Original Research Article

INCLUSION LEVEL OF BITTER (*VERNONIA AMYGDALINA*) LEAF MEAL ON MEAT AND SENSORY QUALITIES OF BROILER CHICKENS

ABSTRACT

Feed constitutes the greatest cost input in livestock production. Feed costs continue to increase due to high inflation rates which impact negatively on livestock production in developing countries. Researchers continue to work toward reducing cost by sourcing for low-cost, unconventional feed ingredients to boost livestock production. This experiment was designed to evaluate the effects of inclusion levels of Bitter Leaf Meal (BLM) on meat and sensory characteristics of broiler chickens. Four dietary treatments were formulated thus: Treatment 1/Control (0% BLM), Treatment 2 (5% BLM), Treatment 3 (7.5% BLM), Treatment 4 (10% BLM). Two hundred and forty, 2 week old broiler chicks were obtained and randomly allotted to each treatment in a completely randomised design making 60 birds per treatment with 3 replicates of 20 birds each. Feed and water were given *ad libitum* for 8 weeks after which four birds from each replicate were randomly selected, fasted overnight and slaughtered. The prime cuts, meat and sensory qualities were evaluated and data obtained were statistically analysed. There was no significant difference between the cooking loss of drumstick of treatment 1(Control) and other treatments fed graded levels of BLM. However cooking loss for breast was significantly higher in treatment 4 (10% BLM) at 24.7, and treatments 1 to 3 recording 21.29, 18.72, and 18.97 respectively. For thigh, cooking loss was significantly lower in treatment 4 at 22.14 while values for other treatments were similar. There was no significant difference among all the treatments for oxidative rancidity and pH. Water Holding Capacity was significantly lower in treatments 3 (7.5%BLM) and 4 (10%) BLM with values of 61.11 and 66.44 2 while treatments 1 and 2 had significantly higher values of 75.00. There were no significant differences among treatments for Colour, Aroma, Tenderness, Texture and Overall Acceptability. Only treatment 4 (10% BLM) had significantly lower value for Juiciness. Flavour was significantly higher in treatments 1 (0% BLM) and 3 (7.5% BLM) with values of 5.6 and 5.7 while the other treatments were similar. Results obtained showed that dietary inclusion of BLM between 5-7.5% generally had no deleterious effects on meat and sensory characteristics of broiler chickens.

Keywords: Bitter leaf meal, Broiler Chicken, Meat quality, Sensory evaluation

INTRODUCTION

"Broiler production is currently oriented for parts marketing, and no longer to whole carcasses, which led to the development of birds with higher lean tissue yield and lower fat content" [1]. "Carcass fat content is one of the main concerns of poultry companies as the increasing awareness of consumers on health problems has generated rejection of fat carcasses. In addition to genetics, lean tissue accretion and fat deposition are influenced by nutrition, feeding program, age, sex, and environmental conditions" [2].

"In the past, Nigeria government in an attempt to alleviate this problem of protein deficiency has always resorted to mass importation of protein product - poultry meat. The present government is emphasizing on self-sustainability in poultry production and a ban has been placed on the importation of all poultry products. The challenge cause by the ban, is that of harmonizing or balancing the shortages in supply caused by the ban on importation of frozen chicken and increasing local poultry production. Poultry industry in Nigeria is controlled and managed by private individuals and farmers"[3]. "Broiler production is a very popular livestock business in Nigeria. many farmers who are into poultry business in Nigeria ranging from layers, turkeys, most times preferred to venture into broiler poultry farming first, because it is a fast and reliable way of raising poultry meat for human consumption and at the same time an income generating venture" [3].

"The poultry business is cost sensitive. Feed cost, for instance, account for between 65% and 70% of the total cost of raising poultry. Even with increasing feed cost, the poultry industry is contending with relative constant and sometimes decreasing prices of poultry products occasioned by low prices of imported broilers and declining income levels of consumers" [4]. "Thus, there is the perception that poultry farmers are being squeezed by the declining output prices and the increasing input (feed) cost. Given the critical role of poultry industry especially broiler production in addressing the countries nutritional needs and the negative impact of economic recession, it becomes imperative to evaluate the profitability of broiler business in a recession period" [4]. One unconventional feed source that could be used to reduce the high cost of conventional protein sources in livestock diet with particular reference to poultry is the bitter leaf (*Vernonia amygdalina*) meal.

"Bitter leaf is a shrub or small tree that grows throughout tropical Africa. It is popularly called bitter leaf because of its abundant bitter principles" [5]. The findings by Akwaowo *et al* [6] reported that "the young leaves, often preferred for human consumption contain high cyanide (60.1 mg 100^{-1}g DM) and tannin content (40.6mg 100^{-1} g DM)". Research has shown that "bitter leaf has some beneficial effects in disease management of poultry" [7]; such as anti-coccidiosis, anti-bacterial and anti-parasitic [8; 9]; as an anti- oxidant [10] and as a growth promoter by enhancing the gastro intestinal enzymes thus increasing feed conversions efficiency [11; 12].

Therefore, the aim of this study was to evaluate the beneficial effects of bitter leaf meal (*Vernonia amygdalina)* on meat quality and sensory evaluation of broiler chicken.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the poultry section of the National Veterinary Research Institute (NVRI) Vom, Nigeria. Vom environment is characterized by the dry harmattan winds which are cold and dry. From the middle or towards the end of January, as the harmattan winds begin to recede [13], Vom is located in Jos South local government area of Plateau state. It is situated on the south east of Jos, the Plateau State capital which is located at $8^0$45 East and $90^0$43 North with a height of about 1,285meters above sea level. Vom has a remarkable cool climate, in December and January; the night may be extremely cold, the wet season is from late April to middle October [13].

Source of test material: Bitter leaf was harvested from the tree in the same community, air dried at room temperature and crushed into a meal.

Experimental diet: Four diets containing 0 (control), 5, 7.5 and 10% of bitter leaf meal (BLM) were formulated. The diets were represented by treatments 1, 2, 3 and 4 respectively and contain 23% crude protein as showed in Table 1.

Experimental birds: Two hundred and forty-day-old arbo acre broiler chicks of mixed sexes were purchased from a reputable hatchery and brooded for two weeks, they were uniform in sizes and at 2-week old they were randomly allotted to the four dietary treatments.

Experimental animals and management

A total of 240 unsexed two weeks old broiler chicks was randomly distributed to four (4) dietary treatments in a completely randomised design at three (3) replicates of twenty (20) birds each. The feed was presented in mash form and water was provided *ad libitum.* The birds were raised on deep litter and were subjected to standard management practices and the recommended vaccines for broilers were administered.

Table 1: Composition of experimental diet

Ingredient	Control T1	T2 (5% BLM)	T3 (7.5% BLM)	T4 (10% BLM)
Maize	50.00	48.00	45.00	47.30
Wheat offal	6.30	6.30	6.80	4.00
Soya beans meal	20.00	18.00	18.00	17.00
Groundnut cake	19.00	18.00	18.00	17.00
Vegetable oil	2.00	2.00	2.00	2.00
BLM	__	5.00	7.50	10.00
Bone meal	2.00	2.00	2.00	2.00
*Premix (broiler ST)	0.15	0.15	0.15	0.15
Methionine	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00

BLM=Bitter Leaf Meal, ST= Starter

*0.25kg contain vita. A – 2,500,000iu:, vita. D-500,000iv, vita. E- 5,000iv, vita. k- 562.5mg; thiamine – 42.5mg; 3iboflavin – 1,250mg; Pyridoxine – 687.5mg; Niacin- 6,875mg; vit B12 -3.75mg; Pantothenic acid – 1,875mg; folic Acid – 1,875mg; Biotin – 12.5mg; manganese – 20g; zine – 12.5g; copper – 1.25g; iodine 0.38g; selenium – 50mg and cobalt – 50mg

Carcass evaluation: At the end of the eight weeks feeding trial, four birds from each replicate were randomly selected, fasted for (16) hours and slaughtered by severing the throat with the aid of sharp knife, The birds were allowed to bleed for five minutes and defeathered manually by immersing in warm water. Determination of carcass characteristics was done according the method described by Barton-Gade [14], carcasses were eviscerated to determine the dressed weight and weight of the carcass components (thighs, drumstick, breast, back, wings, and neck, internal organs were; heart, lung, spleen, liver were measured. Carcass, organs, and gut were weighed with the aid of laboratory electronic scale (ACCULAB).

The cut parts were expressed as percentage of live weight. The dressing percentage was calculated as a ratio of dress weight to live weight multiplied by hundred

$$\text{Dressing percentage} = \frac{dressed\ weight}{live\ weight} \text{ X } 100$$

Cooking yield

The weight of meat was recorded before and after cooking and the yield was expressed as percentage

$$\text{Cooking yield} = \frac{\text{Weight of cooked meat}}{\text{Weight of raw meat}} \text{X100}$$

Drip loss

"This was measured by the method of Mahendrakar *et al* [15] with some modifications. Each breast was weighed immediately after ageing, hung in a laminate bag, closed loosely with string and allowed to thaw. After thawing for 24 h at 4°C, the meat samples were taken out, mopped and re-weighed and the drip loss calculated".

Sensory evaluation

A total of 20 trained individuals aged between 20 and 40 years were used to assess two replicate of the prepared sausage. The samples wereevaluated using a 9-point hedonic scale for flavor, colour, juiciness, tenderness, and overall acceptability. The scale had a maximum score of 9 while the lowest score of 1 was assigned to the poorest condition Mahendrakar *et al* [15]

Water holding capacity

"Water Holding Capacity (WHC) was determined according. Wardlaw *et al* [16]. Minced meat (20 g) was placed in a centrifuge tube containing 30 ml of 0.6 M NaCl and was stirred with glass rod for 1 min. The tube was then kept at 4 ± 1 °C for 15 min, stirred again and centrifuged at 3000g (R-24, Remi Instruments, India) for 25 min. The supernatant was measured and WHC was expressed in percentage".

pH

"The pH value of raw and cooked meat samples was determined by weighing 10 grams of sample into a blender with 90ml of distilled water and homogenised until smooth slurry was formed. The digital pH meter was placed in a buffer solution in order to allow equilibrium for two minute before placing it into prepared slurry. An average of three readings taken gave the pH value according to method described" by AOAC[17].

Determination of Extract Release volume (ERV)

"The technique showed a value in determining incipient spoilage in meat as well as in predicting refrigerator shelf life" by Jay [18].

Principle: The method is based on the amount of aqueous extract that meat homogenate releases when allowed to pass through filter paper for a specified amount of time. Meat with good organoleptic and microbial quality releases a large amount of extract, whereas meat with poor quality releases a smaller amount or none. Requirements: Beaker, distilled water, Whatman No. 1 filter paper, pestle and mortal, graduated cylinder.

Procedure

a) Take 25 g meat sample in 100 ml distilled water
b) Bend it with in pestle and mortal
c) Filter through Whatman No. 1 filter paper, folded thrice so as to make eight sections.
d) Allow the homogenate to seep between the folds
e) Collect the extract in 100 ml graduated cylinder for 15 min.
f) Record extract release volume and interpret results

Interpretation:

ERV (ml) Meat quality
> 25 ml Good quality
> 20 ml Incipient spoilage
< 20 ml Spoiled meat

Determination of meat swelling Capacity

Principle: “This test determines the freshness of meat swelling capacity of meat increases during spoilage due to protein degradation and penetration of more amounts of water in protein matrix. A method of measuring the water binding capacity of muscle proteins with low water holding forces known as meat swelling (SW).

Requirements: distilled water, centrifuge, blender, graduated cylinder Wierbicky” [19]

Procedure

I. Take 25 g of meat in 100 ml of distilled water
II. Blend it for 2 min
III. Centrifuge 35 ml of homogenate at 2000 rpm for 15 min
IV. Measure the volume of supernatant (S)
V. Record the volume and denote it as “S”.

Percent meat swelling can be determined as

$$\% \text{ swelling} = \frac{(35 - S - 7)}{7} \times 100$$

Cold shortening

This was measured by the method of Oshbanjo [20] with some modifications. Each breast meat was cut into 10cm long (initial length) then placed on a tray and immediately kept in the freezer for 24 hours. After frozen for 24 h at -10°C, the meat samples length was taken before thawing (final length). Cold shortening in percentage was calculated using the formula below:

$$\text{Cold shortening} = \frac{\text{Initial length} - \text{Final length}}{\text{Initial length}} \times 100$$

Thermal shortening

This was measured by the method of Oshbanjo [20] with some modifications. Each breast meat was cut into 10cm long (initial length) then placed on a tray and immediately put into the oven which have been preheated to 100^{o}C for 20 min. The final length was measured and recorded. Thermal shortening in percentage was calculated using the formula below:

$$\text{Thermal shortening} = \frac{\text{Initial length} - \text{Final length}}{\text{Initial length}} \times 100$$

Analysis of Oxidative Rancidity/Lipid per oxidation

“Thiobarbituric acid value (TBA) was estimated by modified methods of Buege *et al* [21]. Three mls each of glacial acid and 1% TBA solution were added to test tubes appropriately labelled blank and tests. 0.6ml of distilled water was added to the blank, while 0.6ml of the homogenised sample was added to each of the tests tubes. These were thoroughly mixed, incubated in a boiling water bath for 15 minutes, then allowed to cool, after which they were centrifuged and their supernatants collected. The supernatant from the blank was used to zero the spectrophotometer (preset at 532nm) before reading the absorbance of the supernatant from the test solutions”.

The amount of TBARS was expressed as milligrams of malondialdehyde per gram of sample.

$$TBA = \frac{O.D \times V \times 1000}{A \times v \times I \times Y}$$

Where:

O.D = Absorbance of test at 532nm.

V= Total volume of the reaction mixture = 6.6mL

A= Molar extinction coefficient of the product, and according Buege *et al* [21]. is equal to 1.56×10^{5}

I= Length of light path =1cm.

Y= mg of tissue in the volume of the sample used.

v= volume of tissue extract used =0.6ml

Data analysis

The data obtained were subjected to analysis of variance of S.A.S package and means was separated using New Duncan multiple range test of the same software.

RESULTS

Table 2: Cooking loss of meat from broiler chickens fed graded levels of Bitter leaf meal#

Parameter (%)	Control	5%Bitter leaf	7.5%Bitter leaf	10%Bitter leaf	SEM	P-value
Breast	21.29^{b}	18.72^{c}	18.97^{c}	24.07^{a}	0.66	0.001
Drumstick	25.93	26.17	21.58	25.44	0.94	0.348
Thigh	27.62^{a}	29.39^{a}	28.92^{a}	22.14^{b}	0.92	0.002

^{abc}…Means with different superscript on the same row are significantly different (P<0.05).
SEM= Standard mean error

Table 2 illustrated the cooking loss of meat from broiler chicken fed graded levels of Bitter leaf meal (BLM). As shown in the Table 2, the cooking loss for the breast was significantly higher in broiler chicken fed 10% BLM (24.07% with least loss obtained in both birds fed 5% and 7.5% BLM (18.72 and 18.97%). The drumstick cooking loss shows no significant different. Broiler chickens fed 10% BLM had the least loss at the thigh muscle.

Table 3: Oxidative rancidity and pH of meat from broiler chicken fed graded levels of Bitter leaf meal

Parameter (%)	Control	5%Bitter leaf	7.5%Bitter leaf	10%Bitter leaf	SEM	P-value
Oxidative Rancidity (mg/g)	1.45	1.45	1.39	1.21	0.05	0.110
pH	6.45^{b}	6.65^{a}	6.65^{a}	6.65^{a}	0.03	0.000

^{abc}…Means with different superscript on the same row are significantly different (P<0.05).
SEM= Standard mean error

Table 3 showed the oxidative rancidity and pH of meat from broiler chicken fed graded levels of bitter leaf meal. The oxidative rancidity shows no significant difference among the treatment groups. But a trend was observed. As the BLM inclusion level increased, the oxidative rancidity decreases. (1.45, 1.45, 1.39 and 1.21 for 0.00%, 5.00%, 7.50% and 10.00% respectively). The pH values were significantly higher in the groups fed BLM while the control birds had the least pH value.

Table 4: Physical properties of meat from broiler chickens fed graded levels of Bitter leaf meal

Parameter (%)	Control	5%Bitter leaf	7.5%Bitter leaf	10%Bitter leaf	SEM	P-value
Water Holding Capacity	75.00^{a}	75.00^{a}	61.11^{c}	66.44^{b}	1.8	0.001
Extract Release Volume	47.50^{a}	33.33^{b}	46.67^{a}	48.67^{a}	2.27	0.000
Cold shortening	3.19^{ab}	3.48^{ab}	2.59^{b}	3.95^{a}	0.19	0.001
Drip loss	18.19^{b}	34.38^{a}	14.29^{d}	20.02^{b}	2.29	0.000

^{abc}…Means with different superscript on the same row are significantly different (P<0.05).
SEM= Standard mean error

Table 4 showed the physical properties of broiler chicken fed graded levels of bitter leaf meal. This include the water holding capacity, extracts release volume, cold shortening and drip loss of meat from broiler chicken fed graded levels of bitter leaf meal. The values of water holding capacity (WHC) was higher in meat from control diet with least WHC in meat from chickens fed 7.5% BLM broiler chickens fed 5% BLM had the least extract release volumes 33.33%. The values of the cold shorting recorded includes 3.19, 3.48, 2.59 and 3.95 for the respective treatments. While the drip loss was 18.19, 34.38, 14.29 and 20.02 for 0.00%, 5.00%, 7.50% and 10.00% levels of bitter leaf inclusion respectively.

Table 5: Sensory evaluation of meat from broiler chicken fed graded levels of Bitter leaf meal

Parameter (%)	Control	5%Bitter leaf	7.5%Bitter leaf	10%Bitter leaf	SEM	P-value
Colour	7.20	6.40	6.60	6.50	0.26	0.701
Aroma	5.40	4.60	6.30	4.80	0.32	0.134
Flavour	5.60^{a}	5.00^{b}	5.70^{a}	4.70^{b}	0.28	0.000
Juiciness	5.60^{a}	5.90^{a}	5.50^{ab}	4.20^{b}	0.31	0.000
Tenderness	5.70	6.30	6.70	5.40	0.29	0.098
Texture	5.60	6.10	5.70	5.30	0.26	0.655
Overall acceptability	6.60	7.70	7.00	6.20	0.29	0.061

^{abc}…Means with different superscript on the same row are significantly different (P<0.05).
SEM= Standard mean error

Table 5 showed the colour, aroma, flavor, juiciness, tenderness, texture and overall acceptability of meat from broiler chickens fed graded levels of bitter leaf meal (BLM). The colour, aroma, tenderness, texture and overall acceptability shows no significant difference. Flavour and juiciness was significantly higher in meat from chickens fed control diet with least values in meat from chickens fed 10% BLM.

DISCUSSION

There are many definitions of quality, but the most preferred one is; "Quality is the composite of those characteristics that differentiate individual units of a product and which have significance in determining the degree of acceptability of that unit to the user" Groom [22]. "However, for meat industry, meat quality is a term used to describe the overall meat characteristics including its physical, chemical, morphological, biochemical, microbial, sensory, technological, hygienic, nutritional and culinary properties Ingr" [23].

In Table 2, the results obtained showed significant difference in the values of breast and thigh cooking loss. It was observed that there were significant differences in the breast and thigh muscles cooking loss. The result obtained could be as a result of the bitter leaf inclusion which particularly effective in reducing cooking loss compared to the control, which has significant implications on product yields. Diets for broilers now include leaf meals with a high protein content. In addition to being high in protein, leaf meals also include a number of biologically active substances that may help broiler chickens grow and stay healthy.
Table 3 depicted the oxidative rancidity and pH of meat from broiler chickens fed graded levels of bitter leaf meal. There was no significant difference (P<0.05) in the oxidative rancidity levels across treatments however, T1 and T2 had same numerical value (1.45). But a trend was observed. As the BLM inclusion level increased, the oxidative rancidity decreases. Which means, the BLM has the ability to prevent rancidity. This could be due to the presence of antioxidant in bitter leaf.
"pH has a direct bearing on the meat quality attributes such as tenderness, water-holding capacity, colour, juiciness and shelf life. The broiler breast meat with high pH has a higher water binding capacity than meat with lower pH. The pH of broiler meat is the function of amount of glycogen in the muscle prior to slaughter and the rate of glycogen conversion into lactic acid after slaughter. Identification of colour is an easy way to determine the pH of meat. If the meat is very dark, it will have a high pH and if it is very light, it will have a low pH Anadon" [24]. In this study, the pH values were significantly higher in the meat from broiler chickens fed Bitter leaf meal. This could be due to the alkaline nature of the bitter leaf contents. The slightly higher pH of meat from birds fed with BLM diets is thought to be beneficial to meat quality, as it indicated there was no significant build up of lactic acid in the meat which may increase the rate of protein denaturation and other qualitative nutrient losses [25].

Table 3 showed the physical properties of meat from broiler chicken fed graded levels of bitter leaf meal. The parameters studied were water holding capacity, extract release volume, cold shortening and drip loss. Significant difference (P<0.05) existed in all the parameters studied.
"Water holding capacity (WHC), having direct bearing on the colour and tenderness of meat, is among the most important functional properties of raw meat. For categorization of WHC of meat samples the terms water binding potential (WBP), expressible moisture and free drip has been proposed" Jauregui *et al.*[26]. "The WBP represents the maximum amount of water that muscle proteins can retain under the conditions prevailing at measurement. Expressible moisture refers to the quantity of water that can be expelled from the meat by the use of force and free drip refers to the amount of water that is lost by the meat without the use of force other than capillary forces (gravity). Increase in the water content of muscles, enhancing tenderness, juiciness, firmness,

and appearance, improve the quality and economical value of meat. WHC is the function of factors such as pH, sarcomere length, ionic strength, osmotic pressure, and development of rigor mortis which act by altering the cellular and extracellular components Offer and Knight" [27].
The WHC values observed in this experiment were not compromised in any significant manner by BLM as to negatively impact other importan meat attributes, and are similar to observations by [27]. The extract release volume and the cold shortening were significantly higher in T4 (48.67 and 3.95 respectively). While the drip loss was higher in T2 (34.38), followed by T4 (20.02), T1 (18.19) and T3 (14.29). The results were mixed and followed no particular pattern.

Table 4 illustrated the sensory in valuation of meat from broiler chicken fed graded levels of bitter leaf meal. No significant difference was observed in the colour, aroma, flavor, Juiciness, tenderness, texture and overall acceptability. "It could be argued that appearance is the most important quality attribute 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. Poultry meat is unique because it is sold with intact skin or without skin" [28]. "The availability of lipid soluble pigments such as carotenoids in the feedstuff, feed sources (e.g. grain type), xanthophylls concentrates and exotic sources (e.g. broccoli, paprika extract and tomato), feed additives (e.g. fish oils, antioxidants, vitamins and trace minerals), xanthophyll stability and biological availability and management and processing parameters (e.g. breed and strain, disease and health, environment, housing type, scalding, pre-slaughter conditions, processing variables and sex) and the ability of some breeds to deposit carotenoid pigments in the skin determine the extent of pigmentation Northcutt" [28]. "Texture is probably the most important quality factor associated with consumer satisfaction in the eating quality of poultry. The texture and degree of firmness of the meat is a function of the amount of water held intramuscularly. Water tightly bound to the muscular proteins has a swelling effect on muscle proteins, occupying the spaces between myofibrils and giving the meat a more firm structure Anadon" [24]. "Flavour is another quality attribute that consumers use to determine the acceptability of poultry meat. Though, it is difficult to distinguish between taste and odour while consumption, both of them contribute to the flavour of poultry. Flavour development occurs while cooking of poultry meat due to sugar and amino acid interactions, lipid and thermal oxidation and thiamin degradation. These chemical changes are not unique to poultry but the lipids and fats in poultry are unique and combine with odour to account for the characteristic 'poultry' flavour Northcutt" [28]. In this study, the colour in T1 (7.3) was numerically higher, while T2 (6.4) had the least values. The aroma was numerically higher in T3 (6.3) followed T1 (5.4), T4 (4.8) and T2 (4.6). The juiciness, tenderness, texture and overall acceptability were numerically higher in T1 (5.9, 6.3, 6.1 and 7.7 respectively) and numerically least in T4 (4.2, 5.4, 5.3 and 6.2 respectively).

CONCLUSION AND RECOMMENDATION

The inclusion of bitter leaf meal in broiler chicken diets had significant differences ($P<0.05$) on the cooking loss of the breast, and thigh but not on the drumstick. The pH of meat from broiler chickens fed graded levels of bitter leaf meal was significantly higher than the control. Significant differences were also observed in the physical properties of meat from broiler chickens fed graded levels of bitter leaf meal compared to the control, while no significant difference was observed in most of the sensory quality parameters observed; especially overall acceptability.

Therefore, it is suggested that Bitter leaf meal can be added in boiler chickens diet up to 7.5% without any deleterious effect on meat quality.

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