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Original Article

Ginger (*Zingiber Officinale*) Root Powder as Natural Feed Additive for Broiler Chicks

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ABSTRACT

The study targeted effect of addition of ginger root powder as natural feed additive on growth performance and blood constituents of broiler chicks. One hundred and sixty unsexed one day-old broiler chicks strain (Ross) were divided randomly into four groups. Each represented a treatment (40 birds/treatment) with 4 replicates in a completely randomized design. In addition to the control diet (0.0% ginger root powder), three diets were formulated to meet the nutritional requirements of broiler chicks according to NRC (1994), with graded levels of ginger root powder 0.5%, 0.75% and 1%. Weekly average feed intake, body weight gain and feed conversion ratio were recorded blood samples were taken to determine the content of glucose, cholesterol and triglyceride. The results showed no significant differences (P>0.05) in the final body weight (1103.3g, 1140.2g, 1141.2g and 1146.9g) between the four treatments. Also, there were no significant differences in total feed intake (2266.1g, 2432.6g, 2396.3g and 2443.6g), total body weight gain (1064.3g, 1101.2g, 1102.2g and 1107.8g), and feed conversion ratio among all dietary treatments. Moreover, no significant differences were obtained in serum glucose, cholesterol and triglyceride among the four treatments. Mortality rate was 2.5%, 3.75%, 3.12%, and 0.62% for the four treatments (0.0% 0.5%, 0.75% and 1%.ginger) respectively. Chicks tolerated up to 1% ginger without adverse effect on growth performance and blood parameters.

Key words: broilers, ginger, glucose, cholesterol, triglyceride, performance.

INTRODUCTION

Food is a major component, affecting net return from the poultry business, because 80% of the total expenditure is in term of cash spent on feed purchase (Asghar *et al*., 2000; Farooq *et al*., 2001). To ensure more net return and to minimize `high expenditure on feed are the main challenges, for which many research strategies have been practiced such as introducing feed supplements and feed additives (Perves, 1992). However the current research is looking for natural alternative to antibiotics because of their residue and subsequent resistance to bacteria

(Lee *et al*., 2004).Growth promoters as feed additives are primarily included to improve the efficiency of the bird's growth and/or laying capacity, prevent disease and improve feed utilization. Among all growth promoters, the most commonly used are antibiotics, although nowadays their use is decreasing towards total extinction (Biovet, 2005). Some growth promoters act as pro-nutrients because of the role they play in enhancing the physiology and microbiology of the animal. Many active ingredients from plant are considered as pro-nutrients and recently been tried in animal feeds (Biovet, 2005).Pro-nutrients are also sometimes referred to as phytogenic feed additives. Phytogenic feed additives are plant-derived products used in animal feeding to improve their performance. This class of feed additives has recently gained increasing interest, especially for use in swine and poultry. This appears to be strongly driven by a complete ban on most of the antibiotic feed additives within the European Union in 2006 (Windisch *et al*., 2008).Many types of feed additives are being used in broiler Rations to improve its performance. Spices are very common to be useful as additives in broilers diets (Zhang *et al*., 2009).Plant active principles are chemical Compounds present in the entire plant or in specific parts of the plant that confers their therapeutic activity or Beneficial effects (Martins *et al*., 2001). The supplementation of spices and herbs could have many benefits to broilers health and performance such as having ant oxidative potential (Hui, 1996), antimicrobial activity (Dorman and Deans, 2000), enhancing digestion by stimulating endogenous enzymes (Brugalli, 2003).Ginger (*Zingiber Officinale*) is widely used in many countries as a food condiment and as a medicinal herb (Chrubasik *et al*., 2005). The main important compounds in Ginger are gingerol, gingerdiol and gingerdionewhich have the ability to stimulate digestive enzymes, affect the microbial activityand having antioxidative activity (Dieumou *et al*., 2009). When used in broiler diets, *Zingiber Officinale* Supplementation improved antioxidant and broiler Chickens blood serum (Zhang *et al*., 2009). The objective of this study is to determine the effect of ginger roots powder supplementation as a natural feed additive with various levels on growth performance of broiler chicks and some blood constituents, and to confirm of the previous studies.

Statement of the Problem

The fast growing nature of broilers and their short generation intervals has been associated over the years with the use of antibiotic growth promoters as sub-therapeutic doses in the feeds in order to improve the quality of the product but these were associated with residues in the meat by consumers and have been banned or limited in many countries, as a result, natural alternatives to antibiotics such as herbs and medicinal plants have attracted attention due to their wide range of potential beneficial effects. The essential compounds of ginger evaluated as natural alternatives to feed antibiotics in broiler diets.

MATERIALS AND METHODS

Experimental Diets

The diets were formulated to evaluate the nutritive value of ginger root powder for broiler chicks performance, Three kilo of ginger root were purchased from local market and ground well. In addition to the control diet (0%) ginger root powder, three diets were formulated to contain 0.5%, 0.75% and 1% ginger root powder per 100 kg diet, respectively. The ingredient composition and calculated analysis of the experimental diets are shown in Table 1 and Table2 respectively.

Experimental Birds

A total of one hundred and sixty one-day old unsexed commercial broiler chicks (ROSS) were obtained. The chicks were weighed and then randomly divided into four groups; each group contains 40 birds with four sub-groups as replicates with 10 birds per pen.

Adaptation Period

The first week of experiment was used as adaptation period, all chicks were fed the control diet and the same procedures of management were applied for all groups.

Table 1. The composition of experimental rations

Feed Ingredients	Treatments Ginger levels			
Ginger root powder	0.0	0.5	0.75	1
Feterita grain	65.47	65.97	65.72	65.47
Ground nut Cake	23	22	22	22
Sesame cake	5	5	5	5
Super concentrate *	5	5	5	5
Di Calcium	0.755	0.755	0.755	0.755
Limestone	0.172	0.172	0.172	0.172
Premix	0.1	0.1	0.1	0.1
Lysine	0.1	0.1	0.1	0.1
Methionine	0.05	0.05	0.05	0.05
Antitoxin	0.1	0.1	0.1	0.1
Salt	0.25	0.25	0.25	0.25

*super concentrate (per kg): Na 2.4%, Methionin 3.70%, Lysin 12%, Available Phosphorus 5%, Ca 6.50%, CP 35%, CF 3%, EE 2.50%, ME/Kcal/Kg 2050

Table2. Calculated analysis of the experimental rations

Items	Ginger levels			
	0%	0.5%	0.75%	1%
ME (kcal/kg)	3197	3196	3195	3195
Crude protein%	22.83	22.53	22.52	22.53
Crude fiber%	4.35	4.32	4.35	4.37
Calcium%	1	0.99	0.99	0.99
A Phosphorus%*	0.59	0.59	0.59	0.59
Methionine%	0.05	0.05	0.05	0.05
Lysine%	0.1	0.1	0.1	0.1

* A: available phosphorus

Management Procedures

All procedures of management were applied for all groups during the experimental period. The chicks were allocated randomly as (10 chicks /pen) with 4 treatments. The birds were brooded for the first three weeks of age. Sugar and multivitamin were administrated in drinking water at the first week of experiment to avoid the expected stress, the multivitamin repeated after each vaccination process. The birds were vaccinated against Newcastle disease (ND) and infectious bronchitis (IB) at 7 days of age and at the second week of age the birds were vaccinated against gumboro and repeated at fourth week of age.Newcastle disease vaccine (*Lasota strain*) was administered at the third week of age. Anticoccidia treatment also given in water at fifth week of age. Renewal Water and clean feed were provided *ad libitum* during the experimental period.

Data Collection

Weekly average feed intake, body weight gain and feed conversion ratio was recorded. At the end of the sixth week of experiment, (the duration period of the experiment) 2 birds from each pen were selected randomly and slaughtered, blood samples were taken from jugular vein during slaughtering and collected into tubes and allowed to clot and sera separated by centrifugation at 3000 rpm for 5 minutes for analysis to determine the content of glucose, cholesterol and triglyceride. Birds were scalded in boiling water, handpicked then all the internal organs were removed out.

Chemical Analysis

Sample of ginger powder taken for approximate analysis on dry matter basis for chemical components Table 3. (Dry matter, crude protein, crude fiber, ether extract, ME, nitrogen free extract, and Ash) were determined according to AOAC (1980). Plasma glucose and cholesterol were determined by enzymatic calorimetric methods using Kit GOD-PAP (Randox Labratoty Ltd. London). Plasma triglyceride was determined by the methods described by Buccolo *et al*., (1973).

Table 3: Proximate analysis of ginger root powder (%)

DM	CP	CF	EE	ASH	NFE	ME/MJ/kg*
89.32	13.84	12.12	2.28	7.68	53.40	11.07

* Metabolizable energy was calculated according to the formula derived by Lodhi *et al*., (1976).
ME = 1.549 + 0.0102 CP+ 0.0275 EE + 0.0148 NFE – 0.0034 CF

Experimental Design and Statistical Analysis

The experiment was conducted by using complete randomized design (CRD). All the data of this experiment were collected and subjected to analysis of variance (ANOVA) by using SPSS program (statistical packages for social science). The differences between treatments were tested by the method of Duncan's Multiple Range Test (DMRT) at ($P < 0.05$) level of significance.

RESULTS AND DISCUSSION

Feed Intake

The effect of feeding graded levels of ginger root powder (*Zingiber Officinale*) on weekly feed intake is presented in Table 4. The results showed that the dietary treatment had no significant difference (P>0.05) on feed intake. The highest feed intake was obtained by the birds fed 1% ginger root powder during second, third, fourth and fifth weeks compared with other levels of ginger (0%, 5% and 75%). Also the results in Table8.Showed that there was an increase in total feed intake in level 1%but with no significant difference (P>0.05) between all levels during the experiment duration this result was comparable with the findings of Doley *et al*., (2009) who revealed that no differences in feed intake for broilers fed with ginger extract for 6 weeks period.

Table 4. Feed intake of broiler chicks (g/bird/week) as affected by addition of ginger root powder

Items	Ginger levels				
	0%	0.5	0.75%	1%	Sig
1st week	103.5±3.1	102.4±1.9	103.9±2.4	102.5±2.9	Ns
2nd week	231.2±5.9	240.3±9.7	231.9±14.3	247.4±8.3	Ns
3rd week	291.4±16.2	300.6±12.7	298.6±23.9	303.1±15.5	Ns
4th week	414.4±14.9	422.3±12.1	422±29.4	437.9±29.6	Ns
5th week	619.4±5	698.5±30.4	695.6±59.6	699.7±29.8	Ns
6th week	606.6±11.9	669.1±33.3	644.2±44.1	652.9±36.5	Ns

Values are means ± standard error of the mean for (4) replicates of (10) birds/pen.
NS = no significant difference (P>0.05).

The increment in feed consumption which was illustrated in this study may be due to pungent test or aroma and flavor of ginger. also compared with the work of Ademola *et al*., (2009) who reported higher feed intake of broilers on diet supplemented with ginger and agrees with Kulka (1967) the effect of pungent test in feed intake cause by number of components predominated by gingerols followed by shogaols and zinger one. And also agree with Purseglove *et al*., (1981).Aroma and flavor of ginger caused by more than 70 constituents present in steam volatile oil obtained from dry ginger. However not in agreement with the report of Herawati (2010) who stated that broilers fed 2% dried supplementary red

ginger meal had significantly lower feed intake than those on the control diet. The insignificant effect of addition of ginger root powder to the basal diet may be due to the fact that the sun drying employed in the processing of the experimental ginger. Eze and Agbo (2011) reported that ginger is best preserved in its natural form under open-air sun drying conditions. However Ebewele and Jimoh (1981) reported that sun drying of ginger results in loss of some volatile oils by evaporation and destruction of some heat sensitive properties. The declining of feed intake in the 6th week may be due to stress of raining autumn season.

Body weight

Results of body weight gain are given in Table5.The data showing significant difference (P<0.05) in weekly body weight gain during the 5th week, the highest body weight gain was obtained in the 5th week by the birds fed 1% ginger root powder. In spite of the results of total body weight gain in Table 8. Showed that there was no significant difference (P>0.05) between all treatments during the experiment duration, but also the highest total body weight gain was obtained by the birds fed1% ginger root powder. The increased feed intake resulted in corresponding increase in weight gain.

Table 5. Body weight gain of broiler chicks (g/bird/week) as affected by addition of ginger root powder

Items	Ginger levels				
	0%	0.5	0.75%	1%	Sig
1st week	59.1±1.8	72±5.3	65.7±2.1	71.9±4.9	NS
2nd week	117.4±10.8	111.9±5.2	104±11.8	102.9±16.9	Ns
3rd week	159.6±6.5	161.6±8.1	166.9±15.2	166.9±10.4	Ns
4th week	212.5±10.6	222.6±8.9	228.6±15.8	236.6±16.6	Ns
5th week	$251.4±11.6^{d}$	$229.9±23.4^{cd}$	$288.2±34.4^{bc}$	$313.4±9.4^{a}$	*
6th week	264.4±43.7	293.7±28.3	248.8±43.9	216.3±35.9	Ns

Values are means ± standard error of the mean for (4) replicates of (10) birds/pen.
NS = no significant difference (P >0.05).
* Significant different (P < 0.05).

Feed conversion ratio

There were no significant differences (P>0.05) in weekly feed conversion ratio between treatments as appear in table 6.The present results agree with findings of Wafaa *et al*., (2012) who reported that no difference among birds fed on 0.5%, 1% and 1.5% ginger root powder in feed conversion ratio. On other hand Herawati (2006); Tollba (2003); Herawati (2010); Moorthy *et al*., (2009) and Onimisi *et al*., (2005) they illustrated that birds fed with diets containing ginger up to 2% recorded better feed conversion ratio than unsupplemented one.

Table 6. Effect of dietary ground ginger root on Feed conversion ratio of broiler chicks

Items	Ginger levels				
	0%	0.5	0.75%	1%	Sig
1st week	1.7±0.06	1.4±0.09	1.5±0.03	1.4±0.07	Ns
2nd week	2.2±0.12	2.1±0.04	2.2±0.15	2.6±0.4	Ns
3rd week	1.8±0.03	1.8±0.02	1.7±0.02	1.8±0.02	Ns
4th week	1.9±0.09	1.9±0.03	1.8±0.05	1.8±0.04	Ns
5th week	2.5±0.1	3.1±0.5	2.4±0.2	2.2±0.1	Ns
6th week	2.6±0.6	2.3±0.1	2.9±0.6	3.3±0.7	Ns

Values are means ±standard error of the mean for (4) replicates of (10) birds/pen.
Means with different superscripts along rows were not significantly different (P>0.05).

Overall performance

Overall performance results of broiler chicks fed various levels of ginger from 0 to 6 weeks of age are shown in Table 7. The results showed that there were no significant differences (P>0.05) across all the treatment means for all the parameters analyzed. These results could be compared with the findings of Dieumou *et al*., (2009) who fed ginger essential oils to broilers and found that there were no significant differences (P>0.05) among the ginger oil diets and the control in terms of feed intake, final weight, weight gain and feed

conversion ratio among treatments. Herawati (2010) reported that Hubbard strain broilers fed 2% supplemental red ginger in the diet had significantly higher final body weight than those on the control diet. The non significant difference obtained in this study could be as a result of the differences in quantity and or cultivar of the ginger used, strain of broiler used or environment in which the research was conducted.

Table 7. Effect of dietary ginger root powder on overall Performance of broiler chicks (g/bird/)

Parameters	Ginger levels				
	0%	0.5%	0.75%	1%	Sig
Final body weight (g)	1103.35±47.82	1140.22±15.73	1141.25±74.29	1146.97±37.88	Ns
Body weight gain (g)	1064.35± 47.82	1101.22±15.67	1102.25±74.29	1107.85±37.86	Ns
Total feed intake (g)	2266.1± 46.47	2432.67±53.20	2396.3±151.48	2443.65±97.75	Ns
FCR*	2.5±0.1	2.2±0.3	2.2±.03	2.2±.03	Ns

NS: no significant difference. (P>0.05).
*FCR: feed conversion ratio.

Blood chemistry

Serum constituent's results are shown in Table 8. The results show that there were no significant deference (P>0.05), in Serum glucose, cholesterol and triglyceride between all treatments during the experiment time. this result disagree with the findings reported by Wafaa *et al*., (2012) who pointed that feeding chicks ginger root powder at levels 0.5% and 1% decreased serum cholesterol levels.

Table 8. Effect of dietary ginger root powder on serum constituents of the broiler chicks

Parameters	Ginger levels				
	0%	0.5%	0.75%	1%	Sig
Glucose (mg/dl)	181.03±13.6	195.41±12.34	180.74±20.9	194.31±15.42	Ns
Cholesterol (mg/dl)	99.58±9.21	82.50±6.26	99.58±11.55	90.66±7.49	Ns
Triglyceride (mg/dl)	56.81±6.44	49.74±6.47	61.35±10.18	56.56±10.28	Ns

Data are means for 4 replicates of 2 chicks per pen.
NS: no significant difference. (P>0.05).

CONCLUSION

This study indicated that Supplementation of ground ginger root powder at the different levels of 0.5%, 0.75% and 1% in the broiler chick's diet had no significant effect on the parameters analyzed. Chick tolerate up to 1% ginger without adverse effect on performance.

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