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Effects of Dietary Ground Ginger (Zingiber Officinale) Root Additive on Broiler performance

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ABSTRACT

This study was conducted to evaluate the effect of ground ginger root (*Zingiber officinale*) addition to the diet of broiler chicks. One hundred and sixty one day old boiler unsexed chicks (cobb strain) were till 42 days of age. Four experimental diets containing 0.25, 0.50, and 0.75% ground ginger root were used. Results showed that dietary ginger incorporation had no significant ($p< 0.05$) effects on feed intake in the first four weeks. *Feed consumption* recorded the lowest estimate by broilers fed 0.50% ginger (841.0 g and 777.0g in the 5th and 6th weeks respectively) where as chicks fed 0.0, 0.25 and 0.755 ginger diets were not significantly($p< 0.05$) different from each other. Weight gain was affect by ginger levels in three weeks. The trait estimated the highest result at level 0.00 in week two, at level 0.75, 0.25 and 0.00 in week four and at level 0.25% in week six. Significantly high results for feed conversion ratio were recorded at level 0.25 0.50, 0.75% in the second week and at level 0.00, 0.50, and 0.75% in the last week. Carcass weight and liver weight were affected by addition of ginger. The traits recorded best results at 0.00, 0.25, and 0.75% ginger level. Broiler chick can tolerate up to 0.75% ground ginger root in the diet without adverse effect.

Key words: carcass, feed, liver, weight gain

INTRODUCTION

There are numerous feed additives of plant origin that are used in broiler feeds as to improve the performance by enhancing growth rate, better feed conversion efficiency and lower morbidity and mortality (Mohamed *et al.*, 2012, Zomrawi *et al.*, 2013a).

Recently the use of antibiotics as feed additives is contraindicated due to health concern about their residues in animal tissues and the production of drug resistant bacteria (Zomrawi *et al.*, 2013a). Many researches were conducted to document the benefits of plant feed additives (Kumar, 1991, Babu *et al.*, 1992, Mishra and Singh 2000, Deepak *et al.*, 2002, Jahan *et al.*, 2008) and to evaluate the benefits of using natural phytobiotics as feed additives in poultry diets. Windisch *et al.* (2008) have reported that these natural feed additives have similar effects to antibiotics in improving poultry performance. Ginger is a medicinal herb that have been reported to possess body fat lowering effects (Agarwal 1996, Sharma *et al.*, 1996) it is used for cocking purposes (Zomrawi *et al.*, 2013a) or for its medical effects as it possesses antioxidants, antibacterial, anti-inflammatory, antiseptic, anti-parasitic and immunomodulatory properties (Akhtar *et al.*, 1984, Ali *et al.*, 2008). Incharoen and Yamauchi (2009) reported that ginger stimulate gastric secretion, blood circulation and act as enterokinetic. The objectives of this study were to evaluate the possible improvement in overall performance, reduction in the final cost of feed and to find safe, cheep and efficient natural growth promoter for broiler chicks.

MATERIALS AND METHODS

The experiment was carried out in the premises of Faculty of Animal Production, University of Khartoum, during the period from 21 January to 3 March.

Experimental Diets

Two kilo and half of ginger were purchased from local market beside the other ingredients (sorghum, sesame meal, ground nut meals, dicalcium, salt and super concentrate with multivitamins).Proximate chemical analyses of these ingredients were adopted from Ellis (1981). All nutrient requirements of broiler rations were formulated according to NRC (1984). Chemical composition (%) of experimental diets shown in Table (1 , 2, 3), calculated chemical analysis of experimental diets on dry basis in Table (2) and Table (3) shown a proximate analysis of ginger powder. Ginger was added in four experimental diets (0%, 0.25%, 0.5%, and 0.75 %).

Table (1): Chemical composition (%) of experimental diets (As fed)

Ingredient (Kg)	Ground ginger root level %			
	0	0.25	0.5	0.75
Sorghum	62.15	61	62.4	62.54
Ground nut Meal	15	15	15	15
Seasem Meal	15	15	14.25	14
Wheat Bran	0.7	1	0.7	0.7
Super concentrate*	5	5	5	5
Phosphate dicalcium	1	1	1	1.01
Slate	0.2	0.2	0.2	0.2
L-Lysine	0.13	0.2	0.13	0.14
DL- Methionine	0.1	0.1	0.1	0.1
Vegetable oil	0.47	1	0.47	0.31
Premix	0.25	0.25	0.25	0.25
Total	100	100	100	100

*Super-concentrate in%: Crude protein min40.crude fat min 3.9,crude fiber max 1.44,Lysin 10-12,mthionine min 3,mth+cystin min 3.3 ,calcium min10,availablephosphorus min 6.4,energy 1950 kcal/kg, crude mineral 39.30,sodium min 2.77,linoleic acid 0.24,Nacl (salt)6,6-phytase e.c.3.1.3.26.e4a1640 added, mold inhibitor added, vitamin A IU/kg200000,vitamin D_3IU/kg70000,vitamin E mg/kg400,vitamin k_3 mg/kg30,vitamin B_1 mg/kg50,vitaminB_2mg/kg120,vitamin B_6mg/kg50,vitamin B_{12} mg/kg180, D Pantothenic acid mg/kg155,Niacine mg/kg440,Folic acid mg/kg8,Choline Chloride mg/kg5800.Manganese mg/kg1600,Zinc mg/kg1600,Iron mg/kg580,Copper mg/kg450,Iodine mg/kg55,Selenium mg/kg8,Cobalt g/kg9,Molybden mg/kg20

Table 2.Calculated chemical analysis of experimental diet on dry basis

Content	0%	0.25%	0.5%	0.75%
EE%	4.8	4.8	4.7	4.77
CP%	23.1	23.08	22.9	22.86
CF%	4.4	4.53	4.43	4.4
Ash%	5.7	5.82	5.73	5.72
ME(Mj/kg)	2.73	2.75	2.77	2.67

Table 3. Proximate analysis (%) of ginger powder

DM%	EE%	CP%	CF%	ASH%	NFE%	ME/MJ/kg
89.34	2.56	15.5	13.57	8.6	59.78	2.61

DM= dry matter, EE=ether extract, CP= crude protein, NFE= nitrogen free extract, ME= metabolizeable energy
ME was calculated according to Lodhi *et al*. 1970.
ME (P) =1.549+0.0102CP+0.0275oil+0.0148NFE-0.0034CF.

Experimental Birds

One hundred and sixty one-day old Cobb unsexed commercial broiler were bought from commercial company for poultry production and transferred to the poultry production unit at faculty of animal production.

All chicks were assigned to the control diet for the first three days as adaptation period, chicks of approximately equal live weight were randomly allotted into four groups, Each groups contains 40 birds were distributed into four sub-groups as replicate with 10 birds per pen, in a completely randomized design.

Experimental site

The experiment was carried out in an open mesh sided, deep litter poultry house,, the Eastern and Western sides were covered with Jute sacks to prevent conventional heat effects and to control the direct sun rays, the house was subdivided into 16 rooms (m^2) made of wire netting. Enough space for work was left. The house was cleaned, washed and disinfected using formalin and folic acid. Each pen floor was covered with enough wood shavings with allocation of one tubular feed + trough and one round fountain drinker, A 60 watt bulb per pen was used for artificial lighting through evening time.

Management

Daily throughout the experimental period, the house iterance was cleaned early in the morning using folic acid. Feed and water were provided *ad libitum*. Every week live weight was record and feed intake was calculated by difference i.e. offer minus remaining.

Experimental Procedure

At the end of experimental period(sixth weeks), all birds were leg banded, individually weighted and recorded the live weight, then were slaughtered manually, birds were scalded using boiling water, handpicked, washed left to drain. Complete removal of trachea, esophagus, crop, intestinal tract, giblet (heart and gizzard), spleen, bursa of fabricus, kidney, oil glands and reproduction organs. Then the hot carcass and liver were weighted.

Chemical Analysis

Proximate analysis for the chemical components of ginger powder (dry matter, crude protein, ether extract, crude fiber, ME, ash and nitrogen free extract, were determined according to AOAC (1980).

Statistical Analysis

All the data of this experiment were analyzed statistically by using ANOVA. The data generated from experiment were subjected to analysis of variance according to steel and Towrie (1980). Differences among the treatment were tested by the method of Duncan. The analysis was carried out SPSS program (statistical packages for social science.

RESULTS AND DISCUSSION

Results in Table 4 showed that treatment had no significant effect ($p<0.05$) on feed intake in the first fourth weeks, although the diets were is caloric and the birds were expected to consume similar feed (Scott et al 1982), however there was a significant increase in feed intake in week five and week six this might be due to enhancement of the appetite of birds by the aroma and flavor of ginger (Kulka, 1967). Results in table 7 showed there was an increase in total feed intake at level 0.25% and 0.75% and decrease in level 0.5%, this iritic increase in feed intake and total feed intake may be due to pungent test or aroma and flavor of ginger. This result agrees with (Purseglove *et al.*, 1981) who reported that the effect of pungent test in feed intake cause by number of components predominated by gingerols followed by shogaols and zingerone. Moreover (Purseglove *et al.*, 1981) mentioned that aroma and flavor of ginger caused by more than 70 constituents present in steam volatile oil obtained from dry ginger. total feed intake in this study ranged from 4150 to 4150g and this is higher than the estimates found by Zomrawi *et al.*, (2013b) but lower than the estimates reported by Fakhim *et al* ., (2013).

Table 4. Effect of dietary ground ginger root on feed intake of broiler chick (g/bird/week)

Weeks	Ground ginger root level %				
	0	0.25	0.5	0.75	SEM
Week 1 **(g)**	258	251	256	235	8
Week 2 **(g)**	476	468	466	453	12
Week 3 **(g)**	768	762	710	680	34
Week 4**(g)**	855	847	832	838	18
Week 5**(g)**	884^{ab}	884^{ab}	841^{b}	928^{a}	24
Week 6**(g)**	835^{ab}	938^{a}	777^{b}	809^{ab}	42

$^{a\ b}$ Values within rows on common superscript differ significantly ($p< 0.05$).; SEM = standard error of the mean.

The significant ($p<0.05$) positive effect of ginger on body weight gain in week 2, 4 and 6 observed in table 5. Similar positive effect of ginger on total weight gain was showed in table 7, at 0.25% ginger level diet there was weight gain was 7.3 % above the control diet fed chicks. Also there was a positive effect in weight gain at 0.75% ginger level, this might be due to *Zingiber officinale* content of volatile oil, fixed fatty oil, proteins, starch and mineral elements or might be due to the fatty oil in ginger which is contained saturated and unsaturated fatty acid, the major component of acids were palmitic, oleic and linoleic (Salzer, 1995).

Table 5.Effect of dietary ground ginger root on weight gain of broiler chick (g/bird/week)

Week	Ground ginger root level %				
	0	0.25	0.5	0.75	SEM
Week 1 **(g)**	170	167	164	161	6
Week 2 **(g)**	316[a]	295[b]	279[b]	281[b]	6
Week 3 **(g)**	383	425	431	389	23
Week 4**(g)**	362[ab]	360[ab]	338[b]	450[a]	33
Week 5**(g)**	398	362	355	417	34
Week 6**(g)**	267[b]	426[a]	269[b]	221[b]	41

[a b] Values within rows on common superscript differ significantly (p< 0.05).; SEM = standard error of the mean.

The significant (p<0.05) positive effect of ginger on body weight gain in week 2, 4 and 6 observed in table 5. Similar positive effect of ginger on total weight gain was showed in table 7, at 0.25% ginger level diet there was weight gain was 7.3 % above the control diet fed chicks. Also there was a positive effect in weight gain at 0.75% ginger level, this might be due to *Zingiber officinale* content of volatile oil, fixed fatty oil, proteins, starch and mineral elements or might be due to the fatty oil in ginger which is contained saturated and unsaturated fatty acid, the major component of acids were palmitic, oleic and linoleic (Salzer, 1995). The overall weight gain in this experiment was 2035- 2035g and this is slightly lower than the estimates reported by Fakhim *et al.* (2013) but higher than the results reported by Zomrawi *et al.* (2013b).

Table 6. Effect of dietary ground ginger root on Feed conversion ratio of broiler chick (g Feed/g weight gain/bird/week)

Week	Ground ginger root level %				
	0	0.25	0.5	0.75	SEM
Week 1 (gF/gW)	1.5	1.5	1.6	1.5	0.022
Week 2(gF/gW)	1.5[b]	1.6[ab]	1.7[a]	1.6[b]	0.019
Week 3(gF/gW)	1.9	1.8	1.7	1.8	0.039
Week 4(gF/gW)	2.4	2.4	2.5	1.9	0.11
Week 5(gF/gW)	2.3	2.5	2.5	2.2	0.129
Week 6(gF/gW)	3.1[ab]	2.3[b]	2.9[ab]	3.7[a]	0.213

[ab] Values within rows on common superscript differ significantly (p< 0.05).; FCR = feed conversion ratio.; SEM = standard error of the mean.

There was significantly positive effect of treatment differences on feed conversion ratio (FCR) as shown in table 7 during the second and the sixth week. This might be due to the effect of supplementation of ginger powder which contains high level of plant proterlytic enzyme (Thompson *et al.*, 1973; Ziauddin *et al.*, 1995).

Table 7.Effect of dietary ground ginger root on overall performance of broiler chicks

Parameters	Ground ginger root level %				
	0	0.25	0.5	0.75	SEM
Total feed intake (g)	4074	4150	4150	3943	53
Total weight gain (WTG)	2035[ab]	2035[a]	2035[b]	1918[ab]	28
FCR (gF/gW)	2.2	2.0	2.1	2.1	0.032

[ab] Values within rows on common superscript differ significantly (p< 0.05).; SEM = standard error of the mean.; FCR = Feed conversion ratio.

Total feed conversion ratio (2.0-2.2kg F/kg G) is in accordance with the range reported by Herawati and Marjuki 2011, Zomrawi *et al.* 2013[a], Zomrawi *et al.* 2013[b]).

Results in table 8 showed no significant ($p>0.05$) effects of treatments on dressing percentage, as well as pre- slaughter weight. There was significant effect of treatments on carcass weight which especially at the (0.25%) ginger level where the increase is about 7% higher than in control diet fed chicks. The positive effect in carcass weight might be due to the effect of ginger bioactive compounds on improving protein and fat metabolism (Zhang *et al.*, 2009). Dressings out percentages were in accordance to the results reported by Zomrawi *et al.* (2013[b]). There were significant ($p<0.05$) effects on liver weight, and relative liver weight %, this may be due to photolytic enzyme (Thompson *et al.*, 1973; Ziauddin *et al.*, 1995).

Table 8.Average pre-slaughtered, carcass weight, dressing percentage, liver weight and liver % of broilers fed diet containing ground ginger during 0-6weeks

Parameters	Ground Ginger root level (%)				
	0	0.25	0.5	0.75	SEM
Pre-slaughter weight (g)	2122	2129	1955	2032	57
Carcass (g)	1562[ab]	1591[a]	1450[b]	1541[ab]	38
Dressing %	74.1	75.0	74.3	75.9	1
liver/g	49.8[a]	49.4[a]	40.5[b]	47.5[a]	1.7
Relative liver weigh (%)	2.5[a]	2.3[b]	2.1[b]	2.3[b]	0.1

[ab] Values within rows on common superscript differ significantly ($p< 0.05$).; SEM = standard error of the mean.

Table 9 shows the results of feed cost and profitability of broiler fed diet contain ginger, the highest cost of feed was obtained for birds fed 0.75% ginger then the birds fed 0.5% ginger and the birds fed 0.25% ginger. Birds fed 0.25%ginger showed the highest profitability compared to other bird groups this may be related to the higher weight gain of this group than others, in conclusion the using of ground ginger root at level 0.25% increase carcass yield and return.

Table 9.Feeding benefit of experimental groups

A -Total costs:

Item	Ground Ginger root level (%)			
	0	0.25	0.50	0.75
Chicks purchase (SDG)	108	108	108	108
Feed (SDG)	150.41	154.05	156.20	158.21
Management (SDG)	50	50	50	50
Total costs (SDG)	308.41	312.05	314.2	316.21
Cost/bird/(SDG)	7.7	7.8	7.9	7.9

B-Total returns:

Item	Ground Ginger root level (%)			
	0	0.25	0.50	0.75
Average weight of bird (kg)	1.562	1.591	1.449	1.541
Price kg. of bird (SDG)	11	11	11	11
Total returns (SDG)	17.18	17.50	15.94	16.95
Returns/bird(SDG)	9.48	9.7	8.08	9.0

CONCLUSION

Broiler chick can tolerate up to 0.75% ground ginger root in the diet without adverse effect. Further studies could be done to assess the response of ginger on the physiological and blood biochemical parameters of birds.

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