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Response of Two Genetic Groups of Layers Served Ginger Root Powder on the Internal and External Egg Quality Characteristics

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Abstract: This study was conducted to investigate the effect of ginger root powder on the internal and external egg characteristics of exotic and local breeds of chicken. Seventy two (72) laying hens comprising 36 local breed of the Nigerian heavy local chicken ecotype (NHLCE) and 36 exotic breed (Isa brown) were used for the study. Based on the genetic groups, the birds were divided into two groups and randomly assigned to four dietary treatments T1, T2, T3 and T4 containing 0%, 2.5%, 5% and 7.5% dietary inclusion of ginger root powder respectively. Each genetic group (breed) containing thirty-six (36) layers was replicated three times with three (3) layers per replicate in 2x4 factorial in a completely randomized design (CRD). At the end of the experiment three (3) eggs per replicate were randomly selected for external and internal egg characteristics evaluation. Results of the external egg characteristics showed that there was significant ($p<0.05$) differences in only the egg width, egg shell thickness and shell weight of the local layers egg. Results of the internal egg characteristics showed that there was significant ($p<0.05$) differences in albumen height, yolk height and yolk width of exotic layers and egg yolk weight, albumen length, yolk height, yolk length and haugh unit of the local layers. It was concluded that dietary inclusion of ginger root powder significantly improved the external and internal egg characteristics of local and exotic breeds of layers and therefore recommended that ginger should be included at 7.5% levels in the diets of local and exotic breeds of layers.
Keywords: Genetic group, ginger, layers, eggs quality.

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Introduction

Animal protein is very essential for proper growth and development in man. According to Guéye (2003), egg consumption in Africa is estimated to be around 2.1 kg/person/year. The local chickens constitute the majority of the poultry types in Nigeria, numbering about 103 million (RIM, 1992). Momoh (2005) classified the local chicken of Nigeria into two ecotypes namely heavy and light ecotypes based on body weight.

These local chickens have been extensively studied and found to be dual purpose with the heavy ecotype tending to have potential for meat production while the light ecotype have

potentials for egg production (Momoh, 2005). *Zingiber officinale* is a perennial plant, commonly known as ginger.

Phytochemical studies have shown that the unique culinary and medicinal properties of ginger are due to the presence of phytochemicals like zingerone, shogaols, gingerols, pardols, β-phellandrene, curcumene, cineole, geranyl acetate, terphineol, terpenes, borneol, geraniol, limonene, β-elemene, zingiberol, linalool, α-zingiberene, β-sesquiphellandrene, β-bisabolene, zingiberenol and α-farmesene (Baliga *et al.*, 2011).

Nigeria was rated as the number five in world ginger production with an estimated annual output of 138,000 tonnes. Scientific studies carried out in accordance to the principles of modern system of medicine have convincingly shown that ginger possesses numerous health benefits like antimicrobial, antiviral, gastroprotective, antidiabetic, anti-hypertensive, cardioprotective, anticancer, chemopreventive and immunomodulatory effects (Baliga *et al.*, 2011). Thus, the objective of this study was to investigate the effect of ginger root powder on the internal and external egg characteristics of exotic and local breeds of layers.

Materials and Methods

Location and Duration of Experiment

The experiment was conducted at the Poultry Unit of the Department of Animal Science, University of Nigeria, Nsukka. Nsukka lies within longitude 6˚45'E and 71E and latitude 7˚12.5'N and on the altitude 447m above sea level.

The climate of the study area is typically tropical, with relative humidity ranging from 65–80% and mean daily temperature of 26.8˚C (Agbagha *et al.*, 2001). The rainy season is between April and October while dry season is between November and March with annual rainfall range of 1680–1700mm (Breinholt *et al.*, 1981). The experiment lasted for three months.

Experimental Animal and Management

Seventy-two (72) laying hens comprising 36 local breeds of the Nigerian heavy local chicken ecotype (NHLCE) and 36 exotic breeds (Isa brown) were used for the study. Based on the genetic group, the birds were divided into two groups and randomly assigned to four dietary treatments containing 0% (control), 2.5% (T1), 5% (T2), 7.5% (T3) of ginger root powder in 2x4 factorial in completely randomized design (CRD). Each genetic group (breed) containing thirty-six (36) layers were replicated three times with three (3) layers per replicate.

Feed and water were provided *ad libitum* on daily basis to hens and the leftover feed usually measured through weight-back techniques. At the end of the experiment, three (3) eggs per replicate were randomly selected for external and internal egg characteristics evaluation. NHLCE is a dual purpose breed of local (indigenous) chickens developed at the Department of Animal Science, University of Nigeria, Nsukka. This breed can compare favourably with some exotic breeds of layers in several traits such as total egg number per year, hen day egg production, hen house egg production, body weight at first egg etc.

Composition of the experimental diets

The recommended methods of the Association of Official Analytical Chemists (AOAC, 2000) were used to determine the crude protein and Crude fibre of ginger root powder.

Proximate analysis of the ginger recorded 4.2 Mcal/Kg energy, 10.52% Crude protein and 5.97% Crude fibre.

Table 1. Percentage composition of the experimental diet on dry matter bases

Feedstuffs	**T1 (Kg)**	**T2 (Kg)**	**T3 (Kg)**	**T4 (Kg)**
Maize	50	50	50	50
Wheat offal	8.5	6.0	5.8	6.0
Soyabean meal	18.5	18.5	18.5	18.5
Palm kernel cake	11.9	11.5	9.3	6.9
Oyster shell	8.5	8.5	8.5	8.5
Bone meal	2.0	2.0	2.0	2.0
Methionine	0.1	0.1	0.1	0.1
Lysine	0.2	0.2	0.2	0.2
Salt	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25
Ginger	0	2.5	5.0	7.5
Total	100	100	100	100
Calculated composition				
Crude protein (%)	17	17.01	17.02	17.10
Crude fibre	5.02	5.10	5.01	5.0
Energy (Mcal/kg) ME	2.70	2.50	2.60	2.80

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA) using Statistical Package for Social Sciences (SPSS) version 16, and significantly different means were separated using Duncan New Mutiple Range Test (Duncan, 1955).

Results and Discussion

Effect of Ginger root on the Internal and External egg characteristics of local and exotic breeds of layers

The result of the Effect of Ginger root on the Internal and External egg characteristics of Local and Exotic breeds of layers is presented in Table 2.

Table 2. Effect of Ginger root on the External egg characteristics of Local and Exotic breeds of layers

Breed	Parameters	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)	Sig.
Exotic chicken layers	Egg weight (g)	70.78±4.67	67.22±3.11	72.39±5.83	75.50±1.86	NS
	Egg length (cm)	6.86±0.15	6.25±0.28	6.64±0.49	6.54±0.47	NS
	Egg width (cm)	3.94±0.03	3.22±0.23	3.46±0.29	3.75±0.3	NS
	Shell weight (g)	7.22±0.15	7.45±0.50	7.44±0.47	7.22±0.37	NS
	Egg shell thickness (mm)	0.55±0.01	0.50±0.02	0.51±0.03	0.56±0.515	NS
Local chicken layers	Egg weight (g)	42.93±1.40	43.33±0.07	42.73±1.55	43.87±1.64	NS
	Egg length (cm)	5.53±0.17	5.54±0.94	5.62±0.16	5.93±0.10	NS
	Egg width (cm)	$2.44±0.09^{b}$	$2.58±0.06^{ab}$	$2.61±0.13^{ab}$	$2.77±0.33^{a}$	*
	Egg shell thickness (mm)	$0.51±0.01^{b}$	$0.51±0.00^{b}$	$0.53±0.01^{b}$	$0.56±0.00^{a}$	*
	Shell weight (g)	$6.87±0.13^{b}$	$6.87±0.07^{b}$	$7.27±0.18^{ab}$	$7.33±0.13^{a}$	*

Sample mean scored in the same row with different letters are significantly ($p < 0.05$) different.

From table 2, the result showed that the effect of ginger on the external egg characteristics had no significant differences ($p>0.05$) on the egg weight and egg length of both exotic and local layers and also on the egg width, shell weight and egg shell thickness of exotic layers. However, the result showed significant increase ($p<0.05$) on the egg width, shell weight and egg shell thickness of local layers with. Treatment 4 which has 7.5% inclusion of ginger powder had the highest mean value for egg width, shell weight and egg shell thickness in the local breeds of layers as 2.77±0.33cm, 7.33±0.13g, and 0.56±0.00mm respectively. This result is in line with Zhao *et al.*, (2011) who reported that Hy-Line brown laying hens (exotic) fed with ginger at the rates of 5, 10, 15 and 20g/kg of feed had no effect on laying rate and average egg weight. This is in contrast with the result of Incharoen and Yamauchi (2009) who reported a significant increase in hen day egg production and egg mass of white leghorn fed dietary dried fermented ginger. The significant increase in egg shell weight and egg shell thickness is in line with the result of Nasiroleslami and Torki (2010) who found that the addition of the essential oil of ginger increased egg shell weight and egg shell thickness in laying hens. Akbarian *et al.*, (2011) showed that feeding ginger at the rates of 0.5 and 0.75% improved egg production although egg weight did not differ between the control and treated groups. The increase in the mean external egg quality characteristics in treatment 4 (7.5% ginger root inclusion) above other treatments and control in the local breed of layers could be attributed to the medicinal properties of ginger which suppressed microbial load in the guts of the birds and thus, allow proper utilization of the nutrients in the diets.

Table 3. Effect of Ginger root on the Internal egg characteristics of Local and Exotic breeds of layers

Breed	Parameters	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)	Sig.
Exotic Chicken layers	Egg yolk weight (g)	18.94±0.11	17.33±0.75	19.28±1.07	19.06±0.88	NS
	Albumen weight (g)	45.11±1.27	40.11±1.84	42.84±4.11	42.67±2.77	NS
	Albumen length (cm)	8.02±0.02	7.10±0.41	7.82±0.59	7.77±0.51	NS
	Albumen height (mm)	$0.29±0.15^{ab}$	$0.31±0.03^{ab}$	$0.25±0.04^{b}$	$0.36±0.02^{a}$	*
	Yolk height (cm)	$1.31±0.03^{a}$	$0.77±0.03^{c}$	$0.93±0.04^{b}$	$0.88±0.04^{b}$	*
	Yolk width (cm)	$1.51±0.07^{b}$	$1.44±0.05^{b}$	$1.7±0.10^{ab}$	$1.8±0.06^{a}$	*
	Yolk length (cm)	4.62±0.05	4.75±0.28	4.49±0.26	4.64±0.28	NS
	Haugh unit	84.91±0.00	85.11±0.06	85.05±0.07	84.95±0.07	NS
Local Chicken layers	Egg yolk weight (g)	$20.27±0.35^{a}$	$18.13±0.24^{c}$	$19.4±0.00^{b}$	$18.53±0.18^{c}$	*
	Albumen weight (g)	32.60±0.46	34.80±0.40	35.00±0.40	35.20±1.60	NS
	Albumen length (cm)	$6.90±0.04^{a}$	$6.14±0.16^{b}$	$5.88±0.11^{b}$	$6.14±0.10^{b}$	*
	Albumen height (mm)	0.32±0.02	0.27±0.01	0.33±0.05	0.27±0.01	NS
	Yolk height (cm)	$0.73±0.03^{b}$	$0.69±0.01^{b}$	$0.82±0.11^{ab}$	$0.98±0.12^{a}$	*
	Yolk width (cm)	1.7±0.06	1.52±0.09	1.69±0.04	1.65±0.04	NS
	Yolk length (cm)	$4.69±0.09^{a}$	$4.33±0.08^{b}$	$4.63±0.06^{a}$	$4.47±0.04^{ab}$	*
	Haugh unit	$85.22±0.02^{b}$	$85.30±0.02^{ab}$	$85.36±0.03^{a}$	$85.31±0.05^{ab}$	*

Means in the same row with different letters are significantly ($p<0.05$) different

From table 3, the result showed that the effect of ginger on the internal egg characteristics had no significant differences ($p\geq0.05$) on albumen weight, albumen length, yolk length and haugh unit of exotic chicken layers and on albumen weight, albumen height and yolk width of local chicken layers. However there was significant increase ($p<0.05$) among treatments in the albumen height and yolk width of exotic breeds of layers with treatment 4 showing the highest mean value at 0.36±0.02cm and 1.8±0.06cm respectively. There was a significant decrease ($p<0.05$) in the yolk height of exotic chicken with the control treatment showing the highest mean value (1.31±0.03cm). There was significant decrease in the mean values of egg yolk weight, albumen length and yolk height with increase in ginger across the treatments of local breeds of layers. The mean values of egg yolk weight, albumen length and yolk height at the control treatment were 20.27±0.35g, 6.90±0.04cm and 4.69±0.09cm respectively. There was also a significant increase in the mean values of yolk height and haugh unit with increase in ginger across the treatment of local breeds of layers with the mean values 0.98±0.12cm and 85.36±0.03 at T4 and T3 respectively. This result in exotic breed is in line

with Incharoen and Yamauchi (2009) who found out that White Leghorn laying hens fed dried fermented ginger (1 and 5%) showed no significant differences in albumin ratio, yolk ratio, yolk colour and Haugh unit among the dietary treatments. The significant increase in haugh unit in local breeds of layers was also in line with Nasiroleslami and Torki (2010) who discovered significant increase in haugh unit with inclusion of ginger. The increase in the mean internal egg quality characteristics in treatment 4 (7.5% ginger root inclusion) above other treatments and control could be ascribed to medicinal properties of ginger which suppressed microbial load in the guts of the birds and thus, allow proper utilization of the nutrients in the diets.

Conclusion

Results from the study showed that inclusion of ginger root powder in the diet of laying birds improved some external and internal egg characteristics of local and exotic breeds of layers. It is therefore recommend that poultry that ginger root powder should incorporated in the diets of local and exotic laying birds at 7.5% to improve their egg quality traits.

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