SYNERGISTIC EFFECTS OF DIETARY TURMERIC, CLOVE, GINGER, AND GARLIC ON HAEMATO-SEROLOGICAL PARAMETERS OF BROILER CHICKENS

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ABSTRACT
This study evaluated the effects of turmeric, clove, ginger, and garlic (TCG²) supplementation on the haemato-serological parameters of broiler chickens. The TCG² was prepared as fine powders mixed in a 3.5:1.5:3.5:1.5 ratio for turmeric, clove, ginger, and garlic respectively, the TCG² was administered as a supplement to the diet of 144 Ross 308 broiler chicks. Four dietary treatments were formulated and TCG² was included at 0%, 0.25%, 0.5%, and 0.75% inclusion levels over six weeks. Data were collected on haematological (Packed Cell Volume (PCV), Red Blood Cell (RBC), haemoglobin concentration (Hb), white blood cell (WBC) lymphocytes, neutrophils and monocytes) and serum biochemical indices (liver enzymes (ALP, AST, ALT), total protein, albumin, globulin, urea, creatinine, cholesterol, triglyceride, and lipid profiles). The data was subjected to one-way analysis of variance (ANOVA) and Duncan's Multiple Range Tests was used to separate the mean at ($p<0.05$). Results revealed no significant differences ($P>0.05$) in haematological parameters across treatment groups, indicating that TCG² supplementation did not adversely affect blood profile of the birds and this is an indication that the birds are healthy. The values obtained for the liver enzymes Aspartate Transaminase (AST) and Alanine Transaminase (ALT) were not significantly affected suggesting no negative effects on liver function, while there is a significant increase in Alkaline Phosphatase (ALP) levels at 0.25% TCG² inclusion. Lipid profiles, including cholesterol, triglycerides, HDL, and LDL, showed no significant changes, demonstrating metabolic stability. Additionally, serum proteins and electrolyte levels were consistent across treatments. Based on the result obtained in this study it could be concluded that TCG² supplementation did not adversely affect the haemato-serological parameters, however, its use at 0.25%, significantly improved the ALP value.
Keywords: Haematological, Serological**,** Turmeric, Clove, Ginger, Garlic

INTRODUCTION

Poultry production in Nigeria is continually on the rise due to the high and unending demand for its products, such as meat and eggs, which are staples in homes, restaurants, and food industries nationwide. Poultry farming provides a stable protein supply as well as food and nutritional security for a wide range of population in rural areas around the world especially developing countries (Vaarst *et al.,* 2015). Despite these benefits, the rise of intensive poultry farming systems has introduced significant challenges, particularly the overuse of antibiotics. These antibiotics, traditionally used to enhance growth and prevent diseases, have raised serious concerns about their adverse effects on both humans and animals. Due to the increased prevalence of antibiotic-resistant bacteria, several countries have recently reduced or banned their usage. The increasing cost of antibiotics and their residual effects has necessitated the need to research for natural plant-based products that could serve as a cheap and effective alternative compared to commercial (synthetic) antibiotics. Using plants with phytogenic properties as additives in livestock nutrition is gaining popularity due to its resultant effect on animals such as improved productivity, reproduction, and quality of animal products through improved health (Olayemi *et al.,* 2016).

Turmeric, clove, ginger, and garlic are widely studied phytogenic feed additives known for their diverse bioactive properties and potential as alternatives to synthetic antibiotics in poultry production. Turmeric, ginger, garlic and clove are known for their antimicrobial, anti-inflammatory, and immunomodulatory characteristics, and these have been proven to make them an antibiotic with the potential to improve overall poultry wellness and metabolic stability (Lagua and Ampode, 2021; Uddin *et al*., 2017; Kate and Sutar, 2020 and Batiha *et al*., 2020). Having understood the potential of these phyto-additives individually, findings revealed that there is a paucity of information on their synergetic effect; on this note, current study evaluates the synergetic effect of the four phyto-additives on the haemato-serological parameters of broiler chickens.

MATERIALS AND METHODS

The experiment was conducted at the Poultry Unit of the Teaching and Research Farm, Ladoke Akintola University of Technology (LAUTECH), located in Ogbomoso, Oyo State, Nigeria.

The test ingredients: Turmeric, clove, ginger, and garlic (TCG²) were sourced from a local market in Ogbomoso. Following the method described by Odunsi *et al*. (2017), turmeric and ginger rhizomes were rinsed, peeled, and

cut into small pieces for drying. Cloves were sorted to remove unwanted particles, while garlic was sorted to remove extrinsic components and defective bulbs before peeling and rinsing. All samples were dried at 65°C to a constant weight, ground into powder, and stored in airtight containers for feed formulation and chemical analysis. A total of 144-day-old Ross 308 broiler chickens were obtained from a reputable hatchery in Kwara State. The test ingredients (turmeric, clove, ginger, and garlic) were processed into fine powders and combined in a ratio of 3.5:1.5:3.5:1.5 to form a composite named TCG². Four dietary treatments were formulated such that the birds were allotted to them at 0%, 0.25%, 0.5%, and 0.75% inclusion levels of TCG², the treatments were designated as treatments A, B, C, and D, respectively. Each treatment was replicated three times, with 12 birds per replicate making 36 birds per treatment. Before the arrival of the birds, the brooding house was thoroughly cleaned, washed, and disinfected. Necessary materials, including electric bulbs, coal pots, charcoal, wood shavings, drinkers, and feeders, were prepared. Drinkers and feeders were also disinfected. The birds were reared for six weeks in two phases: starter (0–3 weeks) and finisher (4–6 weeks). Feed and water were provided *ad libitum*, while vaccination and medication schedules from the hatchery were strictly adhered to.

Data Collection

On day 42, three birds were selected per treatment; the birds were slaughtered and 2.5 ml of blood was collected per bird per replicate via the jugular vein into labelled sterile universal bottles containing Ethylene-Diamine-Tetra-Acetic Acid (EDTA) as an anticoagulant. The haematological indices analyzed included Packed Cell Volume (PCV), Red Blood Cell (RBC) count, Haemoglobin concentration (Hb), White Blood Cell (WBC) count, Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), and Mean Corpuscular Haemoglobin Concentration (MCHC). Differential counts were also calculated within an hour of sample collection, following the standard procedures described by Bain *et al*. (2016).

For serum biochemistry, an additional 2.5 ml blood was collected into labelled sterile bottles without anticoagulants. The serum was separated and analyzed for biochemical components such as total protein, total cholesterol, glucose, albumin, globulin, urea, Aspartate Transaminase (AST), Alanine Transaminase (ALT), and Alkaline Phosphatase (ALP), using standard procedures described by Mitruka and Rawnsley (1977). Furthermore, serum lipid profiles were assessed from the collected samples to determine High-Density Lipoprotein (HDL), cholesterol, and triglycerides (TRIG).

Statistical Analysis

All collected data were analyzed using one-way ANOVA in SAS 9.4 software, and significant differences between means were separated using Duncan's Multiple Range Test (DMRT) at a 5% level of significance.

RESULTS AND DISCUSSION

The study assessed the effects of turmeric, clove, ginger, and garlic (TCG²) supplementation on the haematological parameters and serum biochemical of broiler chickens. Results revealed no significant differences (P>0.05) in haematological parameters across treatment groups, indicating that TCG² supplementation did not adversely affect blood profile of the birds and this is an indication that the birds are healthy. The liver enzymes such as aspartate aminotransferase (AST) and alanine aminotransferase (ALT) remained within normal physiological ranges, suggesting no hepatotoxic effects, which is consistent with the findings of Kumar *et al*. (2013). Also, Demir *et al*. (2003) and Dieumou *et al*. (2009) reported that garlic had no significant effect on serum AST and ALT which is in agreement with this result. Significant increases in alkaline phosphatase (ALP) levels were observed in the 0.25% TCG² group (269.00 IU/L), indicating enhanced liver function and bone metabolism (Chen, *et al*., 2022), the result is in contrary with the report of Kumar *et al*. (2013) who noticed no significant changes in ALP of broiler fed garlic-based diets. Serum parameters such as total protein, albumin, and globulin remained stable across all treatments were not significantly affected (p>0.05), the result supported that of Iyaode *et al*. (2020) who reported no significant adverse effects on protein metabolism when using ginger on different strains of broiler chickens' diets.

Table 1: Effect of TCG² Based Diet on the Serum Profile of Broiler Chickens

	A	B	C	D		
TRT	**0% TCG²**	**0.25 TCG²**	**0.5% TCG²**	**0.75% TCG²**	**SEM**	**P. val**
AST (IU/L)	169.62	183.06	183.76	201.38	8.68	0.70
ALT (IU/L)	15.95	17.11	16.59	13.75	1.21	0.82
ALP (IU/L)	245.58^{c}	269.00^{a}	251.98^{bc}	263.11^{ab}	3.23	0.01
TP (g/l)	25.93	33.94	28.21	25.07	1.57	0.18
ALB (g/L)	8.67	11.60	9.72	9.86	0.46	0.14
GLB (g/L)	17.27	27.38	18.49	15.21	2.00	0.13
Urea (mmol/l)	0.14	0.28	0.17	0.22	0.04	0.63
Creat (µmol/l)	69.20	81.58	72.11	61.91	2.83	0.07
CHOL (mmol/l)	2.60	2.82	2.52	3.14	0.15	0.55
TRIG (mmol/l)	0.58	0.30	0.64	0.58	0.17	0.92
HDL-C (mmol/l)	2.22	2.25	2.18	2.50	0.09	0.62

$^{abc:}$ Treatment values on the same row with different super scripts are significantly differed (p<0.05)

Table 2: Effect of TCG² Based Diet on the Haematological Parameters of Broiler Chickens

TRT	A 0% TCG²	B 0.25 TCG²	C 0.5% TCG²	D 0.75% TCG²	SEM	P. val
PCV (HCT) %	24.10	25.83	27.53	23.23	1.28	0.71
HCT (L/L)	0.24	0.26	0.28	0.23	0.01	0.71
HB (g/L)	120.00	127.00	134.33	116.00	5.91	0.76
RBC X 10^12/L	1.98	2.23	2.33	1.96	0.12	0.66
MCV (fL)	122.43	115.70	118.60	118.37	1.84	0.70
MCH (pg)	61.07	56.90	57.83	59.13	0.91	0.45
MCHC (g/L)	500.33	492.00	487.67	499.00	4.51	0.78
WBC X 10^9/L	127.00	133.43	132.37	124.43	5.15	0.94
Neutrophils	5.27	7.37	4.53	5.93	0.56	0.37
Lymphocytes	89.27	87.97	90.23	89.53	0.67	0.74
Monocytes	5.47	4.67	5.23	4.53	0.31	0.72
PLT X 10^9/L	42.33	30.00	40.33	35.67	3.03	0.54

CONCLUSION

Based on the results obtained in this study it could be concluded that TCG² supplementation did not adversely affect the haemato-serological parameters, however, its use at 0.25%, significantly improved the ALP value, making it a potential safe and effective feed additive for broiler production.

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