

Growth performance of ISA Brown pullet chicks fed diets containing single and combined levels of Turmeric (*Curcuma longa*) and Clove (*Syzygium aromaticum*)

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Target Audience: Poultry Farmers, Feed millers, Researchers

Abstract

A feeding trial was conducted to determine the effect Turmeric (TUM), Clove (CLV) and Turmeric + Clove (TUM + CLV) on growth performance of Isa Brown pullet chicks. A total of 504, one-day old pullet chicks were distributed randomly in a 3 x 3 factorial arrangement (phytogenic feed additive x inclusion level) totaling 9 dietary treatments having 4 replicates of 14 birds per replicate each. Birds were brooded for 14 days (2 weeks) on a deep litter floor. At day 15, chicks were weighed, balanced, then equally allotted into experimental treatments comprising of birds maintained on 0%, 1%, 2% TUM, 0%, 1%, 2% CLV and 0%, 1%, 2% TUM+CLV on 1:1 ratio weight for weight. Feed and clean water were offered ad libitum. The experiment lasted for 56 days. Performance parameters were evaluated throughout the experiment. TUM, CLV, TUM + CLV and levels of inclusion showed no significant improvement ($P > 0.05$) on the performance parameters measured.

Key words: Clove, Deep litter, Performance, Phytogenic feed additives, Turmeric

Description of Problem

The practice of using antibiotics in poultry is being questioned, due to reported cases of development of resistant populations of bacteria, alteration of natural gut microbiota and association of health risks in humans (8, 17). The need to improve performance in poultry production creates demand for natural and safe alternative sources. Phytogenic feed additives (PFA) are plant-derived natural bioactive compound that has been reported to enhance performance, feed conversion ratio, carcass meat safety and quality in animals (3, 4). Turmeric (*Curcuma longa*) and clove (*Syzygium aromaticum*) are among many beneficial plants known as phytonics that are widely available and used as condiments in Nigeria.

Turmeric is one of the numerous phytogenic additives of importance in poultry feed production. It is a rhizome of the herbaceous perennial plant of the ginger family, *Zingiberaceae*. Though it is known to be native to the tropical South Asia, it is also grown in other tropical and sub-tropical Africa including Nigeria. It requires temperature between 20 and 30°C and a considerable amount of annual rainfall for growth (12). Curcumin is the active compound in turmeric powder which is reported to have a lot of molecular targets in the cells (19) that could affect cell functions in the body.

Clove, is a medium sized tree (8-12 m) from the Mirtaceae family and native from the Maluku Islands in East Indonesia (13). For centuries the trade of clove and the

search of this valuable spice stimulated the economic development of this Asiatic region (11). The clove tree is frequently cultivated in coastal areas at maximum altitudes of 200 m above the sea level. The production of flower buds, which is the commercialized part of this tree, starts after 4 years of plantation. Flower buds are collected in the maturation phase before flowering. The collection could be done manually or chemically-mediated using a natural phytohormone which liberates ethylene in vegetal tissue, producing precocious maturation (7). Nowadays, clove is cultivated in several parts of the world, including Nigeria. Clove is rich in eugenol and is used as antibacterial in human and veterinary medicine (15). About 89% of clove essential oil is eugenol (10). There have been inconsistent results from several studies on the use of PFA compounds as an alternative to antibiotics in poultry nutrition. (3, 4, 14), reported beneficial effects of these additives and (1, 2, 6) found no significant effects of PFA supplemented in broiler diet. This study therefore, aimed at evaluating the effect of turmeric (TUM), clove (CLV) and its combination (TUM+CLV) on growth performance of ISA brown pullet chicks.

Materials and Methods

Location of the study: This trial was conducted at Ilorin, Kwara State, Nigeria under the supervision of Animal Research Unit of the Department of Animal Science, Babcock University, Ilishan Remo, Ogun State, Nigeria.

Collection and preparation of experimental materials: Fresh turmeric and dried clove buds used in this study were purchased from Mandate market, Ilorin, Kwara State. Fresh turmeric rhizomes were manually cleaned, peeled and cut into thin

pieces. Thinly cut turmeric rhizomes were air dried at temperature between 25 – 29°C for 2-3 weeks until the desired level of dry matter was obtained. Dried clove buds were cleaned and air dried for 24 hours prior to milling. Thereafter, they were milled individually to powder and stored in air-tight bags until incorporation into the formulated diet.

Management of birds and diets: A total of five hundred and four (504) 1-day-old ISA Brown pullet chicks were purchased from a reputable hatchery in Ibadan, Nigeria. They were randomly allocated on weight equalization basis to 9 dietary treatment groups. Each treatment group had four (4) replicates with 14 birds per replicate in a 3×3 factorial experimental design. Chicks were weighed at the beginning of the experiment and on weekly basis thereafter. Feed and clean water were offered *ad libitum*. As shown in Table 1, experimental diets were formulated with the inclusion of TUM (0%, 1%, 2%), CLV (0%, 1%, 2%), and TUM + CLV (0%, 1%, 2%) on 1:1 ratio weight for weight for pullet chicks. The experiment lasted for 56 days.

Data collection

Data on feed intake and body weights were recorded weekly to determine growth performance. Feed conversion ratio, weight gain and daily weight gain were calculated.

Experimental design and statistical analysis

Experimental data were analyzed by ANOVA using a 2-way Analysis of Variance in a 3×3 factorial arrangement. Significant ($p < 0.05$) differences among treatment means were determined using Duncan Multiple Range Test as contained in Statistical Analysis Software (SAS 2010) package.

Table 1: Ingredient composition of pullet chick diets containing Turmeric, Clove and Turmeric + Clove (days 15-56)

Ingredients	TUM			CLV			TUM+CLV		
	0%	1%	2%	0%	1%	2%	0%	1%	2%
Maize	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Fish meal (72%)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Soybean meal	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Wheat offal	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Bone meal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Limestone	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Oyster shell	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Lysine	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Turmeric	-	+	++	-	-	-	-	-	-
Clove	-	-	-	-	+	++	-	-	-
Turmeric+Clove	-	-	-	-	-	-	-	+	++
Total	100	100	100	100	100	100	100	100	100
Calculated	Composition	(%)							
ME (Kcal/kg)	2800.05	2800.05	2800.05	2800.05	2800.05	2800.05	2800.05	2800.05	2800.05
Crude Protein	20.80	20.80	20.80	20.80	20.80	20.80	20.80	20.80	20.80
Ether Extract	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09
Crude Fibre	4.56	4.56	4.56	4.56	4.56	4.56	4.56	4.56	4.56
Ash	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58

*Premix (Composition per kg diet): Vit. A (I.U.) 2,800,000; Vit E (mg) 16,000; Vit. K (mg) 800; Vit. B₁ (mg) 1,200; Vit. B₂ (mg) 1,600; Vit. B₆ E.E4 (mg) 30; Folic Acid (mg) 0.4; Niacin (mg) 20,000; D Cal Pan (mg) 4,400; Co (mg) 120; Cu (mg) 3,200; I (mg) 600; Se (mg) 48; Zn (mg) 24,000; Fe (mg) 16,000; Mn (mg) 40,000; Choline Chloride (mg) 120,000; Antioxidant (mg) 48,000. TUM: Turmeric; CLV: Clove; TUM + CLV: Turmeric + Clove; 0% (exclusion levels), + = 1% (10g/kg diet) ++ = 2% (20g/kg diet).

Results

The main and interaction effects of TUM, CLV, TUM + CLV and level of inclusion on growth performance of pullet chicks shown in Tables 2 and 3 respectively revealed no significant improvement ($P>0.05$). However, higher numerical values of final live weight (FLW) and weight gain (WG) were recorded in birds fed with TUM + CLV (601.12 ; 486.83) in comparison with

single effect of TUM (594.69; 480.41), and CLV(585.58; 471.21) as shown in Table 2. Interaction effect and level of inclusion shown in Table 3 revealed that FLW and WG at 1% (617.33; 503.04) and 2% (602.03; 487.72) inclusion of TUM + CLV were higher numerically when compared to 0% (584.00; 469.73) level of inclusion. Inclusion of TUM+CLV at 2% showed better FCR (2.79).

Table 2: Main Effect of TUM, CLV and TUM + CLV and level of inclusion on growth performance of ISA Brown pullets at chicks stage (days 15-56)

Parameters	Feed Additives				Levels of Inclusion (%)				
	TUM	CLV	TUM + CLV	SEM	0	1	2	SEM	FA x LI
IW (g/bird)	114.28	114.29	114.29	0.14	114.29	114.29	114.29	0.20	NS
FLW(g/bird)	594.69	585.58	601.12	7.78	581.33	604.64	595.43	11.00	NS
WG (g/bird)	480.41	471.21	486.83	29.15	467.05	490.35	481.06	41.23	NS
DWG(g/bird/day)	11.44	11.22	11.59	0.44	11.12	11.68	11.45	0.63	NS
FI (g/bird/day)	36.10	34.96	35.22	1.37	36.28	36.79	33.20	1.94	NS
FCR	3.16	3.12	3.04	0.13	3.27	3.15	2.9	0.18	NS

IW: Initial weight, FLW: Final live weight, WG: Weight gain, DWG: Daily weight gain, FI: Feed intake, FCR: Feed conversion ratio. TUM: Turmeric, CLV: Clove, TUM + CLV: Turmeric + Clove

Table 3: Interaction effect of TUM, CLV and TUM + CLV and level of inclusion on growth performance of ISA Brown pullets at chicks stage (days 15-56)

Test Ingredient	TUM			CLV			TUM + CLV			SEM
	0%	1%	2%	0%	1%	2%	0%	1%	2%	
IW (g/bird)	114.29	114.30	114.26	114.3	114.28	114.29	114.27	114.29	114.31	0.24
FLW(g/bird)	588.00	604.00	592.00	572.00	592.50	592.25	584.00	617.33	602.03	13.47
WG (g/bird)	473.71	489.78	477.74	457.70	478.22	477.71	469.73	503.04	487.72	50.49
DWG(g/bird/day)	11.28	11.66	11.37	10.90	11.39	11.37	11.18	11.98	11.61	0.77
FI (g/bird/day)	36.17	36.86	35.27	36.24	36.64	31.99	36.44	36.87	32.35	2.38
FCR	3.21	3.16	3.10	3.33	3.22	2.81	3.26	3.08	2.79	0.22

IW: Initial weight, FLW: Final live weight, WG: Weight gain, DWG: Daily weight gain, FI: Feed intake, FCR: Feed conversion ratio; TUM: Turmeric, CLV: Clove, TUM + CLV: Turmeric + Clove

Discussion

Phytogenic feed additives have attracted increased interest as an alternative feeding strategy to replace antibiotic growth promoters; however, variation exists on their biological efficacy on performance characteristics (8). Growth performance of pullet chicks in this study revealed non-significant difference among phytogenic feed additives (single and combined) and level of inclusion. These results are similar to the findings of (5) who did not find significant effects of different phytogenic compounds on broiler growth performance. (16), reported that broiler chickens fed diets supplemented with 1000ppm of essential oils of clove, thyme, cinnamon and capsicum had no difference in growth performance.

Likewise supplementation of diets containing turmeric, citrus extract, grape seed extract, chinese cinnamon essential oil, chilean- boldo leaves and fenugreek seeds had no significant effect on growth performance of broilers (6). (2), documented no significant effect of turmeric supplementation in broiler diet. Similarly, (1) also reported no significant effect of turmeric supplementation at 10g/kg and 30g/kg in broiler diet. In contrast, some studies reported dietary supplementation of PFA in broiler diet to improve growth performance (9, 18). The non-significant effects of TUM, CLV, TUM + CLV and levels of inclusion on growth performance of pullet chicks in this study may be due to the basal diets, concentration of the active

ingredient of the plant part, form of PFA, method of processing/ storage, dosage/ inclusion levels, period of exposure, compatibility with other ingredients and experimental design.

Conclusion and Application

1. It can therefore be concluded that turmeric, clove and their combination at 1% (10g/kg and 2% (20g/kg) had no significant effects on the growth parameters of ISA brown pullet chicks fed diets containing them.
2. The findings from this study would be of great benefit to feed-millers, poultry farmers and policymakers.

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