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EFFECT OF DIETARY GINGER ROOT POWDER (*Zingiber officinale*) ON LAYER HENS PERFORMANCE, EGG CHOLESTEROL AND SERUM CONSTITUENTS

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An experiment was conducted to evaluate the effect of ginger root powder as natural feed additive on performance and blood serum constituents of layers, using 80 laying hens, 27 week of age in a completely randomized design with four replicates (20birds/treatment). Four experimental diets were formulated to meet the nutrient requirements of layer hens which included different levels of ginger root powder as follow: 0, 0.5, 1 and 1.5%. The results showed that overall feed intake, daily feed intake, total laid eggs, hen day egg production, FCR (kg feed/dozen of egg) and egg cholesterol were not ($P > 0.05$) affected by the dietary treatments. Body weight change was significantly ($P < 0.05$) lower for birds received the diet contained 1.5% ginger root powder. Heamatological parameters (Hb, PCV and MCHC%) were not affected by dietary treatments. RBcs were significantly ($P < 0.05$) higher for birds consumed 1.5% ginger root powder. MCV and MCH were lowers for group received 1.5% ginger root powder diet. No significant differences were observed for serum total protein. However, serum glucose was decreased for birds fed 1.5% ginger root powder. Significant lowering effect was obtained for serum triglyceride, cholesterol and creatitine for those groups received 0, 1 and 1.5% ginger root powder. A higher level of calcium and phosphorus were showed for birds fed 0.5% ginger root powder. Inclusion of ginger root powder in the diet had no effect on layers performance, but it had lowering effect on serum cholesterol, triglyceride and creatitine levels.

Key words: Ginger root powder, layer hens, serum constituents

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The growing appreciation for low fat poultry products by consumers has encouraged researches to be focused in lowering cholesterol of poultry products using many agents such as copper sources. However, reduced egg production (Ankari et al., 1998), its negative effects in egg weight (Mabe et al., 2003) and feed conversion (Ankari et al., 1998). Medicinal plants such as ginger have been traditionally used from time immemorial for varied human ailments in different parts of the globe, to aid digestion and treat stomach upset, diarrhea and nausea (Shukla and singh 2007). Its rhizome also has the stimulating effect on peptic juices, such as bile and salivary, gastric, pancreatic and intestinal juices (Stoilova et al., 2007), also its known properly of lowering blood cholesterol level in man and it's a cholesterol-lowering effect in mice by interfering with intestinal sterol absorption. Addition of ginger may cause an improvement in digestive tract performance in laying hens and improve the egg production. Ginger possesses health promoting organic substances such as gingerone and shoagaol (Fuhrman et al., 2000) that may be used in lowering yolk cholesterol. Information is lacking on the effect of ginger as a feed additive on laying performance. Therefore, the objective of the present study was to evaluate the effects of

dietary ginger root powder on layer's performance, egg production and egg quality.

MATERIALS AND METHODS

Experimental diets: Dried ginger used in this experiment was obtained from the local market then ground into powder. Four dietary treatments were formulated according to the standard nutrient requirements for layers stated by the (NRC, 1994), containing ginger root powder at levels 0% (control diet), 0.5%, 1% and 1.5%. Each dietary treatment was randomly allocated into four replicate. The ingredients composition and calculated analysis of the experimental diets are shown in table (1).

Experimental birds and management: Eighty Hi-sex layer hens of twenty seven weeks age were divided into four dietary treatments (20 birds/treatments) with four replicates using completely randomized design (CRD). The birds were raised in an open sided house. Birds were vaccinated at day old against Mareks' disease, and against Newcastle and Infectious Bronchitis at five days old, then by injection at 16th weeks of age. Chicks were also vaccinated against infectious bursal disease (Gumboro) at two weeks and 4 weeks. Lasota was administered at 4 weeks and 7 weeks. Fowl pox vaccine was applied at 10 weeks. De-wormer was administered at 11 weeks. Hens were selected according to ability of laying, then allowed for three weeks adaptation to

Table1: The ingredients composition and calculated analysis of the experimental diets.

Ingredients	Levels of ginger root powder %			
	0	0.5	1	1.5
Sorghum	62	61.5	61	60.5
Groundnut meal	11	11	11	11
Sesame meal	4.5	4.5	4.5	4.5
Wheat bran	8.75	8.75	8.75	8.75
Super concentrate*	5	5	5	5
Di-calcium	1.5	1.5	1.5	1.5
Limestone	6.7	6.7	6.7	6.7
Salt	0.3	0.3	0.3	0.3
premix	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated analysis				
ME(kcal/kg)	2822.57	2818	2814	2810
Crude protein%	18.09	18.1	18.11	18.12
Crude fat%	3.43	3.43	3.43	3.43
Crude fiber%	4.34	4.39	4.45	4.5
Calcium	3.31	3.31	3.31	3.31
Available phosphorus%	0.55	0.55	0.55	0.55
Methionine%	0.32	0.32	0.32	0.32
Lysine%	0.65	0.65	0.65	0.65

*****Super concentrate per kg = 35%Cp**,** 2000 kcal ME, 4.5% Crude fibre, 2% EE, 6-8% Ca, 4.6% Av. P, 2.3% Sodium, 5.7% Lysine, 2.1% Methionin , 2.6% Methionine+ cystine, 200.000IU/kg Vitamin A, 40.000 IU/kg Vitamin D3, 300 mg/kg Vitamin E, 40 mg/kg Vitamin K3, 30 mg/kg Vitamin B1, 80 mg/kg Vitamin B2, 40 mg/kg Vitamin B6, 0.5 mg/kg Vitamin B12, 180 mg/kg Pantothenic Acid, 500 mg/kg Niacine, 15 mg/kg Folic Acid, 10.000 mg/kg Choline Chloride, 1.200 mg/kg Manganese, 1.000 mg/kg Zinc, 1.200 mg/kg Iron, 120 mg/kg Copper, 10 mg/kg Iodine, 4 mg/kg Selenium.

**Ginger analysis = 2601mj/kg, 89.29 DM%, 15,5 CP%,2.55 EE%, 13.56 CF%, 59.78 NFE%,8.6 Ash%.

establish feed consumption of treated diets. Water and feed were provided *ad-libitum*. Feed intake was weekly determined. Birds were weighed at the beginning and at the end of the experiment period to obtain average live weight of bird, and body weight change on average basis by subtraction of last live weight from that of the start. Eggs were collected twice a day, early morning and late afternoon. Daily laid eggs for each pen were counted and for every week were recorded, weekly feed consumption and weekly feed conversion ratio FCR for each pen was calculated Hen-day egg Hen-day egg production was recorded throughout the experimental period the experimental period. Mortality was recorded throughout the period of the study as it occurred.

Chemical analysis: Blood samples were taken from wing vein (two birds per pen) using syringe and kept for further hematological and biochemical blood analysis. Hemoglobin concentration (Hb) was determined using Hemoglobin–Drabkin Kit. The packed cell volume% (PCV) of Erythrocytes of whole blood was measured using a microhaematocrict centrifuge (Hawksley,London). The Erythrocytes (RBC) were counted using Hayems solution. Mean corpuscular volume (MCV), Mean Corpusular heamoglobib (MCH) and Mean corpuscular haemoglobin concentration (MCHC) were calculated. Plasma glucose and cholesterol were determine by enzymatic calorimetric methods using Kit GOD-PAP (Randox Labratoty Ltd. London). Plasma total protein was determined as shown by (King and Wootton, 1965). Plasma triglyceride was determined by the methods described by Buccolo et al., (1973). Creatinine was determined using commercial kits (Biosystem Reagents and Instruments). Calcium was determined by colorimetric method described by Gindler and King (1972). Phosphorous was determined by the method described by (Gamst and Try, 1980), (Farrell and Kaplan et al., 1984).

Statistical analysis: All the data obtained were subjected to analysis of variance. The software used was the statistical package for social science (SPSS). Differences of means determined by the Duncan Multiple Range Test as described by Steel and Torrie (1980).

RESULTS

Overall performance of laying hens fed various levels of ginger root powder during

Table 2: Overall performance of laying hens (30 -37 weeks) as affected by dietary ginger root powder.

Parameters↓	Levels of ginger root powder%↓					
	0	0.5	1	1.5	SEM	Sig
Feed intake (g/hen/8week)	6177.1	6532.2	6179.9	6290.1	237.9	NS
Feed intake (g/hen/day)	110.3	116.6	110.4	112.3	3.496	NS
Total laid eggs (egg/hen/8week)	41.4	38.5	40.4	40.6	2.7	NS
Hen-day egg production (%)	73.9	68.7	72.2	72.5	3.85	NS
FCR(Kg feed/dozens of egg)	1.81	2.11	1.89	1.87	0.121	NS
Body weight change (g)	54.13^{a}	63.61^{a}	13.69^{a}	-67.56^{b}	23.73	*
Egg cholesterol (mg/g)	16.29	18.48	18.07	16.16	1.41	NS

a, b = mean with different superscripts along rows are significantly different($P < 0.05$). Values are means of 4 replicates, 5 birds each, (n=20). NS=Non-significant difference ($P > 0.05$). SEM = standard error of treatment means.

Table 3: Effects of dietary ginger root powder on some hematological parameters of laying hens.

Parameters ↓	Levels of ginger root powder%↓					
	0	0.5	1	1.5	SEM	Sig
TRBCs (x106/µL)	3.4375 ^{b}	3.65 ^{ab}	3.3625 ^{b}	4.25 ^{a}	2.590979	*
Hb (g/dL)	7.3	6.9	6.9	7.1	0.33	NS
PCV%	21	21.13	20.63	20.38	0.75	NS
MCV (fl)	63.3^{a}	60.17^{ab}	62.95^{a}	48.98^{b}	4.33	*
MCH (pg)	21.93^{a}	19.57^{ab}	20.76^{ab}	17.1^{b}	1.28	*
MCHC%	34.97	32.81	33.25	35.02	1.68	NS

a, b = mean with different superscripts along rows are significantly different($P < 0.05$). Values are means of 8blood sample. NS=Non-significant difference ($P > 0.05$). SEM = standard error of treatment means.

30 -37 weeks is shown in Table (2). Feed intake and daily feed intake within eight weeks of experimental period haven't been significantly (P > 0.05) affected by the dietary treatments. Total number of laid eggs and hen day egg production were not significantly (P > 0.05) influenced by dietary treatments. FCR for treatment diets also showed none significant (P > 0.05) differences between dietary treatments. Birds fed 1.5% ginger root powder presented significantly (P < 0.05) negative body weight change as compared to those fed on control, 0.5% and 1% ginger root powder, they both achieved equivalent positive (P > 0.05) body weight change. None significant (P > 0.05) differences were recorded for egg cholesterol between dietary treatments.

Blood parameters results are shown in Table (3). TRBcs were significantly (P < 0.05) higher for birds fed 1.5% ginger root powder. A higher MCV was recorded for control group and birds fed on 1% ginger root powder. MCH was significantly (P < 0.05) higher for control group compared to 1.5% ginger root powder. Hb, PCV and MCHC didn't show any (P > 0.05) differences between treatments.

Serum constituent results are illustrated in Table (4). Serum glucose was significantly (P < 0.05) lower for birds fed 1.5% ginger root powder compared to the control group. Serum triglyceride, cholesterol and creatinine were significantly (P < 0.05) higher for birds consumed 0.5% ginger root powder compared to the control, 1% and 1.5% ginger root powder. Serum calcium and phosphorus were significantly (P < 0.05) higher for birds fed 0.5% ginger root powder compared to the others groups. Serum total protein was not (P > 0.05) affected by the dietary treatments.

DISCUSSION

Feed intake of laying hens throughout experimental period (8 weeks) and daily intake of feed per hen records were not different between treatment groups; these results supported by Zhao et al., (2011) who stated that supplementation of ginger powder at the levels of 5 to 20g/kg had no effect on feed intake and efficiency of feed utilization. Total number of laid eggs per hen and egg production percentage showed no difference between treatments, the present result disagree with the findings of Abdollah et al., (2011), who indicated that the supplementation of laying hen diet with ginger root at the rate of 0.5 or 0.75% had positively influence on egg production of laying hens. No difference was observed among dietary treatments in FCR (kg feed/dozen eggs), this result disagreed with the work obtained by Malekizadeh et al., (2012), who reported that addition of ginger root powder at level 1% increased egg production, feed intake and decreased FCR. Body weight change for birds fed on higher level of ginger root powder showed reduction in final body weight. Egg cholesterol was not affected by treatments diets, the current observation disagreed with the finding of Abdollah et al., (2011) who reported that the dietary inclusion of ginger root decreased the concentration of egg yolk cholesterol with no adverse effect on egg weight and feed conversion ratio of hens.

Haematological parameters Hb, PCV, MCHC% were not affected by the treatment diets. The higher levels of TRBcs was recorded for 1.5% ginger root powder, whereas, it achieved lower MCV and MCH. Serum total protein was not affected by treatment diets. Dietary treatment has significant lowering effect on serum glucose, triglyceride, cholesterol and

Table 4: Effect of dietary ginger root powder on serum constituents of laying hens.

Parameters	Levels of ginger root powder%					
	0	0.5	1	1.5	SEM	Sig
Glucose mg/dL	211.38^{a}	198.5^{ab}	191.38^{ab}	189.88^{b}	6.7	*
Total protein g/dL	3.98	4.63	4.36	3.89	0.29	NS
Triglyceride mg/dL	70.63^{b}	94.25^{a}	71.75^{b}	62.5^{b}	5.83	*
Cholesterol mg/dL	121.5^{b}	170.75^{a}	113.88^{b}	101^{b}	14.17	*
Creatinine mg/dL	0.54^{b}	0.89^{a}	0.59^{b}	0.54^{b}	0.08	*
Calcium mg/dL	9.15^{b}	11.29^{a}	10.15^{ab}	9.83^{ab}	0.57	*
i-Phosphorus mg/dL	5.2^{ab}	6.3^{a}	5.95^{ab}	5.03^{b}	0.4	*

a, b = mean with different superscripts along rows are significantly different(P < 0.05). Values are means of 8blood sample. NS= Non-significant difference (P > 0.05). SEM = standard error of treatment means.

creatitine, this finding agreed with the findings of Malekizadeh et al., (2012) who reported that supplementation with ginger root powder in laying hen diet at levels 1% and 3%, reduced total cholesterol level compared with the control diets. Dias et al., (2006) reported that the total serum cholesterol levels were significantly decreased by dietary supplementation of 1% ginger extract meal in Wistar rats. They stated that ginger treatment can reduce total serum cholesterol by enhancing the activity of liver cholesterol-7-a-hydrolase or inhibition of hydroxyl-methyl-glutaryl-coenzyme-A (HMG-CoA) reductase, either by bile-acid conversion or fecal excretion of cholesterol. Higher serum calcium and phosphorus for birds fed 0.5 % ginger root powder compared to the control birds and birds fed on1.5% ginger root powder respectively.

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