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Utilization Potential of Catmint and Better Leaf Aqueous-Extracts on Performance and Physiological Characteristics of Broiler Birds

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Abstract **– Prepared *Vernonia amygdalina* (bitter leaf) and *Nepeta racemosa* (catmint leaf) aqueous extracts were used as probiotic and growth promoters in a broiler research. The five treatments were established such that T1 was (control), T2 and T3 contained 50ml of catmint extract and 50ml of bitter leaf extract respectively per 1litre of drinking water, T4 and T5 contained bitter leaf and catmint extracts at 25 and 50m/l of drinking water respectively. One hundred and fifty day old unsexed broiler chicks were used for the experiment. The birds were randomly allocated to the five treatments which were equally replicated thrice. Daily feed intake and weekly weight gain were monitored. At the end of the six weeks feeding trial, blood samples were collected from three birds per replicate for haematological parameters and serum biochemistry. Also, three birds per replicate were randomly selected fasted and slaughtered. Defeathered, eviscerated, cut to parts and organs were weighed and their relative weight to carcass and life weight respectively were determined. Combination of bitter leaf and catmint extract significantly (P<0.05) enhanced feed intake while bitter leaf only yielded improved weight gain, lower feed to gain ratio and least feed cost per kg body weight which was statistically similar (P<0.05) to the control. The blood parameters measured were statistically (P>0.05) similar except the platelet and cholesterol level that were reduced with the use of catmint extracts and its combination with bitter leaf. Organs were significantly (P<0.05) affected except the gizzard, so also the villi height and width as well as crypt depth. It could be concluded that catmint and bitter leaf extracts at 25ml/l enhances carcass performance, reduced blood cholesterol and platelets, have positive effect on gut morphology and organ characteristics of the birds.**

Keywords **– Broiler, Leaf Extract, Performance, Blood Parameters.**

I. INTRODUCTION

Broiler chickens serve as a source of protein that is required for human growth, maintenance and repairs. Health management and production strength within limited or cheapest production cost are inevitable integral part of its production [1]. Infectious agents reduce the yield of farmed food animals and, to control these, the administration of sub-therapeutic antibiotics and antimicrobial agents has been shown to be effective [2]. The term "antibiotic growth promoter" is used to describe any medicine that destroys or inhibits bacteria and is administered at a low, sub-therapeutic dose [3].

Nigeria, like most other developing countries, suffers greatly due to the residual effect of antibiotics in animal products and the development of resistance to many drugs by some bacteria, as well as a decreasing acceptance of the additive in many countries of the world [4].

Many of these synthetic drugs and growth promoters are supplemented to broiler diets to effect rapid growth, but their use have shown many disadvantages like high cost, adverse side effect on health of birds and long residual properties and carcinogenic effect in humans [5]. Medicinal plants are cheap and renewable sources of pharmacologically active substances and are known to produce certain chemicals that are naturally toxic to bacteria [6], but beneficial to livestock and man.

Vernonia amygdalina leaf is planted mostly for human consumption. It is a good source of photochemical and certain minerals but have low concentration of proteins, digestible carbohydrates and lipids [7]. The leaves contain a considerable amount of anti-nutritive factors such as tannic acid and saponin [8], cyanide [9] as well as 3.85% Calcium, 0.40% Magnesium, 0.03% Phosphorus, 0.006% Iron, 0.33% Potassium and 0.05% Sodium [10].

Research has shown that *Vernonia amygdalina* have some beneficial effects in poultry disease management, such as anti-coccidiosis, anti-bacterial and anti-parasitic [11] as well as an anti-oxidant [12]. Catmint has many reported benefits as herbal supplements for both lives stock and man; some of these include treatment for anxiety, insomnia, Coccidiosis and antistress [13].

This work therefore was carried out to determine the utilization of *Vernonia amygdalina* (bitter leaf) and *Nepeta racemosa* (catmint leaf) aqueous extracts as probiotic and growth promoters and their effects on growth performance, blood profile, carcass and organ characteristics as well as gut morphology of broiler chickens.

II. MATERIALS AND METHODS

Site of Experiment

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria.

Preparation of Test Ingredients

The test ingredients used were bitter leaf (*Vernonia amygdalina)* and catmint leaf (*Nepeta racemosa)* which were harvested from LAUTECH Teaching and Research Farm, Ogbomoso, Oyo State. The catmint leaf and bitter leaf were rinsed with clean water to remove any foreign materials and detached from the stem. They were air dried for seven days after which a constant weight was attained and slightly sundried for 30 minutes to obtain crispy nature. The sundried materials were grinded into powdery form and stored in an air tight container until time of use.

The leaf extracts were prepared by soaking 50g of the ground catmint or bitter leaf meal in 1 liter of cold water for 24 hours then sieved to remove the residues and obtained the filtrate (extract). Measured quantity of filtrate according to the experimental treatment were added to one liter of drinking water and served to the birds. The treatment was available on daily basis.

Experimental Treatments

The five treatments were established such that T1 was (control), T2 (50ml of catmint extract to 1 liter of drinking water), T3 (50ml of bitter leaf extract to 1 liter of drinking water), T4 (25ml of bitter leaf extract and 25ml of catmint extract to 1 liter of water) and T5 (50ml of bitter leaf extract and 50ml of catmint extract to 1 liter of drinking water).

Experimental Birds

One hundred and fifty day old unsexed broiler chicks were used for the experiment. The birds were randomly allocated into five treatments and each treatment was replicated thrice at ten birds per replicated in a Complete Randomized Design (CRD) experiment.

III. Data Collection

Feed Intake

Weighed quantity of feed was fed to the chickens and leftover was collected and weighed to determine the feed intake of the chickens, weight gain and feed conversion ratio were also estimated.

Blood Parameters

At the end of the six weeks feeding trial, blood samples were collected from three birds per replicate by severing the jugular veins. Blood samples meant for haematological parameters were collected into bottles containing EDTA (ethylene diamine tetra acetic acid) while samples meant for serum biochemistry were collected into bottles free of EDTA.

Carcass Characteristics and Relative Organ Weights

Three birds per replicate were selected randomly, tagged and placed in a secluded pen. Feed was withdrawn from the birds while abundant water was supplied to get rid of digesta. The birds were slaughtered, defeathered and eviscerated. The cuts were evaluated and relative carcass weight such as neck, back, breast, drumstick, thigh and wings were determined. The weight of the internal organs; liver, kidney, heart, proventiculus, gizzard, lungs, spleen etc. were also determined and related to their live weight.

Gut Morphology

The samples were handled as described [14]. The samples were placed in a 10% buffered neutral formaldehyde solution (pH 7.2 - 7.4) and were gradually dehydrated with increasing concentrations of ethyl alcohol (50 - 100%). The dehydrated specimens were embedded in paraffin, sectioned at 5µm and stained with hematoxylin and eosin [15]. The sections were analyzed under a light microscope (binocular digital compound microscope with 3D stage and scope image 9.0 USB camera) and the height and width of the villus were measured using a computer assisted image analysis. A total of 15 intact well oriented crypt villus units were selected randomly for each sample. The mean values attributed to individual bird were used in the statistical analysis. Villus height was measured from the tip of the villus to the crypt-villus junction, whereas crypt depth was defined as the depth of the invagination between adjacent villi [16]. The villus width was defined as the distance from the outside epithelial edge along a line passing through the vertical midpoint of the villus. Villus area was calculated from the villus height and width at half height.

Chemical Analysis

The test ingredient and the experimental diets were analyzed for proximate composition by the method of [17].

Data Analysis

All the data collected were subjected to one way analysis of variance (ANOVA) using the general linear model of [18].

IV. Result and Discussion

Broiler chickens subjected to oral administration of aqueous extract of catmint and bitter leaf showed signific-

-ant differences in average weight gain, average daily feed intake, feed to weight gain ratio and feed cost per kg body weight (Table 1). Bitter leaf extract utilization significantly ($P<0.05$) improved the average weight gain than catmint and their combinations. Catmint and bitter leaf extracts significantly ($P<0.05$) enhanced feed intake while bitter leaf only resulted into lower feed to gain ratio which was statistically similar ($P<0.05$) to the control. Least feed cost per kg body weight was also obtained from T3 (bitter leaf extract) though statistically ($P<0.05$) similar to the control.

The result of the present study is in line with the findings of [19] who reported improved growth performance of animals fed bitter leaf extracts. The improvement observed in the weight gain was correlated with the lower FCR observed in the treated group. The lower the FCR the higher it is for the birds to convert feed consumed to meat. It was reported that phytogenic feed additives are often associated to the improvement of flavour and palatability of feed which might be responsible for better feed intake, thus bitter leaf extract thereby enhances production performance of birds [20].

The blood parameters measured were statistically ($P>0.05$) similar except the platelet and cholesterol level. It was observed that the cholesterol level was significantly ($P<0.05$) reduced with the use of the extracts especially the catmint and its combinations with bitter leaf. This implies that the extracts effectively reduced the microbial load due to their antimicrobial and anti-protozoal properties [21], thus help the birds and improved their feed consumption and feed efficiency as well as enhancing the health status. The reduction in blood cholesterol level could be traced to the effect of the extracts and their phytochemical compounds on the cholesterol. Saponin (in excess) causes hypocholestrolaemia because it binds cholesterol making it unavailable for absorption [22].

All the organs of interest were significantly ($P<0.05$) affected except the gizzard that was not significant ($P>0.05$), while the proportions of proventriculus and kidney were increased with utilization of catmint and bitter leaf extract (table 3). Gizzard had better proportional value though not significant ($P>0.05$), which implies higher activities on the ingested feed than the control. These effect enhancing the gastro intestinal enzyme thereby improving digestion and assimilation of nutrients [23, 24]. Bitter leaf extract act as a growth promoter by enhancing the gastro intestinal enzymes thus increasing feed conversion efficiency [24].

All parameters measured under carcass characteristics were significantly ($P<0.05$) different except proportion of neck (table 4). The proportion of primal cuts were enhanced ($P<0.05$) by the extracts. Combination of catmint and bitter leaf at 25ml/l of drinking water gave the best drum stick and breast proportions, while highest ($P<0.05$) proportion of thigh was recorded from 50ml/l of bitter leaf extract. The inclusion of bitter leaf extract in drinking water for broiler birds leads to improvement in body weight, dressing percentage and carcass quality, as it was observed to influence production when leaf meal was incorporated into the broiler diet [25]. It was demonstrated that abdominal fat was significantly reduced in broiler chicks treated with ground ginger and garlic [26]. This could also be attributed to the hypolipidaemic effect of bitter leaf which ensured the development of leaner meat. This could also be attributed to the factor responsible for better conversion of nutrients to meat [27].

Table 5 shows a significant difference ($p<0.05$) in villi height in which the highest value was obtained at T5 (0.10mm) and T4 had the lowest value. Although control (0.088mm), T2 (0.091mm), T3 (0.091mm) and T4 (0.083mm) were statistically similar. Villus width shows a significant ($p<0.05$) difference and control recorded 0.024mm as the highest value and T3 (0.016mm) as the lowest value. Crypt depth was also significantly

affected, control (0.044mm) had the highest value which is slightly similar to T3 (0.037mm), T4 (0.038mm) and T5 (0.037mm) but different in T2 (0.028mm) which is recorded the lowest value. VH/CD ratio shows a significant difference, T2 (3.53) has the highest value obtained. T3 (2.53) and T4 (2.40) were statistically similar and control (2.02) was recorded as the lowest value obtained.

GIT undergoes morphological changes, resulting in increases in intestinal length, villous height and density, which are accompanied by rises in pancreatic and digestive enzymes activity [28]. Therefore increase in the average villi height indicates improved active absorptive area of the gut. The high activity results into high mucus production [29], which improves the protective capacity of the gut. It was reported that bitter leaf enhances gastro intestinal enzymes (chymotrypsin) production there by improves digestion assimilation and utilization of feed nutrients. It could also aid in the digestion of sporozoites and other intestinal parasites [23]. Studied the effects of maize diets supplemented with plant extracts on broiler chickens [30]. They reported a significant increase in jejuna wall villi. Long villi are correlated with improved gut health, and an increase in duodenal and jejuna height or length [31]. Thus, birds whose GIT were stimulated earlier in life show better response to growth performance and nutrient utilization efficiency [32].

V. CONCLUSION

In conclusion, the result obtained revealed that, extracts of catmint leaf (25ml/l) and bitter leaf (25ml/l) enhances carcass performance and primal cut (wing, drumstick, breast and thigh) of the broiler birds. Also the extract of catmint and bitter leaf at various inclusion levels enhances blood cholesterol and platelets. So also, it had positive effect on gut morphology and organ characteristics of the broiler birds.

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Table 1. Growth Performance of Broiler Chicken under the Influence of Catmint leaf and Bitter leaf Aqueous Extract.

	T1	T2	T3	T4	T5	sem
Average Weight Gain (g)	1553.56^{b}	1504.83^{b}	1715.28^{a}	1576.69^{b}	1500.35^{b}	22.08
Average Daily Feed Intake(g)	82.41^{c}	92.40^{a}	90.16^{b}	93.59^{a}	94.4345^{a}	0.62
Feed:Gain Ratio	2.42^{b}	2.80^{a}	2.39^{b}	2.73^{a}	2.89^{a}	0.04
Feed Cost/kg Meat (~~N~~)	351.25^{b}	406.66^{a}	346.33^{b}	396.33^{a}	419.45^{a}	6.35

^{abc} means along the same row with different superscripts are significantly different (P<0.05)

T1: control; T2: 50ml of catmint extract to 1 liter of drinking water; T3: 50ml of bitter leaf extract to 1 liter of drinking water; T4: 25ml of bitter leaf extract and 25ml of catmint extract to 1 liter of wate; T5: 50ml of bitter leaf extract and 50ml of catmint extract to 1 liter of drinking water.

Table 2. Haematological and serum indices of broiler chicken under the influence of catmint and bitter leaf extract.

Parameters	T1	T2	T3	T4	T5	SEM
Haematology						
PVC(µ/ml)	26.00	25.00	27.00	27.00	28.00	0.98
Hb (g/dl)	8.35	8.00	8.25	8.70	8.95	0.32
RBC (10^{6})	4.14	4.09	4.28	4.31	4.55	0.18
WBC (10^{3}/L)	10500	12025	12850	11600	11125	420.86
PLATELETS (x10^{4}/L)	19.95^{b}	20.10^{b}	30.60^{a}	20.25^{b}	18.20^{b}	16.30

LYMPHOCYTE (%)	70.50	68.00	67.50	66.00	63.50	1.11
NEUTROPHIL (%)	25.50	28.50	28.50	30.50	33.50	1.33
MONOCYTES (%)	2.50	2.00	2.50	1.50	1.50	0.21
EOSINOPHIL (%)	1.50	1.50	1.50	2.00	1.50	0.37
Serum						
AST (I.U/L)	10.11	6.30	11.59	9.88	5.57	1.26
ALT (I.U/L)	1.84	0.96	4.08	1.52	0.88	0.55
ALP (I.U/L)	57.25	76.15	76.35	77.00	83.95	5.81
GLUC (mg/dl)	120.00	145.00	160.00	160.00	180.00	12.83
Cholesterol (mg/dl)	85.09^{a}	78.26^{b}	80.03^{a}	57.76^{b}	75.77^{ab}	3.52
Total protein (g/dl)	2.925	2.730	3.020	3.210	3.095	0.20
ALBUMIN (g/dl)	1.405	1.430	1.370	1.945	1.585	0.11

^{abc} means along the same row with different superscripts are significantly different (P<0.05)

T1: control; T2: 50ml of catmint extract to 1 liter of drinking water; T3: 50ml of bitter leaf extract to 1 liter of drinking water; T4: 25ml of bitter leaf extract and 25ml of catmint extract to 1 liter of water; T5: 50ml of bitter leaf extract and 50ml of catmint extract to 1 liter of drinking water.

Table 3. Organ Characteristics of Broiler Chicken under the Influence of catmint leaf and bitter leaf extract.

Parameters (%)	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Proventiculus	0.33^{b}	0.37^{ab}	0.38^{ab}	0.42^{a}	0.30^{b}	0.01
Gizzard	2.40	2.68	2.76	2.43	2.40	0.06
Spleen	0.13^{a}	0.12^{a}	0.12^{a}	0.07^{b}	0.14^{a}	0.01
Liver	2.09^{ab}	2.10^{ab}	2.07^{ab}	1.86^{b}	2.16^{a}	0.04
Pancrease	0.17^{b}	0.27^{a}	0.22^{ab}	0.21^{ab}	0.24^{ab}	0.01
Kidney	0.43^{ab}	0.43^{ab}	0.49^{a}	0.30^{b}	0.60^{a}	0.02
Lungs	0.54^{a}	0.41^{b}	0.50^{a}	0.37^{b}	0.60^{a}	0.03
Heart	0.52^{a}	0.43^{b}	0.44^{b}	0.45^{b}	0.48^{ab}	0.01

^{abc} means along the same row with different superscripts are significantly different (P<0.05)

T1: control; T2: 50ml of catmint extract to 1 liter of drinking water; T3: 50ml of bitter leaf extract to 1 liter of drinking water; T4: 25ml of bitter leaf extract and 25ml of catmint extract to 1 liter of wate; T5: 50ml of bitter leaf extract and 50ml of catmint extract to 1 liter of drinking water.

Table 4: Carcass Characteristics of Broiler Chicken under the Influence of Catmint and Bitter leaf Extract

Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Bleed weight (g)	1.80^{a}	1.67^{b}	1.56^{c}	1.73^{ab}	1.54^{c}	0.023
Live weight (g)	1897^{a}	1761^{b}	1644^{c}	1852^{ab}	1618^{c}	24.664
Defeathered weight (g)	1719^{a}	1591^{b}	1489^{c}	1654^{ab}	1461^{c}	22.143

Eviscerated weight (g)	1507[a]	1311[ab]	1260[ab]	1116[b]	1252[ab]	44.430
Carcass weight (g)	1326[a]	1193[ab]	1104[ab]	935[b]	1097[ab]	43.957
%Neck	4.14	5.37	5.52	6.02	7.23	0.874
%Wing	10.62[b]	11.36[ab]	11.56[ab]	10.11[b]	12.32[a]	1.439
%Drum stick	13.12[b]	15.30[a]	15.61[a]	15.65[a]	15.36[a]	2.063
%Breast	35.22[a]	35.80[a]	32.33[b]	36.60[a]	33.68[b]	4.032
%Back	23.92[a]	19.09[b]	21.31[ab]	20.25[ab]	21.41[ab]	2.658
%Thigh	12.89[ab]	13.48[a]	14.03[a]	12.31[ab]	10.46[b]	2.184

[abc] means along the same row with different superscripts are significantly different (P<0.05)

T1: control; T2: 50ml of catmint extract to 1 liter of drinking water; T3: 50ml of bitter leaf extract to 1 liter of drinking water; T4: 25ml of bitter leaf extract and 25ml of catmint extract to 1 liter of water; T5: 50ml of bitter leaf extract and 50ml of catmint extract to 1 liter of drinking water.

Table 5. Villi height (mm), Villus width (mm), Crypt depth and VH/CD of Broiler Chickens under the Influence of Catmint and Bitter leaf extract.

Parameter	T1	T2	T3	T4	T5	SEM
Villi Height	0.088[bc]	0.091[b]	0.091[b]	0.083[c]	0.100[a]	0.001
Villi Width	0.024[a]	0.021[ab]	0.016[b]	0.019[ab]	0.017[b]	0.001
Crypt Depth	0.044[a]	0.028[b]	0.037[a]	0.038[a]	0.037[a]	0.001
VH/CD	2.02[c]	3.53[a]	2.53[bc]	2.40[bc]	2.78[b]	0.118

[abc] means along the same row with different superscripts are significantly different (P<0.05)

T1: control; T2: 50ml of catmint extract to 1 liter of drinking water; T3: 50ml of bitter leaf extract to 1 liter of drinking water; T4: 25ml of bitter leaf extract and 25ml of catmint extract to 1 liter of water; T5: 50ml of bitter leaf extract and 50ml of catmint extract to 1 liter of drinking water.

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