NSAP 47th Annual Conference (JOS 2022) CONFERENCE PROCEEDINGS
THEME: SECURING ANIMAL AGRICULTURE AMIDST GLOBAL CHALLENGES

# EFFECTS OF NEGRO PEPPER, GINGER AND GARLIC AS FEED ADDITIVES ON GROWTH PERFORMANCE, SERUM BIOCHEMICAL AND HEMATOLOGICAL RESPONSES OF BROILER CHICKENS

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**Abstract**

A feeding trial was conducted to evaluate the performance and physiological characteristic of broiler chickens fed Negro pepper, ginger and garlic as additives in broiler diets for eight weeks. One hundred and twenty (120) day old broiler chicks were randomly allocated to four dietary treatments, replicated thrice with 10 birds per replicate in a completely randomized design experiment. A balanced diet of the same nutritional composition was partitioned into 4, such that diet 1 contains a zero-additive while diets 2, 3, 4 contain 1% of Negro pepper, ginger, garlic additives, respectively. The usage of the test ingredients had no significant (P>0.05) effects on feed conversion ratio (FCR) but had the best numerical value of 2.03 on Negro pepper fed broiler chickens. Moreover, chickens fed diets containing Negro pepper had significantly (P<0.05) higher total weight gains (1821.37g) compared to those fed the control and garlic and ginger supplemented diets. A significant (P<0.05) variation existed among treatment means with haematological parameters and serum biochemical indices in basophils, heterophils, lymphocyte, monocyte, white blood cell, platelet, aspartate, alanine transferase, albumin, total protein, globulin, urea and creatinine. It was therefore concluded that there is substantial benefits of Negro pepper, as phyto-additives in the broiler performance and wellbeing without any adverse effect.

Key words: Negro pepper, Ginger, Garlic, Additives, broiler, blood

## INTRODUCTION:

The fast growing nature of broilers and their short generation interval has been associated over the years with the use of antibiotic growth promoters used at sub-therapeutic doses in animal feeds (Nettleton, 1991). The benefits of these compounds include control of zoonotic pathogens such as *Salmonella, Campylobacter, Escherichia coli* and *Enterococci species* in the gut (NOAH, 2001). At the present time, there is increasing pressure to reduce or eliminate the use of antibiotics in poultry due to its side effect and daily increase in cost. On the other hand, the proposed ban of anti-microbial growth promoters in the European union in 2006 and the voluntary reduction in the use of it in many other countries have forced producers to look for alternative growth promoters to be used in poultry production. Several studies conducted on the use of herbs and spices in broilers as growth promoters have revealed benefits for the health of broilers and function such as antioxidant property, antimicrobial activity, digestion stimulating endogenous enzymes, increased production of digestive enzymes, improved utilization of digestive products by enhancing liver function, increase in body weight and best feed conversion ratio (Duwa *et al*., 2020). Herbaceous products have received increased attention and many have shown significant results. Some of such products are ginger (*Zingiber officinale),* garlic *(Allium sativum)* and Negro pepper

*(Xylopia Ethiopica).* The main important compounds in ginger are gingerol, gingeriol and gingerdione which have the ability to stimulate digestive enzymes, attack the microbial activity and having anti-oxidative activity when used in broiler diets. Just like ginger, *Allium sativum* known as garlic has been used as a spice and as native medicine for many years. It possesses antibacterial, anti-fungal, anti-cancerous properties. Garlic supplement in broiler chicken diets have been recognized for their strong stimulating effect on the immune and digestive systems in birds. Also according to Isikwenu *et al* (2014), *Xylopia aethiopica* (Negro pepper) dried fruit has growth promoting potentials and can serve as a natural alternative to many antibiotics in broiler production. The use of blood examination as a way of assessing the health status of animals has been recorded (Shittu *et al*., 2017 and Okunlola *et al*., 2021). This is because it plays a vital role in physiological, nutritional and pathological status of organisms. These three herbaceous plants have different active ingredients but similar in their functions towards improvement in poultry production therefore this study was designed to investigate the effectiveness of Ginger, Garlic and Negro pepper used as additives in the diets of broiler chickens.

**Materials and methods**

**Experimental Site**: The experiment was carried out at the Poultry Unit, Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso. Ogbomoso is located in the derived savannah that lies on longitude $4^{0}10^{1}$ east of Greenwich meridian and latitude $8^{0}$ $10^{1}$ North of equator. The altitude ranges from 300m to 600m above sea level and the mean temperature and annual rainfall are $27^{0}$C and 1247mm, respectively (Google Earth, 2020).

**Preparation of Test Ingredients**: Dried Ginger and Negro peppers were purchased from Oja'gbo market in Ogbomosho. They were cleaned and ground to powdered form separately while garlic was peeled and oven dried to reduce the moisture content before grinding. Negro pepper was ground with seed after which its shaft was removed.

**Preparation of experimental diets and animal management**: Broiler starter and finisher feeds were formulated for each phase of the chickens. The feed was divided to four dietary treatments. Treatment 1 contains no additives, treatments 2, 3 and 4 contained 10g in 1000g of feed *Xylopia aethiopica*, *Zingiber officinale* and *Allium sativum*, respectively. A total of one hundred and twenty day-old chicks of ROSS-308 strain were sourced from a reputable farm and randomly allotted to the four dietary treatments with 30 birds per treatment, each treatment was replicated thrice on a deep litter system with 10 birds per replicate in a completely randomised design experiment. **Data were collected on growth performance and blood profile according to methods described by Shittu *et al* (2013).**

**Statistical Analysis:** All data collected were subjected to analysis of variance (ANOVA) using SAS (2000) and Duncan's Multiple Range Test of the same software was used to separate significant means.

**Result and Discussion**

The similarities in feed intake of broiler chickens fed industrial antibiotic (control group), xylopia and garlic feed additives and feed conversion ratio values obtained in this study shows similar effectiveness of xylopia and garlic additives and the industrial antibiotic used in the control diet. Demir *et al* (2003) had earlier found that garlic fed broiler chickens had improvement in feed conversion ratio compared to control birds. The body weight gain of broilers chickens fed *Xylopia aethiopica* additive recorded a significantly ($P<0.05$) higher weight that exceed control and other treatments indicate the superior quality of *Xylopia aethiopica* additive in the broiler production. The result was in line with the report of Isikwenu *et al* (2015) who reported that *Xylopia aethiopica* additive had statistically higher growth performance than control broiler chickens. The improved performance observed in this study may be due to the presence of several phytochemical compounds produced by *Xylopia aethiopica* supplements which have biological activities such as antioxidant, antimicrobial and pharmacological effect on broiler chickens for healthy micro flora as well as balance gut environment.

Table 1: Growth response of broiler chickens to three selected phyto-additives

| Parameters | Control 0%) | Xylopia (1%) | Ginger (1%) | Garlic (1%) | SEM |
|---|---|---|---|---|---|
| Initial Weights (g) | 37.47 | 37.13 | 37.10 | 37.20 | - |
| Final Weights (g) | 1540.50$^{b}$ | 1858.50$^{a}$ | 1572.33$^{b}$ | 1583.33$^{b}$ | 49.99 |
| Total Weight Gain (g) | 1503.03$^{b}$ | 1821.37$^{a}$ | 1535.23$^{b}$ | 1546.13$^{b}$ | 47.00 |
| ATFI (g) | 3583.66$^{a}$ | 3654.68$^{a}$ | 3295.38$^{b}$ | 3516.58$^{ab}$ | 48.34 |
| ADFI (g) | 63.99$^{a}$ | 65.26$^{a}$ | 58.85$^{b}$ | 62.80$^{ab}$ | 0.86 |
| FCR | 2.41 | 2.03 | 2.19 | 2.31 | 0.67 |
| ACFI (₦) | 924.89$^{ab}$ | 922.91$^{b}$ | 930.21$^{a}$ | 927.28$^{a}$ | 12.47 |
| ACWG (₦) | 621.79 | 523.53 | 564.21 | 595.21 | 17.24 |

$^{a,b}$: Means along the same row with different superscripts are significantly different (p>0.05).
ATFI = Average Total Feed Intake, ADFI = Average Daily Feed Intake, FCR = Feed Conversion Ratio, ACFI =Average Cost per Feed Intake, ACWG = Average Cost per Weight gain.

The numerical value obtained in the present study for Packed Cell Volume, Red Blood Cell and mean corpuscular haemoglobin concentrations fall within the normal range for broilers (Mitruka and Rawnsley, 1977) although other haematological parameters were varied compared to the reference values according to the authors. Packed Cell Volume and haemoglobin were positively correlated with nutritional status of the broiler chickens. Lymphocytes had a better value in birds fed *Xylopia aethiopica* and garlic additives, this was similar with the report of Isikwenu *et al* (2015). Higher WBC obtained from broiler chickens fed garlic supplemented diet compared to *Xylopia aethiopica* and ginger group is in agreement with Olumide and Odunowo (2019) who reported that high WBC count in birds fed garlic supplemented diets and was attributed to absence of anti-nutrients in garlic. The significant increase in platelet values across the dietary treatments indicated that *Xylopia aethiopica*, ginger and garlic additives boost blood platelet and helps in homeostasis in broiler chickens.

Table 2: Haematological response of broiler chickens to three selected phyto-additives

| Parameters | Control (0%) | Xylopia (1%) | Ginger (1%) | Garlic (1%) | SEM |
|---|---|---|---|---|---|
| Basophils (%) | 1.60$^{b}$ | 1.60$^{b}$ | 1.60$^{b}$ | 2.40$^{a}$ | 0.14 |
| Eosinopils (%) | 3.40 | 2.60 | 2.60 | 2.80 | 0.17 |
| Heamoglobin (g/dL) | 10.90 | 10.70 | 10.78 | 9.48 | 0.25 |
| Heterophils (%) | 19.80$^{b}$ | 18.60$^{b}$ | 22.60$^{a}$ | 20.40$^{ab}$ | 0.48 |
| Lymphocyte (%) | 73.80$^{ab}$ | 75.60$^{a}$ | 75.60$^{a}$ | 73.80$^{ab}$ | 0.48 |
| Monocyte (%) | 1.40$^{b}$ | 1.60$^{b}$ | 1.40$^{b}$ | 2.40$^{a}$ | 0.15 |
| Pack Cell Volume (%) | 32.80 | 32.00 | 32.80 | 28.40 | 0.38 |
| Red Blood Cell (x10$^{6}$/µL) | 3.58 | 3.50 | 3.58 | 3.12 | 0.09 |
| White Blood Cell (x10$^{3}$/µL) | 332.40$^{a}$ | 176.40$^{b}$ | 133.60$^{c}$ | 346.80$^{a}$ | 22.43 |
| MCH (g/dL) | 30.44 | 30.57 | 30.12 | 30.62 | 0.14 |
| MCV (fL) | 91.61 | 91.39 | 91.61 | 91.28 | 0.17 |
| MCHC (%) | 33.46 | 33.46 | 32.88 | 33.53 | 0.12 |
| Platelet (x10$^{6}$/µL) | 137.60$^{b}$ | 180.80$^{ab}$ | 183.40$^{ab}$ | 207.00$^{a}$ | 8.83 |

$^{a,b,c}$: Mean along the same row with different superscripts are significantly different (p>0.05) MCH = Mean Corpuscle Haemoglobin, MCV= Mean Corpuscle Volume, MCHC = Mean Corpuscle Haemoglobin Concentration.

Blood serum proteins are significant indicators of the health condition and production features of animals because of their numerous roles in the body physiology. *Xylopia aethiopica* and ginger in this study recorded the highest and similar effect of total protein, globulin and albumin, this implies that supplementation of *Xylopia aethiopica* and ginger in feed improves utilization of dietary protein and indirectly health status. Negro pepper, garlic and ginger had similar result of aspartate transaminase although the birds fed experimental diets did not follow any particular trend, and the concentrations are within range of 88.0-208.1 U/L reported for chickens (Mitruka and Rawnsley, 1977).

Table 3: Serum biochemical response of broiler chickens to three selected phyto-additives

| Parameters | Control 0% | Xylopia (1%) | Ginger (1%) | Garlic (1%) | SEM |
|---|---|---|---|---|---|
| Aspartate (IUI/L) | 49.80$^{b}$ | 114.00$^{a}$ | 92.40$^{a}$ | 95.60$^{a}$ | 7.70 |
| Alanine Transaminase (IU/L) | 3.40$^{b}$ | 4.40$^{b}$ | 3.40$^{b}$ | 5.80$^{a}$ | 0.30 |
| Alkaline Phosphase (IU/L) | 222.80 | 210.60 | 221.40 | 206.40 | 3.08 |
| Albumin (g/dL) | 15.00$^{b}$ | 16.00$^{a}$ | 16.20$^{a}$ | 15.40$^{ab}$ | 0.17 |
| Total Protein (g/dL) | 35.80$^{bc}$ | 37.00$^{ab}$ | 39.40$^{a}$ | 33.40$^{c}$ | 0.64 |
| Cholesterol (mg/dL) | 113.86 | 116.94 | 116.94 | 116.72 | 1.42 |
| Globulin (g/dL) | 17.80$^{c}$ | 21.00$^{b}$ | 23.20$^{a}$ | 18.00$^{c}$ | 0.61 |
| Urea (mg/dL) | 8.04$^{ab}$ | 9.24$^{a}$ | 7.08$^{b}$ | 8.64$^{a}$ | 0.29 |
| Creatinine (mg/dL) | 0.27$^{b}$ | 0.16$^{c}$ | 0.27$^{b}$ | 0.38$^{a}$ | 0.20 |

$^{a,b,c}$: Mean along the same row with different subscript are significantly different ($p>0.05$)

## Conclusion and Recommendation

Based on the performance with respect to feed intake, body weight gain, feed conversion ratio, haematology and serum parameters, it was summarized that *Xylopia aethiopica* (Negro pepper) supplementation was superior to *Allium sativum* (Garlic) and *Ziginber officinale* (Ginger) as feed additive. The inclusion of *Xylopia aethiopica* at 1% in broiler chickens feed is recommended to commercial producer for effective performance and physiological production traits.

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