

## No Damage of Dietary Dried Fermented Ginger Diet without Antibiotics on Growth Performance in Broilers Reared in Tropical Area

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**Abstract: Problem statement:** The experiment was carried out to determine whether the dietary Dried Fermented Ginger (DFG) has no affecting damage on broiler growth performance and can also be applicable in tropical and subtropical area using basal diets without antibiotics. **Approach:** Three hundred and fifty 7-d-old Arbor Acres broiler chicks were divided into one basal diet group (control) and 6 experimental groups. The basal diets were adequately formulated, but not added with antibiotics. Among the 6 DFG groups, 3 groups were fed each basal diet supplemented with DFG at 0.25 (0.25 S), 0.5 (0.5 S) and 1% (1 S) levels from 7-42 days of age (starter groups). The remaining 3 DFG groups were fed the starter basal diet until 21 days of age. At 22 days of age, they were switched to finisher diet supplemented with DFG at 0.25 (0.25 F), 0.5 (0.5 F) and 1% (1 F), from 22-42 days of age (finisher groups). **Results:** Feed intake, body weight gain and feed efficiency were not significantly different among the groups ( $p > 0.05$ ). However, when the body weight gain of the control was expressed as an index of 100, the body weight gain index of the DFG groups was better than the control except the 0.25 S groups. Compared to the body weight gain index of the starter groups, they showed the better index. The values of feed efficiency were also better in all the experimental groups than in the control. **Conclusion:** The present results suggest that DFG can apply to tropical and subtropical area as a natural supplementation without antibiotics and it is better to supplement to basal diet during finisher stage (from 22 days old).

**Key words:** Dried fermented ginger, growth performance, finisher groups, feed efficiency, weight gain, starter basal, determine whether, adequately formulated, without antibiotics, poultry production, promoting qualities, natural supplementation

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### INTRODUCTION

Chemical disinfectants are used to prevent pathogens and disease, thereby improving the production of animals for meat. However, dietary antibiotics have elevated the feed cost in poultry production and continued use of dietary antibiotics has induced the development of drug residues in the animal body (Butaye *et al.*, 2001), imbalance in normal microflora (Andremont, 2000) and drug-resistant pathogens (Castanon, 2007). Furthermore, the use of such chemicals contaminates the environment. As a result, alternatives are being developed to enhance physiological functions and to reduce environmental pollution through the use of natural ingredients. Ginger rhizome (*Zingiber*

*officinale* Roscoe, Zingiberaceae) is widely used in food condiments and medical herb around the world. Their compound has properties that improve the functioning of the immune system, anti-tumorigenic, anti-inflammatory, anti-apoptosis, anti-hyperglycemia, anti-lipidemic (Ali *et al.*, 2008) and antifungal activities (Atai *et al.*, 2009). Recently, instead of antibiotics, we reported that DFG possesses growth-promoting qualities in broiler chicken (Incharoen *et al.*, 2010) and egg-production-promoting qualities in layer chickens (Incharoen and Yamauchi, 2009). However, these results were basic data obtained in temperate region of Japan using small number of chickens.

In tropical and subtropical areas, stress caused by high environmental temperatures is widely recognized

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as one of the primary problems in poultry production (Maak *et al.*, 2003; Aberra *et al.*, 2005). Feed intake and feed efficiency of animal was decreased in high temperature and in violent case heat stress caused death (Darcana *et al.*, 2007). As the ginger has strong flavor and is known to have pyrogenicity (Eldershaw *et al.*, 1992; Fujisawa *et al.*, 2005), it have to examine whether this pyrogenicity of ginger in DFG inhibit the growth performance of the broilers when they were reared in tropical and subtropical areas. Therefore, for the next step it was important to determine whether the DFG has no damaging effects on broiler growth performance and can also be applicable in tropical and subtropical area using basal diets without antibiotics.

This study was designed to demonstrate the effects of dietary DFG on the growth performance of 350 broiler chickens raised in a tropical area and fed DFG from the starter stage or the finisher stage using diets without antibiotics.

#### MATERIALS AND METHODS

Three hundred and fifty one-day-old Arbor Acres strain broiler chicks of both sexes were provisioned from a commercial hatchery. At 7 days of age, chicks of similar weights were divided into 7 treatments with 5 replicates of 10 birds. The basal mash diets for the starter (7-21 days of age) and finisher (22-42 days of age) phases were adequately formulated (NRC, 1994) (Table 1), but not treated with antibiotics. Each basal diet was supplemented with DFG (Table 2) at 0 (control group), 0.25, 0.5 and 1% levels.

Among the 6 DFG groups, 3 groups started the feeding experiment at levels of 0.25 (0.25 S group), 0.5 (0.5 S group) and 1% (1 S group) at 7 days of age until

42 days of age (starter groups). The remaining 3 groups were fed the starter basal diet until 21 days of age; from 22 days of age, they were switched to the finisher diet, supplemented with DFG at 0.25 (0.25 F group), 0.5 (0.5 F group) and 1% (1 F group) from 22-42 days of age (finisher groups). Feed and water were provided *ad libitum*, as was 24 h light. Body weight and feed intake were measured weekly. At 14 and 28 days of age, all chicks were vaccinated against Infectious Bronchitis (IB) and Newcastle Disease (ND).

Statistical analysis: All data were analyzed using analysis of variance in Completely Randomized Design (CRD). Duncan's Multiple Range Test (DMRT) was used to compare sets of means by using the Statistical Package for the Social Sciences (SPSS) Version 13.

#### RESULTS

The feed intake, body weight gain and feed efficiency of the chickens in the starter groups and finisher groups were not significantly different among the groups ( $p > 0.05$ ) (Table 3). However, when the body weight gain of the control was expressed as an index of 100, the body weight gain index of the DFG groups were better than the control except the 0.25 S group. Compared to the body weight gain index of the starter groups (98.24 in the 0.25 S group, 101.81 in the 0.5 S group and 100.85 in 1 S group) the finisher groups showed better indices: 102.77 in the 0.25 F group, 104.48 in the 0.5 F group and 103.79 in the 1 F group.

The values for feed efficiency were also better in all the experimental groups than in the control.

Table 1: Composition of the experimental diets

Ingredient	Level of ginger (%)							
	7-21 days old				22-42 days old			
	0	0.25	0.5	1	0	0.25	0.5	1
Ground corn	51.300	51.700	51.450	50.900	59.290	58.840	58.680	58.080
Soybean meal (46% CP)	33.000	32.000	32.000	32.000	27.500	27.750	27.650	27.700
Fish meal (61% CP)	6.100	6.800	6.800	6.800	6.100	6.000	6.000	6.000
Rice bran oi	16.400	6.200	6.200	6.200	54.700	4.750	4.750	4.800
Dicalcium phosphate	0.850	0.700	0.700	0.700	0.300	0.300	0.300	0.300
Limestone	1.100	1.100	1.100	1.100	1.250	1.250	1.250	1.250
DL-Methionine	0.150	0.150	0.150	0.150	0.015	0.015	0.015	0.015
Salts	0.350	0.350	0.350	0.350	0.350	0.350	0.350	0.350
Premix	0.750	0.750	0.750	0.750	0.500	0.500	0.500	0.500
Calculated analysis								
ME (kcal kg <sup>-1</sup> )	3205.000	3205.000	3205.000	3202.000	3205.000	3202.000	3202.000	3200.000
Crude protein (%)	23.000	23.000	23.000	23.000	20.000	20.000	20.000	20.000
Methionine (%)	0.540	0.540	0.540	0.540	0.390	0.380	0.380	0.380
Lysine (%)	1.310	1.310	1.310	1.310	1.180	1.180	1.180	1.180
Ca (%)	1.030	1.000	1.000	1.000	0.900	0.910	0.910	0.910
Available Phosphorus (%)	0.450	0.450	0.450	0.450	0.350	0.350	0.350	0.350

Table 2: Chemical composition of fermented ginger by-product

Chemical composition	(%)
Gross energy (kcal kg <sup>-1</sup> )	3905.00
Dry matter	87.44
Crude protein	7.29
Crude fat 6	51.00
Crude fiber	22.10
Crude ash	13.40
Calcium	0.46
Phosphorus	0.84

Table 3: Feed intake, body weight gain, ratio for 100 of control and feed efficiency of broilers in the control (Control) and in the 0.25 (0.25 S), 0.5 (0.5 S) and 1% (1 S) dietary Dried Fermented Ginger (DFG) from 7-42 days of age as well as in the 0.25 (0.25 F), 0.5 (0.5 F) and 1% (1 F) dietary DFG from 21 to 42 days of age (Mean ± SEM, n = 5)

Item	Groups						
	Control	0.25S	0.5S	1 S	0.25F	0.5F	1 F
Feed intake (g)	3800±36.74	3703.25±184.31	3671.75±139.17	3739.25±72.57	3717±67.87	3902.25±33.86	3912.5±77.69
Bodyweightgain(g)	1874.25±40.28	1841.25±14.27	1908.25±54.89	1889.75±33.39	1926.25±43.46	1958±44.73	1945±49.06
Ratiofor 100 index of control	100	98.24	101.81	100.85	102.77	104.48	103.79
Feed efficiency	0.49±0.01	0.50±0.02	0.52±0.03	0.51±0.01	0.52±0.01	0.50±0.01	0.50±0.01

S = Starter groups in which DFG was supplemented from 7-42 days of age. F = Finisher groups in which DFG was supplemented from 22-42 days of age

## DISCUSSION

For poultry farmers, it is very important to produce chicken meat cheaply without using chemicals. In the previous study, we obtained significantly increased body weight gain and feed efficiency in the 1% DFG group (Incharoen *et al.*, 2010). However, in the present study, we failed to obtain a significant increase in body weight gain in the dietary DFG groups. There seems to be a correlation between this result and the high environmental temperatures and humidity in Thailand. The body temperature of adult chickens is normally in the range of 40-41°C and increased significantly when environmental temperatures increased (Donkoh, 1989). To optimize body weight gain and feed utilization for broilers, the environmental temperature should be near 21°C (Cooper and Washburn, 1998). In fact, it was found that there was a significant correlation with growth rate and the diurnal fluctuation in cloacal temperature (Cooper and Washburn, 1998) and that the growth rate and feed consumption of birds raised in higher environmental temperatures were depressed (Dei and Bumbie, 2011). Additionally, the present ginger (*Zingiber officinale* Roscoe) is known for its strong flavor and to have pyrogenicity (Eldershaw *et al.*, 1992; Fujisawa *et al.*, 2005). These might provide reasons why the present DFG groups did not show a dramatic body weight gain seen in warm area (Incharoen *et al.*, 2010). However, the body weight gain of DFG groups did not decrease significantly than the control. This suggests

that pyrogenicity of ginger in DFG had not a harmful influence on the body weight gain of birds raised in tropical and subtropical area. Rather, the body weight gain of DFG groups was better than that of the control, with the exception of the 0.25 S groups. Feed efficiency was also better in all the DFG groups than in the control; even the feed efficiency of the 0.25 S groups was better than the control. As DFG is a mixture of a fermented product of ginger and Japanese mugwort (*Artemisia princeps* Pamp.) silage juice, a little better growth performance of DFG groups than the control might be induced by that ginger stimulated gastric emptying (Hu *et al.*, 2011) and by that Japanese mugwort has qualities that improve the functioning of the immune system, the gastrointestinal tract and the liver (Swanston-Flatt *et al.*, 1989; Umamo *et al.*, 2000). Besides, as the Japanese mugwort included natural microorganisms, such as lactic acid bacteria, yeast, photosynthetic bacteria, hyperthermal bacteria, *Actinomycetes*, *Aspergillus* and *Bacillus subtilis* (Incharoen *et al.*, 2010), these probiotic also stimulate the intestinal function.

Compared to the starter groups, the body weight gain of the finisher groups showed a better value; this can ultimately contribute to reduced feed costs. For example, body weight gain of 0.5F group is 4% higher than the control. Current price of broiler in Japan is about 3 dollar per kg. Therefore, one bird of 0.5F group is 0.25 dollar higher than the control; 250,000 dollar will be made a profit in farmer rearing million broilers. Besides, the expensive cost of antibiotics can save it, too.

## CONCLUSION

DFG can apply to tropical and subtropical area as a natural supplementation without antibiotics and it is better to supplement to basal diet at 0.5% during finisher stage (from 22 days old), resulting in reduced feed cost.

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