Research Article

Effects of Ginger Supplement on Growth Performance, Digestion and Blood Chemistry of Tau Vang Chicken (7-14 Weeks)

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Abstract | A study was conducted to evaluate the effect of ginger supplement on the growth performance of Tau Vang chicken in 7-14week old period. It was a completely randomized design with 5 treatments corresponding to 5 diets and 4 replications with 10 birds per experimental unit. The treatments were the different ginger supplement levels of 0.1. 0.2. 0.3 and 0.4 % (in DM) to basal diet. Corresponding to the G0, G0.1, G0.2, G0.3 and G0.4 treatments. The results showed that the daily intakes of DM, OM, CP and EE were signiificantly higher (P<0.05) for the 3 last treatments (the G0.2, G0.3 and G0.4 treatments). The significantly higher daily weight gain, final live weight and the lower FCR were found for the G0.3 treatments (P<0.05). The ginger supplement in the diets of Tau Vang chicken improved the carcass, breast meat and thigh meat weights (P<0.05). The adding ginger into the diet the triglyceride and total cholesterol index in the blood of local chicken decreases, which is good for the health of chicken. Consumers using low triglyceride and total cholesterol chicken meat will be good for their health as well. It was concluded that ginger supplementation in the diet at a level of from 0.3 to 0.4% DM improved growth performance and digestin for growing Tau Vang chicken production. It showed that ginger made quantification of triglycerid and quantification of total cholesterol in chicken blood decrease.

Keywords | Tau Vang chicken, Ginger, Triglyceride, Cholesterol and digestion

Received | October 20, 2021; **Accepted** | December 20, 2021; **Published** | January 15, 2022
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Citation | Nha PT, Dong NTK, Thuy LT (2022). Effects of ginger supplement on growth performance, digestion and blood chemistry of Tau Vang chicken (7-14 weeks). Adv. Anim. Vet. Sci. 10(3): 500-505.
DOI | http://dx.doi.org/10.17582/journal.aavs/2022/10.3.500.505
ISSN (Online) | 2307-8316

INTRODUCTION

Tau Vang chicken is originally Vietnamese local breed, which has been popularly raised in the Mekong delta of Vietnam. It can tolerate the harsh conditions and low quality diets; however, it gives good meat with more than double price as compared to commercial chicken (Pham, 2019). Ginger additives in diets give better health and meat quality of chicken. It is concluded that supplementation of garlic improves the performance of broilers when added at the level of 1% of broiler ration and could be a viable alternative to antibiotic growth promoter in the feeding of broiler chicken (Issa and Omar, 2012).

In recent years some plant additives such as garlic, ginger, etc, in diets for feeding gave better health, improved growth rate and carcass quality of chicken. The results of the recent study are in agreement with the previous findings by Isstga K, Omar J (2012). who reported garlic powder supplementation in basal diet of broiler chicken significantly increased the body weight gain and feed conversion ratio. Okoleh et al. (2014) also observed that the birds supplemented garlic had better feed conversion ratio (FCR) than those in control group (2.17 vs 2.53). The objective of this study to determine optimum level of ginger supplement in diets on growth performance, digestion, blood chemistry and carcass quality of growing Tau Vang chicken were raised under the conditions of the Mekong delta of Vietnam for the useful recommendations to the producers.

MATERIALS AND METHODS

Location and climate of the study area

Experiment was conducted from August to November in 2020, at a private farm (a householder) in Vinh Long province. The chemical analysis of feeds was done at the laboratory of the Department of Animal sciences. Faculty

of Agriculture of Can Tho University.

Experimental animals

One day old-Tau Vang chicken were bought from a Tau Vang breeding farm in Long An province. Chicks from 2 to 28 days were fed special concentrate pellet (20% CP). Chicks from 25 to 42 days were fed concentrate pellet and supplemented a small amount of experimental diets. The chicken at 43 days of age were introduced to the trial, all birds were vaccinated H5N1. Newcastle and some common diseases before using in the trial.

Experimental design and treatments

Two hundred Tau Vang chicken at 7 weeks of age (425 ± 15.60 g/bird) were allotted in a completely randomized design with 5 treatments and 4 replicates and 10 birds per experimental unit (balanced sex). The treatments were the different ginger supplement levels of 0, 0.1, 0.2, 0.3 and 0.4% to concentrate basal diets, corresponding to the G0 (basal diet). G0.1, G0.2, G0.3 and G0.4 treatments, respectively). The trial lasted 8 weeks with Tau Vang chicken from 7 to 14 weeks of age. Feed ingredients of basal diet was presented in Table 1.

Table 1: Feed ingredient composition of concentrate basal diet in the experiment.

No.	Feed	(%)	No.	Feed	(%)
1	Rice bran	4.8	6	Premix vitamin	0.40
2	Maize	35.1	7	Premix mineral	0.50
3	Fish meal	10.4	8	$CaCO_3$	0.49
4	Broken rice	36.2	9	DCP	0.51
5	Soybean extraction	11.6			

Feeds and preparation of ginger

Ginger was bought at a supermarket. then peeled and cut into 1-2mm pieces and dried for 4-5 days under sunlight. After drying, the ginger was ground to ginger powder by meat grinder. All feed ingredients were bought in one occasion from feed store for throughout the experiment. The basal diet was formulated and contained 12.9 MJ ME/kgDM and 18% CP. Ginger powder was finely mixed with the concentrate following experimental design before feeding. Chemical compositions of ginger, feed ingredients and basal diet were presented in Tables 2 and 3.

Housing and management

House for birds was made by wood and tole. Experimental birds were confined in pens with 2.5 m^2/10 birds, which were surrounded by wood, plastic net and its floor was overlaid with 20 cm of sand and rice straw layer in its surface for bedding. Feeders and drinkers were put in front of each cage. Feeders and drinkers were cleaned daily every morning and chicken litters were removed weekly. The birds were fed 3 times daily at 7.00, 13.00 and 17.00 h and feed offered to the birds was weekly adjusted by an increase from 5 to 10% according to real feed intake. Birds were freely to access water.

Photo 1: Raw ginger

Photo 2: Ginger flour

Table 2: Chemical compositions of ginger per 100g.

Item	(%)
Energy	19 kcal
Carbohydrates	17.77 g
Sugar	1.7 g
CF	2 g
EE	0.75 g
CP	1.82 g
Thiamine (B1)	0.025 mg
Riboflavin (B2)	0.034 mg
Nacin (B3)	0.075 mg
Vitamin C	5 mg
Calcium	16 mg
Fe	0.6 mg

Nguyen Thi Thu Hương and Pham Tan Nha, 2019.

Table 3: Chemical compositions of feed ingredients and basal diet (% DM).

Feed item	Maize	Broken rice	Rice bran	Soybean extraction	Fish meal	Basal diet
DM	88.6	86.7	86.0	89.5	91.9	89.1
OM	98.6	99.5	89.6	94.8	78.1	91.8
CP	8.08	9.29	12.5	43.4	60.4	18.1
EE	4.85	0.82	18.1	1.22	12.7	4.01
CF	2.12	0.59	6.59	5.44	0.19	3.65
NDF	28.5	7.35	32.1	12.3	11.0	17.9
Ash	1.40	0.51	10.4	6.82	21.9	8.24
ME (MJ/kg DM)	13.9	13.5	13.0	10.3	12.6	12.9

DM: dry matter; OM: orgarnic matter; CP: crude protein; EE: ether extraction; CF: crude fibre; NDF: neutral detergent fibre; ME: metablolizable ernergy (Janssen et al., 1989).

Measurements

Daily intakes of feed and nutrients: feed and refusals were collected and weighed daily morning. Daily weight gains and feed conversion ratio: the birds were weighed weekly and at the end of experiment. Carcass values: after finishing

4 birds (2 males and 2 females) per each experimental unit were slaughtered for the evaluation of carcass traits. Body measurements of birds were described by Salomon (1996).

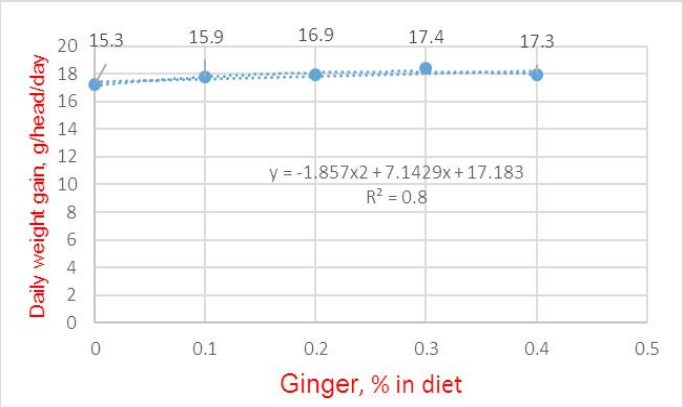

Figure 1: The effect of ginger on daily weight gain.

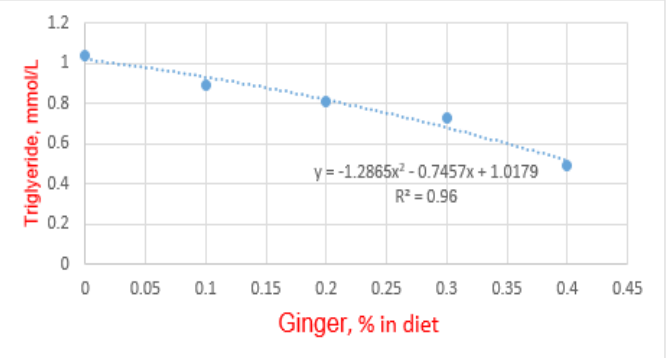

Figure 2: The effect of ginger on quantification of triglyceride.

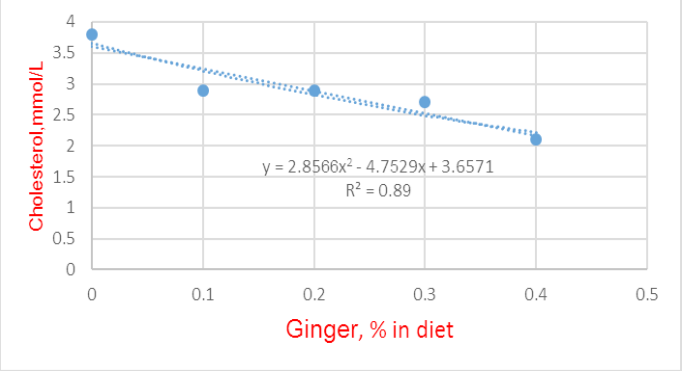

Figure 3: The effect of ginger on quantification of total cholesterol.

Digestive experiment

Accumulated Nitrogen: Content of accumulated nitrogen per 1kg test diets was calculated by using the following formula (Lammers et al., 2008):

$$Nr = (N_d - N_e \times AIA_d/AIA_e) \times 1000/100$$

Where; N_r: Mass of accumulated nitrogen (g / kg); N_d: Content of Nitrogen in a diet (%); N_e: Content of Nitrogen in faeces (%); AIA_d: Content of acid chlorhydric insoluble ash in a diet (%); AIA_e Content of HCl-insoluble minerals in faeces (%).

Determine the ratio of nutrient digestibility in diet

Apparent digestibility EE, dry matter (DM), organic matter (OM) and CF in a diet calculated according to the formula of Huang et al. (2005) as follows:

$$DD = (1 - [(ID \times AF) / (IF \times AD)]) \times 100$$

Among them; DD: Full apparent digestibility tatio of nutrients in diet (%); ID: Ash content (AIA) in diet insoluble in acid (mg / kg); AF: Nutrient content in waste (mg / kg); IF: AIA content insoluble in acid of waste (mg / kg); AD: Nutrient content in diet (mg / kg).

Table 4: Daily intakes of feed and nutrient of Tau Vang chicken (g/bird).

Item	Treatment					SE	P
	G0	G0.1	G.02	G0.3	G0.4		
DM	55.20^{c}	55.22^{c}	55.68^{bc}	57.66^{b}	59.68^{a}	0.55	0.042
OM	51.16^{b}	51.07^{b}	51.5^{b}	52.72^{ab}	55.08^{a}	1.80	0.04
CP	10.4^{b}	10.4^{b}	10.5^{a}	10.7^{a}	11.0^{a}	0.06	0.02
EE	2.47^{b}	2.47^{b}	2.50^{a}	2.52^{a}	2.53^{a}	0.05	0.01
CF	2.20	2.22	2.27	2.30	2.31	0.02	0.07
NDF	10.6^{b}	10.7^{b}	11.0^{a}	11.1^{a}	11.2^{a}	0.08	0.01
Ash	4.04^{b}	4.15^{b}	4.18^{a}	4.94^{a}	4.60^{a}	0.05	0.01
ME (MJ/ kg/ DM)	0.78^{b}	0.79^{b}	0.80^{ab}	0.81^{a}	0.82^{a}	0.01	0.03

$^{a, b, c}$ Mean values with different superscripts within the same row are different at P<0.05

Chemical analyses

Feeds offered were analyzed for chemical compositions: DM, OM, CP, EE, CF, Ash. They were analyzed following procedures of AOAC (1990). NDF analysis was followed the Van Soest et al. (1991) and ME was calculated by Janssen (1989).

Statistical analysis

Data were analyzed by using General Linear Model (GLM) of Minitab progam 16.1.0 (Minitab, 2010) and the comparison of significant difference between two treatments was done by Tukey method of Minitab (2010).

RESULTS AND DISCUSSION

Daily intakes of feed and nutrients of growing Tau Vang chicken

Daily intakes of DM, OM, CP, EE and NDF were significantly lower (P<0.05) for the birds given G0 diet than for other diets with the highest values observed in bird group fed G0.4 diet. The DM and CP intakes in the present trial are higher than those of a previous study on

Tau Vang chicken (45.9-49.4 gDM/day; 9.17-9.59 gCP/day, respectively) reported by Nguyen (2012). The ME intake was significantly higher for the birds in the G0.3 and G0.4 treatments (P<0.05) than for the birds in the G0 treatment, possibly due to higher DM intake.

Effects of dietary different ginger supplement on the growth performance of growing Tau Vang chicken

Table 5 shows that daily weight gain (DWG) was lower for the birds without supplementing ginger (G0 treament) than those fed ginger and the significantly higher result found in the G0.3 and G0.4 treament (P<0.05). The explanation was that the birds in this treatment had higher DM, OM, CP, EE and ME intakes. The results of DM intake and daily weight gain in a current study are in agreement with the findings that supplementing 3% garlic powder (in DM) in diet for kids which improved feed consumption and weight gain (Okali, 2020). The DWGs obtained are closed with the results of 18.5g-19.7 g/bird, but being slightly higher than the values of 15.3 -16.8 g/bird in previous trials on Tau Vang chicken (Huynh, 2017; Nguyen, 2017, respectively). Final live weights were significantly higher for the birds supplemented ginger than that of those in the G0 treatment (P<0.05), resulting from higher daily weight gain. The final live weights in this trial are in a range of 1300- 1417g of a previous experiment on Tau Vang chicken (Nguyen, 2012). Results of CP consumption/weight gain were significantly lower for the birds in the G0.3 treatments (P< 0.05). FCR of Tau Vang chicken was better in the G0.2 and G0.3 treatments (P <0.05), it could be due to higher daily weight gain. The results of FCR are consistent with the values of 3.24-3.53 reported by Pham (2019).

Effects of dietary different black saffron supplement on carcass quality of growing Tau Vang chicken

Slaughter weights of chicken were correspondent to the final live weights. Carcass weight was significantly higher in the G 0.3 and G 0.4 treatments (P<0.05) (Table 6). Percentage of carcass was closed among the treatments (P> 0.05), these results are in a range of 70.5-72.9%, published by Huynh (2017). Breast meat and thigh meat weights were significantly highest in G 0.3 treatments. Percentages of breast meat and thigh meat were resembled among the treatments (P> 0.05). All internal organs were not significantly different among the treatments (P>0.05).

Digestive experiment

The results showed that the apparent digestibility coefficients of nutrients in feeds were considerably valuable. The nutrients in the test feed ingredients were well digested. The DM and OM digestibility coefficient of G0.3 and G0.4 treatments were higest (DM: 87.79% and 87.22%; OM: 92.45% and 92.09%, respectively). The EE digestibility coefficients of G0.2, G0.3 and G0.4 treatments were higest (82.25%, 82.75% and 82.43%, respectively). The CF digestibility coefficient of G0.3 and G0.4 treatments were higher than that of treatments. Also, Accumulated Nitrogen (Nr) of G0.3 and G0.4 treatments were higest (58.65g/kg and 58.55g/kg, respectively).

The triglyceride index is high; it will affect the blood transport process that will cause many negative effects on health.

Fat accumulation in the walls of blood vessels for a long time will cause narrowing of the coronary arteries, causing heart attacks and strokes. If the Triglyceride index is high, often, the patient is at risk of atherosclerosis, high blood pressure, obesity, hyperlipidemia.

The adding ginger into the diet, the Triglyceride index in the blood of local chicken decreases, which is good for the health of chicken. Consumers using low Triglyceride chicken meat will be good for their health as well. Triglyceride index was lowest in treatment G0.4 (0.48 mmol/L).

Quantification of total cholesterol decreare from GO treatment to G0.4 treatments. It was highest at GO treatment (3.80 mmol/L) and It was lowest at GO.4 treatments (2.2 mmol/L). This showed that ginger made quantification of total cholesterol in chicken blood decrease. HDL-C. LDL-C and Quantification of Albumin decreare from GO treatment to G0.4 treatment, it was lowest at G0.4 treatment (15.7 mmol/L. 16.6 mmol/L. 14.1 mmol/L. 14.7 mmol/L and 13.2 g/L, respectively).

Cholesterol is an essential and indispensable factor for the body. However, if the body is provided with too much cholesterol, unused cholesterol can accumulate in blood vessels. For a long time, it will form plaques, narrow and clog blood vessels, cause many cardiovascular disease and stroke risk.

The total cholesterol test index reflects the risk of cardiovascular disease. Therefore, the higher the total cholesterol test result is, the greater the risk of cardiovascular disease. When adding ginger, the total cholesterol in the blood of local chicken decrease, which is good for the health of chicken as well as for human health when using this chicken meat. The lowest total cholesterol in the treatment was G0.4 (2.2 mmol/L).

Table 5: Daily weight gain. final live weight and feed conversion ratio (FCR) of Tau Vang chicken (g/bird).

Item	Treatment					SE	P
	G0	G0.1	G.02	G0.3	G0.4		
Initial live weight	445	450	447	443	445	7.5	0.178
Final live weight	1300^{c}	1340^{bc}	1393^{b}	1417^{a}	1414^{a}	4.15	0.001
Daily weight gain	15.3^{c}	15.9^{bc}	16.9^{b}	17.4^{a}	17.3^{a}	0.29	0.007
FCR	3.62^{a}	3.48^{b}	3.30^{c}	3.31^{c}	3.40^{bc}	0.4	0.005
CP/ weight gain (g/kg)	657.2^{a}	658.3^{a}	634.1^{b}	604.1^{c}	609.4^{c}	7.05	0.005

$^{a, b, c}$ Mean values with different superscripts within the same row are different at P<0.05

Table 6: Caracass values and internal organs of Tau Vang chicken Supplemented ginger in diets (g. bird).

Item	Treatment					SE	P
	G0	G0.1	G.02	G0.3	G0.4		
Slaughter live weight	1300^{b}	1340^{a}	1390^{ab}	1415^{a}	1410^{a}	22.3	0.016
Carcass weight	903^{c}	953^{bc}	997^{b}	1026^{a}	1021^{a}	33.0	0.037
% Carcass	69.5	71.1	71.7	72.5	72.4	1.98	0.745
Breast meat weight	171.6^{c}	183.0^{bc}	199.4^{b}	216.5^{a}	214.4^{a}	9.44	0.004
% Breast meat	19.0	19.2	20.0	21.1	21.0	0.79	0.054
Thigh meat weight	105.7^{c}	112.5^{bc}	119.6^{b}	125.2^{a}	124.6^{a}	3.12	0.041
%Thigh meat	11.7	11.8	12.0	12.2	12.2	0.45	0.743
Heart weight	9.1	10.2	8.60	10.1	9.67	0.87	0.068
Liver weight	22.0	21.3	23.8	22.9	22.5	4.22	0.640
Cecal length. cm	13.1	12.9	13.0	12.5	13.4	1.21	0.795

$^{a, b, c}$ Mean values with different superscripts within the same row are different at P<0.05

Table 7: Percentage of total nutrient digestibility in experiment diet.

Ingredientes (%)	Experiment diet					SEM	P
	G.0	G 0.1	G 0.2	G 0.3	G 0.4		
DMD	85.40^{c}	86.77^{b}	87.65^{a}	87.79^{a}	87.22^{a}	0.15	0.001
OMD	90.93^{c}	91.07^{b}	91.89^{ab}	92.45^{a}	92.09^{a}	0.07	0.003
Nr (g/kg)	55.34^{c}	56.73^{b}	57.54^{ab}	58.65^{a}	58.55^{a}	0.14	0.001
EED	80.29^{c}	81.46^{b}	82.25^{a}	82.75^{a}	82.43^{a}	0.13	0.001
CFD	33.01^{c}	34.70^{bc}	35.90^{ab}	36.54^{a}	36.31^{a}	0.15	0.001

DMD: Dry matter digestibility, OMD: Organic matter digestibility; EED: Ether extract digestibility; CFD: Crude fiber digestibility; Nr: Accumulated Nitrogen.

Table 8: Blood biochemical indicators of Tau Vang chicken supplemented ginger in diets (mmol/L).

Item	Treatment					
	G0	G0.1	G.02	G0.3	**G0.4**	Normal index of human
Quantification of triglycerid	1.04	0.88	0.82	0.71	0.48	0.46 - 1.88
Quantification of total cholesterol	3.80	3.1	3.0	2.8	2.2	3.9 - 5.2
HDL-C (High density lipoprotein Cholesterol)	2.47	2.11	1.61	2.28	1.66	> 0.9
LDL-C (Low density lipoprotein Cholesterol)	1.24	0.80	1.64	1.01	0.79	< 3.4
Quantification of Albumin (g/L)	15.70	16.6	14.1	14.7	13.2	34 - 48

Center Lab Vietnam of Cantho city.

CONCLUSIONS

It was concluded that ginger supplementation in the diet at a level of from 0.3 to 0.4% DM improved growth performance for growing Tau Vang chicken production. It showed that ginger made quantification of triglycerid

and quantification of total cholesterol in chicken blood decrease.

ACKNOWLEDGMENTS

I am grateful to the JAPAN's ODA Project for finance and gave me the opportunity to undertake this experiment.

NOVELTY STATEMENT

Ginger supplementation in the diet at a level of 0.3 to 0.4% DM improved growth performance for growing Tau Vang chicken production. It showed that ginger made quantification of triglycerides and quantification of total cholesterol in the chicken blood decrease.

AUTHOR'S CONTRIBUTION

The author came up with the idea, designed the experiment, conducted the experiment and wrote the article.

Conflict of interest

The authors have declared no conflict of interest.

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