PERFORMANCE AND NUTRIENT DIGESTIBILITY OF LAYING HENS FED DIETARY TURMERIC AND CLOVE

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ABSTRACT
Eighty (80) 18 weeks old, grower birds of ISA Brown strain were used to evaluate performance and nutrient digestibility of hens fed dietary turmeric and clove. The birds were randomly divided into 5 groups of 4 replicates per group. Each replicate contained 4 birds. Five experimental diets were formulated for the study namely: Basal diet without test ingredients (control). Diet T1 was basal diet supplemented with 0.1% Clove Bud Powder (CBP) and 0.25% Turmeric Rhizome Powder (TRP). The T2 was basal diet that contained 0.2% CBP and 0.25% TRP. Basal diet containing 0.1% CBP and 0.5% TRP was tagged T3. Diet T4 was basal diet supplemented with 0.2% CLP and 0.5% TRP. The results showed that dietary treatment significantly (P>0.05) influence performance and nutrient digestibility of laying hens. The highest average daily feed intake (ADFI) was observed in hens fed diet T2. The heaviest egg mass (45.24 g/egg) was recorded for laying hens fed 0.1% CBP and 0.25% TRP diet (T1). The main effect of CBP at 0.1% impacted higher Hen Day Production (HDP) (P= 0.048) and egg mass (P = 0.021) than those fed 0.2% CBP. Dietary treatment significantly influenced nutrient digestibility for crude protein (P=0.002), ash (P=0.0001), ether extract (P=0.048), crude fibre (P=0.0002) and nitrogen Free Extract, NFE, (P=0.0003). The highest digestibility for ash (74.22%), ether extract (92.67%) and NFE (76.99%) was observed in laying hens fed diet supplemented with 0.1% CBP and 0.5% TRP (T3).
Keywords: Clove, Turmeric, Layers, Production performance, nutrient digestibility.

INTRODUCTION

Commercial egg production is perhaps the most significant and cheap source of quality protein and income as compared with other livestock production activities (Ebraheem *et al*., 2012). The industrialization of poultry husbandry and the improvement of feed nutritional efficiency have accelerated the introduction of feed additives which became widely used in animal feed for many decades. The objective outlined by scientists, is to increase production (eggs and meat) while maintaining animals in good health (Alloui *et al*., 2014). This situation requires the world to restrict using antibiotics growth promoters (AGPs) in animal feed (Nisha, 2008). The removal of AGPs from animal feed may affect their productions performance and foster the resurgence of pathogens causing illness and economic losses in farms. In this context, herbs and plant extracts are searched to be incorporated in poultry feed as growth promoters such phyto additives (Alloui *et al*., 2014).

Syzygium aromaticum (clove) is an aromatic plant commonly used as a spice. It is an evergreen plant available all year round with different harvest seasons in different countries (Yun, 2018). Aside from vitamins A, K, B6, B1 and C present in *S. aromaticum* (Dorman and Deans, 2000). It contains numerous biologically active compounds such as eugenol (72–90%), eugenol acetate, β caryophyllene, flavonoids and triterpenoids (Jimoh *et al*., 2017). It has been well reported for its antimicrobial properties (Kim and Wang, 2011) and immune stimulating properties which have positive effects on the growth performance and health of poultry (Al-Mufarrej *et al*., 2019). Turmeric (*Curcuma longa*) is one of the numerous phytogenic additives of importance in poultry feed production (Basak, 2017). Turmeric 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 widely grown in Nigeria and other tropical and sub-tropical Africa since it requires temperature between 20 and 30 and a considerable amount of annual rainfall for growth (Khan *et al*., 2012). Turmeric and clove are known for their bioactive compounds, including curcumin and eugenol, which have been associated with various health-promoting properties. Understanding how turmeric and clove affect nutrient digestibility is essential for formulating balanced and efficient diets. Improved nutrient utilization can positively impact the efficiency of feed conversion, leading to better performance and

economic benefits in poultry production. The sole and synergistic effects of clove and turmeric on performance and nutrient digestibility of laying hens have not been given much attention in previous studies. Therefore, this study evaluated the performance and nutrient digestibility of laying hens fed clove and turmeric.

MATERIALS AND METHODS

Site of the Experiment:

The experiment was conducted at Layer Unit, Teaching and Research Farm of LAUTECH, Ogbomoso, Oyo State, Nigeria.

Preparation of Test Ingredients: Clove buds were purchased from Oja Jagun market in Ogbomoso, Oyo State. Turmeric rhizomes were sourced from Teaching and Research Farm, LAUTECH. Turmeric rhizomes were sliced into 2mm pieces, and sundried until constant weight is achieved. Dried sliced turmeric was ground in a mechanical grinder and sieved using a 1mm mesh to obtain turmeric powder (TRP). The dried clove materials was pulverized into fine powder using a mechanical blender to obtain clove powder (CBP).

Experimental Diets, Birds and Management: Five experimental diets were formulated for the study. Basal diet without test ingredients served as the control. Basal diet + 0.1% CBP and 0.25% TRP (T1); Basal diet + 0.2% CBP and 0.25% TRP (T2). Basal diet + 0.1% CBP and 0.5% TRP (T3). Basal diet + 0.2% CBP and 0.5% TRP (T4). The gross composition of basal diet is as follows: 50% maize, 15.8% maize offal, 3% wheat offal, 18% SBM, 3% fishmeal, 0.1% methionine, 0.25% salt, 0.25% vitamin premix, 1.8% bone meal, 7.8% limestone. Basal diet was characterized by 2739.90 kcal ME/kg and 16.97% CP. Eighty (80) 18 weeks old, grower birds of ISA Brown strain were used for the study. Daily egg production was at 20% when the experimental diets were introduced to the birds. These birds were randomly divided into 5 treatment groups of 4 replicates per treatment. Each replicate contained 4 birds. Normal management procedure was observed during the study. All necessary medication and vaccination were administered appropriately. A period of 12 weeks was used for the experiment.

Experimental Design: Completely Randomized Design (CRD) was adopted for the study. A 2x2 factorial arrangement for CBP and TRP was also used. The two factors were CBP (0.1 & 0.2%) and TRP (0.25 & 0.50%) with each at two inclusion levels.

Data Collection

Laying Performance: During the study, daily egg production were monitored. The number of eggs laid and their weight were recorded daily using digital sensitive scale. Hen day production (HDP), ADFI and feed conversion were calculated. Feed efficiency per dozen was calculated using Kg of feed consumed x 12/ Total numbers of eggs laid. To calculate egg mass, the weight of the egg were multiplied by HDP.

Nutrient digestibility: This was carried out on the 11th week of the experiment. Two (2) laying hens from each replicate was used to assess the utilization of experimental diets. The birds were offered 70g of the experimental diets daily. The faecal collection was done for 3 days, after 4 days of pre-adjustment to the quantity of restricted feed intake. Faecal samples was oven dried at 70^0C until constant weight was achieved.

Statistical Analysis: Data collected were analyzed using One-Way ANOVA of SAS (2003) software package. The main and interaction effects were assessed using 2x2 factorial ANOVA. Duncan's option of the same software was used to compare the means. A probability of 5 percent was considered significant.

RESULTS AND DISCUSSION

The performance of laying hens fed clove and turmeric is shown in Table 4.2. Dietary treatment significantly influenced the Average Daily Feed Intake (ADFI, P=0.006) and egg mass (P=0.051). The highest (35.40 g/bird) ADFI was observed for laying hens fed diet supplemented with 0.2% CBP and 0.25% TRP (T2) while the control had the lowest. Laying hens grouped in T1, T2, T3 and T4 had higher ADFI (35.08, 35.40, 35.25 and 33.78 g/hen, respectively) and egg mass (45.24, 40.21, 42.49 and 41.53g/egg, respectively) than the control (32.03g/hen and 37.82/egg). The heaviest (45.24g) egg mass was observed in laying hens fed diet in T2. The main effect of clove had significant effect on HDP (P= 0.048) and egg mass (P= 0.021) with hens fed diets containing 0.1% CBP had higher HDP

and egg mass than those fed 0.2% CBP. Furthermore, interaction effect significantly impacted feed conversion (P=0.033) with higher inclusion level of CBP (0.2%) leading to worse feed conversion relative to group fed 0.1% CBP (when TRP was included at 0.25% and 0.50%, respectively). The best feed conversion was noticed in hens fed 0.1% CBP and 0.25% TRP diet (T1). The increases in ADFI observed in laying hens fed CBP and TRP concurred with the observation of Akinwumi *et al*. (2022a) who reported increases in feed intake of laying hens when clove was supplemented into (feed and water) of laying hens. This observation further corresponded with the observation of Zacaria and Ampode, (2021) who reported increases in feed intake of Japanese quail fed 0. 1, 3 and 5% turmeric powder. The maximum egg mass was in accordance with the observation of Radwan *et al.* (2008) who found that egg production and egg mass increased by addition of turmeric at 0.5% to layers diet. Similarly, the increases in egg mass of laying hens fed diet supplemented with CBP and TRP at all level of inclusions agreed with the observation of Van Phouc *et al* (2019) who found that the production performance of Ac (Black bone) chickens was enhanced by turmeric rhizome extract, resulting in higher egg mass output. The nutrient digestibility of laying hens fed dietary CBP and TRP is shown in Table 2. Dietary treatment significantly influenced nutrient digestibility for crude protein (P=0.002), ash (P=0.0001), ether extract (P=0.048), crude fibre (P=0.0002) and nitrogen Free Extract (NFE) (P=0.0003). The highest digestibility for ash (74.22%), ether extract (92.67%) and NFE (76.99%) was observed in laying hens fed diet supplemented with 0.1% CBP and 0.5% TRP (T3). The CP, CF, ash and EE digestibility of T1 were comparable with that of T3. The lowest ash, ether extract and NFE digestibility were observed in hens grouped in T2, T2 and control, respectively. The interaction effect of clove and turmeric significantly influenced CP (P=0.008), CF (P=0.008) and NFE (P=0.026) digestibility.

Table 1: Laying performance of hens fed clove bud and turmeric rhizome diets

Parameters	Control	T1	T2	T3	T4	P value	SEM	CBP	TRP	INT
Clove →	0.00	0.1%	0.2%	0.1%	0.2%					
Turmeric →	0.00	0.25%	0.25%	0.5%	0.5%					
HDP (%)	76.41	86.24	78.57	83.11	80.95	0.225	2.71	0.048	0.870	0.240
ADFI (g/hen)	32.03^{b}	35.08^{a}	35.40^{a}	35.25^{a}	33.78^{ab}	0.006	0.54	0.363	0.256	0.165
FC	2.55	2.31	2.63	2.47	2.42	0.232	0.09	0.099	0.786	0.033
Egg Weight (g/egg)	49.44	52.51	51.16	51.16	51.30	0.137	0.68	0.455	0.468	0.362
Egg mass (g/egg)	37.82^{b}	45.24^{a}	40.21^{ab}	42.49^{ab}	41.53^{ab}	0.051	1.41	0.021	0.537	0.096
FEDP	1.51	1.45	1.61	1.52	1.49	0.388	0.05	0.184	0.570	0.070

^{ab} Means along the same row with different superscripts are significantly different (P< 0.050).
HDP= Hen day production, ADFI= Average daily feed intake, FC= Feed conversion, FEPD= Feed efficiency per dozen

The optimum nutrients digestibility for ash, ether extract and NFE observed in laying hens fed diet supplemented with 0.1% CBP and 0.5% TRP (T3) were in accordance with the findings of Zacaria and Ampode, (2021) who observed enhanced digestibility of crude protein, ash and ether extract for laying quails fed diet supplemented with 5% turmeric powder. Dalal *et al*. (2018) observed that the addition of either 0.5 or 1.0% turmeric to hen's diet numerically increased nutrient digestibility coefficients compared to control group. The bioactive components of phytogenic plants such as eugenol have been reported to be able to stimulate digestion and enhance nutrient absorption (Reddy, 2004).

CONCLUSION AND APPLICATION

It was concluded that supplementation of 0.1% CBP and 0.25% TRP in laying hens' diet produced the highest egg mass and most efficient feed conversion. The optimum nutrient digestibility particularly for crude protein was noticed in hens fed 0.2% CBP and 0.25% TRP. The synergistic effect of clove and turmeric (at 0.1 & 0.2% CBP and 0.25% TRP) was demonstrated in increased feed intake, maximum egg mass and optimum nutrient digestibility. The inclusion levels for clove and turmeric were the lowest ever reported to be beneficial response in poultry production.

Table 2: Nutrient digestibility of laying hens fed clove and turmeric… Create additional rows for Clove and Tumeric. Not ok as presented

Parameters (%) Clove → Turmeric →	Control 0.00 0.00	T1 0.1% 0.25%	T2 0.2% 0.25%	T3 0.1% 0.5%	T4 0.2% 0.5%	P value	SEM	CBP	TRP	Interaction
Dry matter	70.85	74.09	72.27	75.14	72.40	0.151	1.19	0.061	0.604	0.685
Crude protein	68.35^{c}	73.52^{ab}	76.84^{a}	74.30^{ab}	70.51^{bc}	0.002	1.25	0.836	0.030	0.008
Ash	73.02^{a}	70.31^{a}	63.20^{b}	74.22^{a}	71.69^{a}	0.0001	1.24	0.002	0.000	0.081
Ether extract	92.63^{a}	92.43^{a}	91.27^{b}	92.67^{a}	91.88^{ab}	0.048	0.34	0.011	0.221	0.575
Crude fibre	52.21^{a}	53.59^{a}	35.83^{b}	52.64^{a}	48.41^{a}	0.0002	2.19	0.000	0.018	0.008
NFE	65.41^{c}	72.30^{b}	72.25^{b}	76.99^{a}	71.38^{b}	0.0003	1.26	0.024	0.105	0.026

$^{a, b, c}$Means along the same row with different superscripts are significantly different (P<0.05)
NFE= Nitrogen free extract

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