviscerated weight and dressed weight were significantly ($P<0.05$) different across the treatment groups. Also, weight of thighs, drumsticks, gizzard, liver and heart were significantly ($P<0.05$) different across the treatment groups. When these results are compared to that obtained by Onunkwo and George (2015) when they fed *Moringa* leaf meal (MOLM) at 0.0, 5.0, 7.5 and 10 % dietary inclusion levels to broiler chicks for seven weeks, it was found that live weights were not significant but dressed weight and weight of cut parts (drumsticks, breasts, back, neck and shanks) and weight of organs (liver, kidney, spleen and gizzard) were significantly ($P<0.05$) different across the treatments. Hence, it can be safely concluded that the chemical and nutritive components of *Jatropha tanjorensis* leaf meal must have exerted their beneficial effects on the carcass characteristics and weight of the primal cuts of broiler chicken. The sensory properties of the meat of broiler chicken fed diets containing JTLM are shown in Table 7. Of all the sensory properties examined, only appearance and overall acceptability were significantly ($P<0.05$) affected by the dietary treatments; with the meat from birds fed 1.0 % JTLM having significantly higher scores for appearance and general acceptability, but not significantly different from the scores obtained for 1.5 % JTLM. Appearance is the most important quality attributes of cooked or raw poultry meat because consumers associate it with the product's freshness, and they decide whether or not to buy the product based on their opinion of its attractiveness (Mir *et al*., 2017). According to Froning (1995), principal haem pigments found in meat are myoglobin, haemoglobin and cytochrome C, which significantly influence meat colour; and it has been found that nutrition of birds has a significant impact on poultry meat quality and safety (Mir *et al*., 2017). Hence, certain chemical components in *Jatropha tanjorensis* leaf meal, most probably the phytochemical constituents like alkaloids, flavonoids and other secondary metabolites, must have exerted their desirable influence on the consumption features of the meat of broiler chicken, thus giving us the observed results.

Table 6: Carcass characteristics and weight of cut-up-parts of broiler chicken fed diets containing *Jatropha tanjorensis* leaf meal as a growth promoter

Parameters	T_1 0 %	T_2 0.5 %	T_3 1.0 %	T_4 1.5 %	SEM	P-value
Live weight, LW (g)	1300.00^{c}	1366.67^{b}	1400.00^{b}	1466.67^{a}	62.56	0.86
Slaughtered weight (% LW)	90.35	91.39	89.06	90.75	2.75	0.75
Plucked weight (% LW)	85.61	82.97	83.35	87.40	5.46	0.41
Eviscerated weight (% LW)	63.92^{c}	69.31^{b}	74.10^{b}	79.63^{a}	5.24	0.05
Dressed weight, DW(% LW)	56.59^{c}	61.78^{bc}	66.00^{b}	71.92^{a}	5.25	0.05
Back (% DW)	14.58	18.32	16.07	17.40	4.77	0.39
Breast (% DW)	21.90	27.36	26.88	24.21	6.36	0.51
Head (% DW)	3.87	4.24	4.40	4.98	2.27	0.59
Drumsticks (% DW)	12.43	16.20	16.35	17.77	5.91	0.19
Neck (% DW)	7.53	8.14	8.75	7.68	1.41	0.78
Shanks (% DW)	7.13	8.06	7.79	8.01	1.45	0.91
Thighs (%DW)	12.90	16.19	15.66	15.75	5.80	0.51
Wings (% DW)	13.00	14.73	14.25	16.35	3.86	0.64

^{abc}Means in the same row with different superscripts were significantly different ($p<0.05$)
T_1: Jatropha leaf meal at 0 % inclusion level, T_2: Jatropha leaf meal at 0.5 % inclusion level
T_3: Jatropha leaf meal at 1.0 % inclusion level, T_4: Jatropha leaf meal at 1.5 % inclusion level
SEM = Standard error of means MOR = Mortality, P-value = Probability value

Table 7: Sensory properties of the meat of broiler chicken fed diets containing *Jatropha tanjorensis* leaf meal as a growth promoter

Parameters	T_1 0 %	T_2 0.5 %	T_3 1.0 %	T_4 1.5 %	SEM	P-value
Appearance	6.35^{b}	6.90^{ab}	7.65^{a}	7.35^{ab}	1.20	0.05
Aroma	6.75	7.00	7.15	6.85	0.50	0.72
Tenderness	7.25	7.50	8.00	7.50	0.85	0.33
Juiciness	6.50^{b}	7.55^{a}	8.35^{a}	7.75^{a}	1.00	0.00
Overall Acceptability	6.90^{c}	7.50^{bc}	8.30^{a}	7.95^{ab}	0.51	0.00

^{abc}Means in the same row with different superscripts were significantly different ($p<0.05$)
T_1: Jatropha leaf meal at 0 % inclusion level, T_2: Jatropha leaf meal at 0.5 % inclusion level
T_3: Jatropha leaf meal at 1.0 % inclusion level, T_4: Jatropha leaf meal at 1.5 % inclusion level
SEM = Standard error of means MOR = Mortality, P-value = Probability value

Conclusion and recommendations

From the results of this research study, it can be concluded that *Jatropha tanjorensis* leaf meal can be included in the diets of broiler chicken up to 1.5 %, especially at the finisher phase, for optimum growth performance, carcass characteristics and sensory properties of the meat of broiler chicken. It is a promising phytogenic feed additive and growth promoter, with medicinal uses and health benefits, for the overall growth performance and wellbeing of broiler chicken.

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