

## GUT MICROBIOTA OF BROILER CHICKENS FED VARYING LEVELS OF *Syzygium aromaticum*

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### ABSTRACT

The impact of *Syzygium aromaticum* on gut microbial of broiler chickens was investigated. One hundred- and ninety-two-day old Cobb 500 broiler chicks were used for the feeding trial. There were four treatments replicated thrice with sixteen birds per replicate corresponding to forty-eight birds per treatment using a Completely Randomized Design. Treatment 1 was the control group; Treatment 2 contained 0.2% *Syzygium aromaticum* supplemented diet; Treatment 3 contained 0.3% *Syzygium aromaticum* supplemented diet while Treatment 4 contained 0.4% *Syzygium aromaticum* supplemented diet. The feeding trial period was 56 days to determine the effect of *Syzygium aromaticum* on the gut microbiota of broiler chickens. The results showed that lactic acid producing bacteria of birds fed control diet and 0.2% *Syzygium aromaticum* were ( $P>0.05$ ) similar but significantly ( $P<0.05$ ) lower than the values recorded for birds fed diets 0.3 and 0.4% *Syzygium aromaticum*. Total aerobic bacteria values of birds fed control diet was significantly ( $P<0.05$ ) higher than the values recorded for birds on diets 2, 3 and 4. Coliform bacteria and intestinal negative bacteria of birds fed diet 4 were significantly ( $P<0.05$ ) lower than those of birds fed control, diets 2 and 3. The supplementation of *Syzygium aromaticum* in broiler chicken diets influenced the composition of gut microbiota. It reduced harmful bacteria in the gut, suggesting its potential as an antimicrobial agent.

**Keywords: Broilers, *Syzygium aromaticum*, Microbiota, Phytochemicals, Growth promoters**

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### INTRODUCTION

Modifying the gut ecosystem and functions of farm animals through dietary changes is a proven strategy for achieving desired outcomes in poultry (Madal *et al.*, 2015). Consequently, growth promoters are added to poultry feed to enhance chicken health and maintain a stable gut environment. Natural growth promoters (NGPs) are considered ideal additives for poultry feeds because they are natural, toxin-free, and leave minimal residues. These alternatives, including organic acids and phytochemical feed additives, help modulate the host immune system by generating antioxidant and anti-inflammatory responses in the gut, thereby enhancing nutrient absorption (Mueller *et al.*, 2012; Liu *et al.*, 2014). Phytochemical feed additives (phytochemicals or botanicals) are plant-derived compounds that are added to diets to increase livestock productivity by improving feed properties, nutrient digestibility, absorption, and pathogen elimination in the gut (Abou-Bakr, 2011). Phytochemical feed additives (PFA) are known for their beneficial effects (Amad *et al.*, 2013; Raza *et al.*, 2016; Abudabos *et al.*, 2017). Herbs and spices in these additives boost feed intake by stimulating the secretion of endogenous enzymes, providing antibacterial benefits, and offering antioxidant properties (Shahid *et al.*, 2015). These actions result in improved nutrient absorption in the gut (Tehseen *et al.*, 2016). Clove (*Syzygium aromaticum*) is a native plant of Indonesia widely used as a kitchen spice. Clove is a tropical plant with a strong fragrance (with a distinctive aroma) (Bhowmik *et al.*, 2012) and has antioxidant, antimicrobial, analgesic, anti-obesity, and hepatoprotective activities in biological systems (Bhowmik *et al.*, 2012).

### MATERIALS AND METHODS

#### The experimental site

The study was carried out in the Poultry Unit of the Department of Agricultural Technology; The Federal Polytechnic Ado, Ekiti State, Nigeria. The State is located in the South Western part of Nigeria. The State covers a land area of 6,353km square (2453sqm) with two distinct seasons; the rainy season (April to October) and the dry season (November to March). Ado-Ekiti has a temperature range between 21° and 28°C with high humidity, the South Western wind and the North East trade which blows in the raining season and dry (harmattan) season, respectively.

#### Site preparation

The poultry house was thoroughly washed, fumigated with disinfectant. It was then allowed to stay and dried for two weeks before the arrival of the experimental birds. Proper weeding of the surrounding was carried out to prevent predators and pests.

### Experimental animals

A total number of one hundred and ninety-two (192) Cobb 500 broiler chicks were used in this experiment. There were 4 treatments and 3 replicates per treatment. Sixteen (16) birds were allotted per replicate corresponding to 48 birds per treatment. Vaccinations were given to the experimental birds when appropriate. The test ingredients cloves (*Syzygium aromaticum*) used were purchased from a local market, and air-dried for 13 days in order to reduce the moisture content. They were milled into fine particles and used to formulate the diets.

### Experimental diets

The composition of experimental diets are presented in Table 1. The basal diets were formulated for broiler starter (0-28 days) and finisher phase (29-56 days). The basal diets were divided into 4:

Diet 1: Control diet (without supplements)

Diet 2: Contained 0.2% *Syzygium aromaticum* inclusion

Diet 3: Contained 0.3% *Syzygium aromaticum* inclusion.

Diet 4: Contained 0.4% *Syzygium aromaticum* inclusion.

**Table 1: Composition of experimental diets (g/100kg) for broiler starter**

Ingredient	Inclusion level of <i>Syzygium aromaticum</i>			
	T1 (0%)	T2 (0.2%)	T3 (0.3%)	T4 (0.4%)
Maize	39	39	39	39
Soybean Meal (SBM)	26	26	26	26
Groundnut Cake	24	24	24	24
Fish Meal	2.5	2.5	2.5	2.5
Bone Meal	3	3	3	3
Limestone	2.5	2.5	2.5	2.5
Broiler Premix	0.20	0.20	0.20	0.20
Methionine	0.25	0.25	0.25	0.25
Lysine	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25
Vegetable oil	2	2	2	2
Total	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Calculated Analysis</b>				
Crude protein (%)	23.76	23.76	23.76	23.76
Metabolizable Energy (kcal)	2919.12	2919.12	2919.12	2919.12
Calcium	2.24	2.24	2.24	2.24
Average phosphorus	0.73	0.73	0.73	0.73

### Data collection

On the 56<sup>th</sup> day of the experiment, one bird per replicate was randomly selected, weighed and euthanized by severing the two jugular veins (Oloruntola *et al.*, 2018). Prior to euthanasia, the birds were deprived of feed overnight. The caecal contents of the slaughtered birds were collected for microbiological examination. The aerobic bacteria were cultured in the nutrient agar, lactic acid-producing bacteria were cultured in Man Rogosa agar while the coliforms and intestinal negative lactose bacteria were cultured in the Mac Conkey agar (Dibaji *et al.*, 2014; Seidavi and Simoes, 2015). The parameters of interest were lactic acid producing bacteria, total aerobic bacteria, intestinal negative bacteria and coliform bacteria.

### Statistical analysis

All data collected in this study were subjected to analysis of variance (ANOVA) using Duncan Multiple Range Test was used to separate the means. Significant differences were considered where necessary at a level of  $P < 0.05$

### RESULTS

Table 2 shows the effect of *Syzygium aromaticum* on gut microbiota of broiler chickens. Lactic acid producing bacteria of birds fed control diet and 0.2% *Syzygium aromaticum* were ( $P > 0.05$ ) similar but significantly ( $P < 0.05$ ) lower than the values recorded for birds fed diets 0.3 and 0.4% *Syzygium aromaticum*. Total aerobic bacteria of birds fed control diet was significantly ( $P < 0.05$ ) higher than the birds fed diets 2, 3 and 4. Coliform bacteria and intestine negative bacteria of birds fed diet 4 were significantly ( $P < 0.05$ ) lower than birds fed control, diets 2 and 3.

**Table 2: Gut microbiota of broiler chickens fed varying levels of *Syzygium aromaticum***

Parameters	DIET				±SEM	P-Value
	Diet 1 (0%)	Diet 2 (0.2%)	Diet 3 (0.3%)	Diet 4 (0.4%)		
Lactic acid Producing Bacteria	10.57 <sup>c</sup>	10.72 <sup>c</sup>	11.17 <sup>b</sup>	11.92 <sup>a</sup>	0.16	0.01
Total Aerobic Bacteria	11.82 <sup>a</sup>	11.61 <sup>b</sup>	11.58 <sup>bc</sup>	11.51 <sup>c</sup>	0.37	0.02
Coliform bacteria	8.84 <sup>a</sup>	8.52 <sup>ab</sup>	8.35 <sup>b</sup>	7.69 <sup>c</sup>	0.13	0.01
Intestine Negative Bacteria	12.75 <sup>a</sup>	12.49 <sup>b</sup>	11.94 <sup>c</sup>	11.36 <sup>d</sup>	0.16	0.01

<sup>a,b,c</sup> means in the same row with different superscripts are significantly (P<0.05) different; SEM: standard error of the mean.

## DISCUSSION

Gut health is directly related to the profile of the microbiota that interacts with the host. The microbiota regulates absorption efficiency, antagonize the effects of pathogenic bacteria, improve gut integrity, and modulate immunity (Pan and Yu, 2014). The results of the present study revealed that *Syzygium aromaticum* supplementation in the diet of broiler chickens significantly increased the production of lactic acid-producing bacteria in the gut of broiler chickens compared to the control group. This indicates the ability of cloves to enhance the growth of lactic acid producing bacteria in the gut. The phytochemicals from cloves may modify the broiler's gut environment in favour of lactic acid producing bacteria proliferation by strengthening the gut barrier, preventing harmful bacteria from colonizing, reducing inflammation and promoting a healthier microbial balance, thereby creating a favourable environment for beneficial bacteria like lactic acid-producing bacteria (Kikusato, 2021). However, comparable findings about a decrease in total bacteria, coliform bacteria and intestine negative bacteria were noted. The reduction in the intestinal microbiology in experimental birds fed 0.2, 0.3 and 0.4% cloves supplemented diets could be attributed to the phytochemicals present in the test ingredients, which promote intestinal tract functions such as digestive secretion, nutrient digestion, absorption and metabolism (Dhama *et al.*, 2015).

## CONCLUSION

The supplementation of *Syzygium aromaticum* in broiler chicken diets influenced the composition of intestinal microbiota. It reduced harmful bacteria in the gut, suggesting its potential as an antimicrobial agent.

## RECOMMENDATION

Incorporating *Syzygium aromaticum* at 0.4% in broiler chicken's diets had notable effect on gut microbiota.

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