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The Effect of *Zingiber officinale* and *Mucuna poggei* on the Growth Performances, Carcass Characterisics and Meat Quality of Broiler Chicks

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Abstract: Growth promoters are added for varying purposes with the most common use as antibiotics and pro-nutrients. *Zingiber officinale*, commonly known as ginger and *Mucuna poggei* were investigated for their growth performances, carcass characteristics and meat quality of broiler chicks when supplemented in their feeds. The leaves ground and mixed in poultry feeds in varying compositions. A total of twenty broiler birds were used for this study. The birds were grouped into four groups: A, B, C and D (Control) of five birds each. Following acclimatization, each of the groups was given separate treatments of feed mixed with dried ground leaves of *Mucuna poggei* and *Zingiber officinale* except for the control group. At the end of eight weeks, blood was collected from the birds from each of the treatment for hematological analysis. Results showed that the *Zingiber officinale* and *Mucuna Poggei* leaves had negative effects on the broilers growth and performances as seen in the variation of mean weight of the broilers since the weight of the control were increasing faster than the treated groups in a significant manner ($p>0.05$). On the other hand, there was a significant difference in the haemotological parameters in favour of the treated groups which will increase the immunity of the birds.

Key words: *Zingiber officinale* · *Mucuna poggei* · Broilers · Carcass Characteristics · Meat Quality

INTRODUCTION

Growth promoters or feed additives are molecules that are added at low rate to animal feeds without changing considerably their composition. They speed up the growth and consequently increase the body size and weight of animals [1]. Among all growth promoters, the most commonly used are antibiotics, although nowadays their use is decreasing towards total extinction [2]. Some growth promoters act as pro-nutrients because of the role they play in enhancing the physiology and microbiology of the animals. Pro-nutrients are substances that could have the same effect as antibiotic feed additives and are defined as micro ingredients included in the formulation of animal feeds with physiological and microbiological functions different from any other nutrient [3].

Antimicrobials have been used in the poultry industry for growth promotion, disease prevention and treatment of infections for many years [4]. However, evidence is mounting that resistant bacteria might be passed from animals to humans. The use of antimicrobials in poultry industry for growth promotion and treatment of infections for many years have caused microbiological and clinical evidence of resistant bacteria that might be passed from animals to humans resulting in infections that are more difficult to treat [5]. This situation has put tremendous pressure on the poultry industry to withdraw or limit antibiotic use in animal feeds and to look for viable alternatives [6].

There are serious worries that through over use, the effectiveness of feed antibiotics might diminish and that strains of bacteria would arise which would be resistant to their effect, of greater concern is the possibility or risk that resistance generated on the farm could lead to a loss of effectiveness of key antibiotics in human medicine. Antibiotics and other drug residues in meat and milk are dangerous to hypersensitive consumers of these products and may subject all consumers to potentially dangerous amounts of these substances [7].

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These current perceived dangers of having drug resistant microbes from the use of antibiotics as feed additives and the current ban by some countries on using antibiotics in animal feeds it would be of great importance to find suitable substitute especially through the use of phytogenics. Also the advent of present day organic agriculture discourages the use of inorganic feed additives in animal feeds [8].

Zingiber officinale is a perennial plant, commonly known as ginger. It acts as a pro-nutrient because of the vast active ingredients it has been reported to contain Herbs Hands Healing. [9] reported that ginger contains volatile oils like borneol, camphene, citral, eucalyptol, linalool, phenllandrene, zingiberine, zingiberol (Gingerol, zingirone and shogaol) and resin. Some gingers' medicinal properties are contained in the chemicals responsible for the taste, the most noteworthy being gingerol and shogaol. A protein digesting enzyme (Zingibain) found in ginger is believed to improve digestion as well as kill parasites and their eggs. It was also reported to enhance antibacterial and anti-inflammatory actions and it is thought to assist other antibacterial, such as antibiotics, by up to 50%. The nutrients found in ginger include carbohydrates, lipids, proteins, minerals and vitamins. Among these phosphorus, potassium, riboflavin and vitamin C may be found. Ginger contains about 12 antioxidant constituents, the combined actions of which have been regarded as being more powerful than vitamin C [10].

Mucuna poggei were once the most widely grown legume in the U.S. before being replaced by soybeans in the early part of this century. Up to 2 million ha were planted at that time [11]. In developing countries such as Honduras, the plant is increasingly being used as a cover crop usually intercropped with corn [12]. It is valuable in subsistence and sustainable agriculture because it is hardy, resistant to insects, resistant to drought, easily managed with minimal careand improves soil fertility through nitrogen fixation. The foliage is frequently fed to grazing animals and its prolific production of beans is sometimes eaten by humans and monogastric animals such as pigs and chickens [13]. There are limited scientific literature indicating that they are toxic when fed to poultry in commercial rations, causing reductions in growth, feed intake and egg production and increased mortality [14].

Many anti-nutritional and potentially toxic factors are found in *Mucuna poggei*, among them antitrypsin factors, tannins and cyanide [15] anticoagulants [16] analgesic, antipyreticand anti-inflammatory factors [17] and others [18]. L-3,4-dihydroxyphenylalanine (L-DOPA), a potentially neurotoxic agent, is found in relatively large amounts [3].

Broilers are strictly meat birds, often referred to as fryers. They are bred to grow rapidly so that they are ready for the dinner table between 4 and 10 weeks of age. As early as 4 weeks, they are marketed as Cornish hens. Closer to 7 weeks they will be ready for the grocery store. After 8 weeks, these birds are used most often for de-boned chicken products like nuggets or sandwiches. Broilers do require a different diet than a layer or even a dual purpose bird. Because broilers need to grow quickly, they present some physical challenges in addition to specific nutritional requirements [11].

Moreover for rapid growth, maximum food consumption is required. For this reason, it is often recommended that you raise your broilers with 24 hours of light each day so that they have continuous access to food. Once the heat lamps have been removed from your brooder box (Usually around 4 weeks depending on your climate) you would hang a 40 watt light bulb at 6 feet above the birds [2].

MATERIALS AND METHODS

Sample Collection and Treatment: The leaves of *Mucuna poggei and Zingiber officinale* leaves were collected from a farm at Onicha community of Onicha Local Government.Area (LGA). Ebonyi State and twenty broiler chicks bought from a market in Enugu, Nigeria for the experiment. The chicks were given poultry routine vaccination against Newcastle disease and infection bursal disease and other required veterinary care. The birds were grouped into four groups (Group A, B, C and D) of five chicks each. They were allowed to acclimatize for two weeks, during which they were fed with broiler starter feeds.

From the third week, chicks in group A were fed with fed containing *Mucuna poggeileaves,* group Bwere feed with fed containing *Zingiber officinale, group C* were fed with feedcontaining a mixture of *Mucuna poggei* and *Zingiber officinale* leaves while group Dwhichserved as control and were fed with normal feeds only. The weights of the broilers were taken twice every week using a sensitive weighing balance.

Haematological Evaluation: During the weeks 8 of the experiment, blood samples were collected from the birds from each of the treatments treatment. The blood, which

was collected from the wing vein of each bird, was used for hematological analysis including Packed cell volume (PCV) and Hemoglobin concentration (Hb) were determined by the methods described by [5].

RESULTS

The weekly mean ± standard deviation of the four groups of the broiler chicks fed with commercial feeds and supplemented with varying amounts of pounded leaves of *Mucuna poggei* and *Zingiber officinale* are shown in the Table 1. From the results, it can be seen that during the first 2 weeks of acclimatization when the chicks were fed the starter feed, there was no significant difference in their growth and weight ($p>0.05$).

Results from the third week showed significant differences ($p>0.05$) in the weights of broilers from each treatments. Chicks in Group B, that were administered feed incorporated with *Zingiber officinale* for the experimental period had the highest mean value of the weight (1150.50±5.0g) and Group C members that were administered feed with a combination of *Mucuna poggei* and *Zingiber officinale* (Mixture) showed the least broiler weight gain (950.40±82g) when compared to other groups ($p>0.05$).

From Table 2, results show significant differences ($P>0.05$) in weights of the carcasses of the broilers. Broilers in group D had the greatest carcass weight (1081.76±0.90 g) followed by broilers in group B (977.33±22.05 g), while group C had the least weight (813.37±45.12 g).

After the feathers had been plucked off, variations in the net weight losses of the birds were significant ($p>0.05$) with group B having the greatest net weight loss (172.67±28.87 g) followed by group A (160.00 g), then group C (136.33±40.50 g). The control group (Group D) had the least net weight loss (151.57±16.53 g).

Table 3 shows the mean weights (Sizes) of the different organs of the broiler carcass. There was no significant difference among the mean weights of the hearts of broilers in groups A, B and the control while group C differed significantly ($p>0.05$). The mean weight of the heart for all groups was 4.5g, while the weight of the hearts ranged from 3g to 5g.

There was a significant difference in the weights of the head of the broilers. The mean weight of the head was 18.25g. Also, there was a significant difference among the weights of the gizzards. The mean weight of the gizzards was 21.25g and ranged from 15g to 30g. The control had the highest mean weight of 30g while groups A and C had the least mean weights of 15g each while group B had a mean weight of 20g.

The mean weights of the drumstick-thigh, breast, back-cut, wing and neck were taken after preservation at 4°C for 24 hours. The results are as shown in Table 4. The weight of the drumstick-thigh shows that the F-calculated was higher than the F-tabulated, an indication that there was no significant difference in the weights of the drumstick-thigh. The weights of the drum-thigh range from 100-130g with the mean weights of 118.25g. The weights of the breast show significant difference, since F-tabulated (3667) was greater than

Table 1: Weekly Weights of Twenty Broiler Chicks Fed *Mucuna poggei and Zingiber officinale* dried and pounded leaves inBroiler Feed (In grams).

Weeks	Group A	Groups B	Groups C	Control
First week	310.00±28.50^{a}	317.00±31.23^{a}	280.00±32.59^{a}	305.00±32.59^{a}
Second week	412.50±32.27^{a}	425.00±25.00^{a}	362.50±32.27^{b}	406.25±51.54^{a}
Third week	550.00±20.41^{b}	550.00±25^{a}	450.00±20.41^{b}	575.00±54.01^{b}
Fourth week	643.75±31.46^{a}	650.00±25.00^{a}	550.00±20.4^{b}	693.75±37.50^{b}
Fifth week	725.00±35.36^{a}	733.33±38.19^{a}	650.00±20.4^{c}	815.00±37.75^{b}
Sixth week	826.25±33.01^{a}	891.67±38.19^{a}	717.50±23.63^{c}	916.67±38.19^{b}
Seventh week	900.00±20.41^{b}	1033.33±20.4^{a}	812.50±32.27^{d}	116.67±104.08^{c}
Eighth week	1000.00±40.82^{b}	1150±50.00^{a}	950±40.82^{d}	1233.33±76.38^{c}

*Means followed with the same letter in each column are not significantly different ($p<0.05$).

Table 2: Variation in the Carcass Weight loss of the Featherless Broilers

Weeks	Group A	Group B	Group C	Group D
Weight of broilers	840.00±17.60^{c}	977.33±22.05^{b}	813.37±45.12^{d}	1081.76±0.90^{a}
Net weight loss	160.00±0.00^{b}	172.67±28.87^{a}	136.33±40.50^{d}	151.57±16.53^{c}

*Means followed with the same letter in each column are not significantly different ($p<0.05$).

Table 3: The Average Net Gain in Weights of the Different Organs of the Four Groups of Broiler Carcasses after Preservation at 4^0c for 24 hours

Group Organ	Group A	Group B	Group C	Control	$LSD_{0.05}$	Mean
Heart	4.00±1.00^{a}	5.00±1.00^{a}	3.00±1.00^{b}	5.00±1.00^{a}	1.886	4.25
Head	15.00±1.00^{ba}	20.00±1.00^{a}	13.00±1.00^{b}	25.00±1.00^{a}	5.17	18.25
Gizzard	20.00±2.00^{b}	20.00±2.00^{b}	1.500±0.00^{c}	30.00±2.00^{a}	2.74	21.25
Leg	15.00±0.00^{b}	20.00±2.00^{a}	15.00±1.00^{a}	20.00±1.00^{a}	1.886	17.25
Liver	5.000±1.00^{b}	5.00±1.00^{a}	5.00±1.00^{b}	10.00±0.00^{a}	2.50	7.00

*Means followed with the same letter in each column are not significantly different ($p<0.05$).

Table 4: Weights of some Organs of four groups of broiler carcasses after preservation in a fridge at 4ºC for 24 hours

Group Organ	Group A	Group B	Group C	Control	$LSD_{0.05}$	Mean
Drumstick-thigh	120.00±2.00^{b}	123.33±1.53.00^{a}	100.00±0.00^{c}	130.00±5.00^{a}	8.64	118.25^{b}
Breast	150.00±5.00^{b}	155.00±5.00^{a}	140.00±5.00^{c}	160.00±5.00^{a}	9.40	151.25^{a}
Back-cut	190.00±5.00^{c}	215.00±5.00^{b}	180.00±10.00^{d}	225.00±5.00^{a}	9.40	202.50^{b}
Wing	50.00±0.00^{b}	75.00±5.00^{a}	50.00±5.00^{b}	80.00±5.00^{a}	9.40	63.75^{c}
Neck	50.00±5.00^{c}	60.00±0.00^{b}	45.00±0.00^{c}	70.00±5.00^{a}	9.89	56.25^{a}

*Means followed with the same letter in each column are not significantly different ($p<0.05$).

Table 5: The mean cooking loss and drip loss of breast meat of broilers after preservation in a fridge at 4 for 48 hours

Group	Group A	Group B	Group C	Control	Mean	Prob.	$LSD_{0.05}$
Cookingloss	50.00±5.00^{a}	60.00±5.00^{a}	45.00±5.00^{a}	50.00±5.00^{a}	94.17	0.8592	10.87
Drip loss	20.00±2.00^{ba}	25.00±0.00^{a}	15.00±3.00^{b}	25.00±5.00^{a}	21.25	0.012	5.80

*Means followed with the same letter in each column are not significantly different ($p<0.05$).

Table 6: A comparison of hematological values of the different groups of broilers.

Parameter	Control	*Zingiber officinale*	*Mucuna poggei*	*Zingiber officinale and Mucuna poggei*
Haemoglobin (gm/dl)	11.22±1.00^{b}	15.09±2.02^{a}	15.0±1.02^{a}	15.8±1.02^{a}
RBC (10%)	4.03 ± 0.22^{a}	5.02± 2.02^{b}	5.24 ± 0.60^{b}	4.60±0.21^{a}
Haematrocrit (%)	51.63± 3.14^{a}	47.14± 0.86^{b}	43.04 ± 4.94^{b}	46.02±4.12^{b}

*Means followed with the same letter in each column are not significantly different ($p<0.05$).

F-calculated (4.07). The weights of the breast ranged from 140g to 160g. Group C had the least weight (140g) followed by control (150g) while the control had the highest weight (160g) followed by ginger with the mean weight of 155g and the mean weight of the breast for the groups was 151.25g. the weight of the back-cut for the four groups of the broilers showed that the control had the highest mean weight of 225g followed by ginger with the mean weight of 215g while group C had the least mean weight of 180g followed by group A with mean weight of 190g.

Table 5 shows the cooking weight and drip loss results of the broilers. The breast meat cooking weight loss of the broiler in group B with 60.00±5.00 value was the highest. Group A and control has same values of 50 00±5.00 and the least was that in group C with 45.00±5.00 value. There was no significant difference ($p>0.05$) in the drip loss in all the treatment except for group C which was also the least having the value of 45.00±5.00.

Results from the hemoglobin analysis showed that hemoglobin in the control was normal but there was an increase in hemoglobin and Red cell count level of the experimental groups A and B that had dried of leaves of *Mucuna poggei andZingiber officinale* incorporated in their feed. There was a decrease in the level of Hematocrit in the experimental groups of broilers than the control as shown in Table 6.

DISCUSSION

Form the resultsthere were no significant variations observed in the growth of the broilers in all the groups including the control during the first and second week of the experiment as shown in the weights and sizes of the broiler chicks in table 1. It would be recalled as regards to the first weeks of the study; the chicks were fed with commercial feeds under the same condition to enable them to acclimatize. The lack of significant variation among the chicks could be because the broilers were yet to start eating well in the first week after the change of the uniform diet initially given to all of them. As a result no much variation in the weights of the broilers occurred in spite being subjected to diets with different compositions.

At the end of the third week, a significant difference ($P< 0.05$) was observed in the weights of the broilers in the different groups. The broilers were fully utilizing their nutrients and their consequent effects on their growth were observed. The broilers in the "Control" which had no dried pounded leaves of *Zingiber officinale* and *Mucuna poggei* in their meal grew faster than the ones in the other groups and had an average weight of 506.25±81.54g, through this was lower than the 647.5±55.00g live weight of broilers fed with geriforte supplement reported by [8]. Group A, B and C (Those which feed on the dried pounded leaves of Zingiber *officinale* and *Mucuna poggei* incorporated in their meal had the mean weight of 417.50±32.27g, 525.00±25.00g and 362.50±32.27g respectively.

The observed variation in the weight of the broilers could be attributed to the nutritional contents of the feeds given to the broilers in the individual groups. The control must have performed better than the other groups whose feed were added dried pounded leaves of Zingiber *officinale* and *Mucuna poggei* due to the fact that incorporation of dried pounded leaves of *Zingiber officinale* and *Mucuna poggei* in broilers feed reduces the growth performance of the broiler. This is in line with the low protein content (1.16%) of *Zingiber officinale* and *Mucuna poggei* leaves reported its seeds reported by [9] which was much lower than 20% proteins and reported in its seeds reported by [15].

Reduction in weight gain, feed efficiency and body weight as observed in Group C maybe as a result of addition of higher level of *Zingiber officinale*and *Mucuna Poggei* (1.5%) to broilers during the starter period may be due to the presence of phytate which is considered as anti-nutritional factor. [17] reported that extracted kernel and seed meal of *Zingiber officinale* have higher levels of phytate. As mentioned by some researchers, phytate reduced bioavailability of minerals in non-ruminant animals [5] and decline digestibility of starch and protein [9]. But this negative effect appeared to be overcome during finisher and whole periods due to the presence of benefit factors in *Zingiber officinale* and *Mucuna Poggei* dried leaves including antibacterial materials as reported by [13].

Also [17] mentioned that use of *Zingiber officinale* seeds reduced bacterial count of turbid Nile water in Sudan by 1-4 log units (90-99.9%) within the first 1-2 hours of treatment. Furthermore, [3] noticed that *Zingiber officinale* and *Mucuna Poggei* (Methanol and n-hexane) leaves extracts produced inhibition effect on *Salmonella typhii*, *Vibrio cholerae* and *Escherichia coli*, which normally cause water borne diseases [8] mentioned that *Zingiber officinale* leaves are considered as a good source of fat, protein, antioxidants and minerals (Mg and Zn), so it can overcome malnutrition due to micronutrients deficiencies in children. Increase in abdominal fat weight with increased supplementation level of *Zingiber officinale* and *Mucuna Poggei* to broiler chicks diet (Table 11) may be due to the higher level of fat content of *Zingiber officinale* leaves as observed by [10].

The drip and cooking losses were used to determine the meat quality of the broilers. There were no significant variations ($p>0. 05$) in the cooking losses of the breast meat of the broilers as shown in table 5. The $LSD_{0.05}$ also showed no real differences among the broilers in all groups. This could be attributed to the proportion of the breast meat lost into the water and by implication, the result of the cooking loss of the broilers means that the cooking quality of the do not differ significantly. There was low proportion of meat loss to the water by the breast meat which aggress with the report of [6] that low cooking loss occur as a result of water holding capacity which prevents lost to water. There were significant variations in drip loss of the broilers ($p<0.00115$). Groups with higher cooking loss had lower drip loss while *Mucuna* with the lowest drip loss the lowest drip loss. These indicate a correlation between the drip loss and the cook loss of broilers' breast meat.

The level of hemoglobin in the control was normal but there was a significant difference in hemoglobin and Red cell count level of the experimental groups that dried of leaves of *Mucuna poggei andZingiber officinale* was incorporated in their feed. There was decrease in the level of Haematrocrit in the experimental groups of broilers than the control as shown in Table 10 [1] reported that leaves of *Mucuna poggei andZingiber officinale* increases the level of hematological values in broilers.

CONCLUSION

Zingiber officinale and *Mucuna poggei* leaves had negative effects on the broilers growth and performances as seen in the variation of mean weight of the broilers since the weight of the control were increasing faster than the treated groups in a significant manner ($p>0.05$). On the other hand, there was a significant difference in the haemotological parameters in favour of the treated groups which will increase the immunity of the birds.

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