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Effects of Cinnamon Powder on Egg Quality: A New Approach using Layer Birds

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Abstract**—** *Attention towards natural growth promoters in poultry has been on the increase in different parts of the world. However, most studies focus on broiler birds and quail. This study analyzed how cinnamon powder supplemented in the diet of Lohmann Brown layer birds can improve egg quality. This study consisted of 5 treatments of 30 birds per treatment, comprising fifteen replicates of 2 birds per replicates. The treatments included: T1: Control without Cinnamon; T2: 4 litres of water + 0.1g of cinnamon; T3: 4 litres of water + 0.2g of cinnamon; T4: 4 litres of water + 0.3g of cinnamon; T5: 4 litres of water + 0.4g of cinnamon. Parameters measured were egg weight, egg mass, egg breadth, egg length, albumen height, albumen weight, yolk height, yolk length, yolk colour, yolk weight, shell weight, and shell thickness. The results revealed an increase in the albumen weight, yolk weight, albumen height, and yolk height as the inclusion levels of cinnamon powder increase. In addition, the egg weight was highest in treatment 5. Taken together, cinnamon powder addition in the diet of Lohmann Brown layer birds has a positive outcome on egg quality.*

Keywords**— Antibiotic growth promoters, Cinnamon, Egg quality, Layers, Poultry**

I. INTRODUCTION

Poultry production has been on the increase over the years in different parts of the world. According to research, it is the most consumed meat globally, with production peaking 137 million tons in 2020 (Ali *et al.*, 2021). Even in developing countries like Nigeria, poultry is the fastest growing subsector of animal husbandry, with eggs being the most affordable and demanded product (Heise *et al.*, 2015).

In order to keep up with demand, antibiotic growth promoters (AGP) have long been in use as the primary growth promotant and carcass modifier. However, due to increasing consumer awareness about food safety, AGPs have been banned in most countries of the world (Beg *et al.*, 2016).

The global trend against antibiotic growth promoters in animal diets has led researchers to find safer and natural alternatives. Hence, natural products like rosemary, turmeric, cumin, and cinnamon have been in the spotlight in the past decade due to their natural medicinal properties (Rao & Gan, 2014).

Cinnamon belonging to the genus *Cinnamomum* is the most consumed spice globally, with over 250 evergreen trees and shrubs mainly found in Asia and Australia. It has been in use in different countries for thousands of years with reference in ancient scriptures (Barceloux, 2009). As yet, research have been carried out to evaluate the effects of Cinnamon on broiler meat and quail eggs (Ciftci *et al.*, 2010; Santos *et al.*, 2019).

This paper aimed to explore the effects of Cinnamon powder on egg quality parameters of commercial laying birds fed varying levels of cinnamon powder inclusion in their diets.

II. MATERIALS AND METHODS

The experiment was carried out using battery cages at the Poultry Unit of the Teaching and Research Farm at Ladoke Akintola University of Technology Ogbomoso, Oyo state.

One hundred and fifty (150) point of lay birds (Lohmann Brown) were used for this experiment, and the birds were

purchased at 18 weeks old from Global West Farms at Ewura in Oyo State. Before starting the experiment, the birds were allowed to acclimatize for three weeks and randomly divided into five treatments of 30 birds per treatment comprising fifteen replicates of 2 birds per replicates. They were offered adequate feed, clean and fresh water daily throughout the experiment and were submitted to a light regimen of 15 hours daily. Diet was fed to each treatment group at 7.00 am and 12.00 pm daily. The experiment started when the birds have started laying fully at 21 weeks old and lasted till 33 weeks old translating to twelve (12) weeks of data collection.

The Cinnamon powder (*Cinnamomum zeylanicum*) used was procured from Gel Spice Company in its finished fine powder form. Layer mash and *Cinnamomum zeylanicum* was introduced to the commercial layers when they started laying at an inclusion level of 4litres of water in 0g, 0.1g, 0.2g, 0.3g and 0.4g of cinnamon powder. Cinnamon powder was adequately mixed to dissolve in drinking water fully to avoid settling of the powder. Five experimental diets (*Cinnamomum zeylanicum* + 4 litres of water) was formulated:

Diet 1: Control without Cinnamon, Diet 2: 4 litres of water + 0.1g of cinnamon, Diet 3: 4 litres of water + 0.2g of cinnamon, Diet 4: 4 litres of water + 0.3g of cinnamon, and Diet 5: 4 litres of water + 0.4g of cinnamon.

Eggs were collected and weighed from each replicate daily. At the end of each week, one egg was randomly selected from each replicate. It was subjected to the following measurements: Egg weight (g), egg mass (g), egg breadth (mm), egg length (mm), albumen height (cm), albumen weight (g), yolk height (cm), yolk length (mm), yolk colour, yolk weight (g), shell weight (g), shell thickness (mm).

Weight measurements were carried out using an electric weighing balance. Length and breadth measurements using a vernier calliper. Height was measured using a ruler while the thickness with a micrometre screw gauge. Yolk colours were measured by comparing with an egg yolk colour fan.

Data obtained from this study were subjected to analysis of variance using SAS. Significantly different means were separated using Duncan's Multiple Range Test (DMRT) of the same package.

Table 1: Gross composition and nutrient content of experimental diets

Feed Ingredients	Quantity (%)
Maize	35.00
Groundnut Cake	12.000
Soybean Meal	9.000
Palm Kernel Cake	15.000
Corn Bran	15.00
Fish Meal	1.200
Oyster Shell	8.000
Bone Meal	4.000
Lysine	0.150
Methionine	0.200
Premix*	0.250
Salt	0.200
TOTAL	**100.000**
Crude Protein (g kg^{-1})	17.890
ME (Kcal kg^{-1})	2497.270
Crude Fiber (%)	5.347
Calcium (g kg^{-1})	29.22
Available Phosphorus (g kg^{-1})	3.04
Sodium (g kg^{-1})	1.46
Chlorine (g kg^{-1})	2.42
Potassium (g kg^{-1})	7.25

***Premix composition per kg diet:** Vitamin A 10,000,000iu, Vitamin B 13750 Mg, Vitamin B2 5000Mg, Vitamin B6 3750Mg, Vitamin B12 2000 Mg, Vitamin D3 2,500,000iu, Vitamin E30,000iu, Vitamin k3 5000Mg, Antioxidant 1250 Mg, Biotin 1500 Mg, Choline chloride 500,000Mg, Copper 6500 Mg, Cobalt 200 Mg, Folic 125 Mg, Iron 70,200 Mg, Iodine 400 Mg, manganese 75,000 Mg, Niacin (PP) 30,000Mg, Selenium 80 Mg, Zinc 85,500Mg.

III. RESULTS

The results of the supplementation of cinnamon powder on external egg quality characteristics of layers is shown in table 2. There were significant ($p<0.05$) differences among the parameters measured across the treatment except for egg length, similar all through. The highest value of the egg weight was recorded in T_5 (61.32g), with the lowest value in T_2 (58.24g).

Egg mass was highest in T_5 (54.08g), similar to T_3 (53.47g), while the lowest value of 51.31g was observed in T_2, similar to T_1 with the value 51.87g. The birds on T_5 have the highest egg breath value, 43.63g, while T_1, T_3 and T_4 were observed to be similar with the values of T_1 (43.30g), T_3 (43.57g) and T_4 (43.40g) with the lowest value (43.04g) recorded in T_2.

Table 2: Mean values of cinnamon powder on external egg quality characteristics of layers chicken

Parameters	T_1	T_2	T_3	T_4	T_5	±SEM
Shell weight	4.63^{ab}	4.48^{ab}	4.39^{b}	4.78^{a}	4.48^{ab}	0.47
Shell thickness	0.33^{b}	0.32^{b}	0.50^{a}	0.34^{b}	0.33^{b}	0.13
Egg weight	59.22^{bc}	58.24^{c}	60.34^{ab}	59.65^{abc}	61.32^{a}	2.43
Egg mass	51.87^{b}	51.31^{b}	53.47^{a}	52.62^{ab}	54.08^{a}	2.24
Egg length	55.16^{a}	55.43^{a}	54.82^{a}	55.64^{a}	55.50^{a}	1.67
Egg breadth	43.30^{ab}	43.04^{b}	43.57^{ab}	43.40^{ab}	43.63^{a}	0.81

T1: Control without Cinnamon; T2: 4 litres of water + 0.1g of cinnamon; T3: 4 litres of water + 0.2g of cinnamon; T4: 4 litres of water + 0.3g of cinnamon; T5: 4 litres of water + 0.4g of cinnamon. Means along the same row with different superscripts are significantly ($p<0.05$) different, SEM=Standard Error Mean.

Table 3 shows the mean values of cinnamon powder on internal egg quality characteristics of layers. There were significant ($p<0.05$) differences among the parameters measured across the dietary treatments. The value of the albumin weight was observed to be highest in T_5 (38.95g), the lowest value was in T_2 (36.64g).

Yolk height was highest in T_5 (2.24g), while the lowest was observed in chickens fed on diet T_2 (2.07g). The result revealed an increase in the albumen weight, yolk weight, albumen height, and yolk height as the inclusion levels of cinnamon powder increase.

Table 3: Mean values of cinnamon on internal egg quality characteristics of layers

Parameters	T_1	T_2	T_3	T_4	T_5	±SEM
Albumen weight	36.80^{b}	36.64^{b}	37.80^{ab}	37.61^{ab}	38.95^{a}	2.14
Yolk weight	14.38^{a}	13.93^{b}	14.39^{a}	13.93^{b}	14.53^{a}	0.15
Albumen height	1.62^{a}	1.61^{a}	1.63^{a}	1.78^{a}	1.67^{a}	0.27
Yolk length	37.05^{a}	36.90^{a}	37.20^{a}	37.04^{a}	37.01^{a}	1.42
Yolk height	2.11^{b}	2.07^{b}	2.10^{b}	2.11^{b}	2.24^{a}	0.12
Yolk colour	7.45^{a}	6.85^{b}	7.20^{a}	6.92^{a}	6.63^{a}	1.38

T1: Control without Cinnamon; T2: 4 litres of water + 0.1g of cinnamon; T3: 4 litres of water + 0.2g of cinnamon; T4: 4 litres of water + 0.3g of cinnamon; T5: 4 litres of water + 0.4g of cinnamon. Means along the same row with different superscripts are significantly ($p<0.05$) different, SEM=Standard Error Mean.

IV. DISCUSSION

In the present article, we investigated whether cinnamon affects the egg qualities of laying commercial birds. Our findings converge with Suwarta & Suryani (2019) research on quail that cinnamon powder significantly increased egg weight and egg shell weight. In addition, our study revealed for the first time that shell weight, shell thickness, egg weight, egg mass and egg breadth were significantly influenced by cinnamon powder supplementation in the diet of layer birds. Vali *et al.* (2013) reported that supplementation of *Cinnamon zeylanicum* bloom and *Thymus vulgaris* on the egg quality of Japanese quail significantly improved egg quality parameters, supporting the present result on egg quality and cinnamon powder. Ulku *et al.* (2015) on the effect of cinnamon and rosemary oils on egg quality in laying quails indicated that cinnamon oil added a positive effect on egg shell quality.

Our finding revealed a significant interaction between cinnamon powder and egg weight, in line with Torki *et al.* (2015) and Hesham *et al.* (2019), who studied the effect of cinnamon essential oil on the egg quality of laying hens. Abo Ghanima *et al.* (2020) reported on the effect of housing system, rosemary and cinnamon essential oils on egg quality traits, reviewed that supplementation of rosemary and cinnamon essential oils in laying hens had a significant effect on egg quality characteristics. The study of Vali & Mottaghi (2016) reported the effect of using different levels of cinnamon and thyme powder on egg quality characteristics in Japanese quails reviewed that egg shell and egg shell thickness increases significantly compared to control.

However, the result of this study contradicted the findings of Santos *et al.* (2019), who reported that the use of cinnamon in Japanese laying quail had no significant effect on performance or the egg quality variable. Except for the specific gravity and colour of the yolk, which increases linearly as the inclusion of cinnamon powder increases. The findings of Soomro *et al.* (2018) also disagreed with the current study that the alternative use of turmeric in induced moulting on the performance of layers had non-significant differences among the groups for egg width, yolk weight, and albumin weight.

V. CONCLUSION

In conclusion, the result of the study indicated that the inclusion of cinnamon powder at 0.4g/4liters to the drinking water of layers has improved egg quality compared to other dietary treatments. Thus, cinnamon can be used as a natural egg booster for layer birds. Future research may extend this work by exploring other natural AGP alternatives on different breeds of laying birds.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICAL APPROVAL

The two authors have declared that, “principle of laboratory animal care” (NIH publication 8023 revised 1978) were followed as well as the University law.

AUTHORS' CONTRIBUTIONS

This work was conducted in collaboration by both authors. Both authors have read and approved the final version of the manuscript.

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