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Original Article

Effect of dietary inclusion of turmeric (*Curcuma longa*) on the intestinal parasite and egg quality characteristics of Quails

OPEN ACCESS

Cordelia Ifeyinwa EBENEBE[1,2]*, Francisca Chinwendu EZEOKE[3], Chukwuemeka Johnjude EZIKE[2], Benedeth Ndidi EZENYILIMBA[2] & Joan Nneamaka EZE[4]

[1]*TETFund Centre of Excellence for Biomedical, Engineering, Agricultural and Translational Studies (TCE-BEATS), Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.*
[2]*Department of Animal Science, Nnamdi Azikiwe University ,Awka, Anambra State, Nigeria*
[3]*Department of Animal Science, Chukwuemeka Odumegwu Ojukwu University, Anambra State, Nigeria*
[4]*Department of Vocational Education, Federal College of Education (Technical) Asaba, Delta State, Nigeria*

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ABSTRACT

The problem of antibiotic resistance in birds necessitates the search for alternatives. This study evaluated the effect of dietary inclusion of turmeric (*Curcuma longa*) on the intestinal parasite infestation and egg-laying performance of Japanese quails (*Coturnix japonica*). Forty-five points of lay quails were randomly assigned to three treatments: T1 received 3g of turmeric per 1 liter of water, T2 received 1 tea spoon (4.2g) of dewormer (Bactro-expeller) per 3 liters of water, and T3 served as the control without any test ingredient. The experiment lasted for six weeks, with three replicates of five quails each. Egg quality parameters such as albumen height, egg weight, yolk index, and yolk width were significantly affected by the treatments ($P<0.05$). Analysis revealed the presence of intestinal parasites, with two cases of *Strongyloides* spp. in the turmeric-fed group and one case of *Ascaridia* spp. in the control. However, the dewormer-treated group showed no signs of intestinal parasites. The study concludes that turmeric inclusion in quail diets does not adversely affect egg performance and quality. However, it is ineffective in controlling *Strongyloides* spp. and should not be relied upon as a preventive or control measure for intestinal parasites. Instead, dewormers should be used, with strict adherence to dosage and withdrawal periods, by comparing turmeric-based diets with conventional worm expellers and evaluating their influence on quail egg production.

K E Y W O R D S : *Dewormer, Intestinal parasite, Laying performances, Turmeric, Quails*

INTRODUCTION

Turmeric (*Curcuma longa)* has been widely recongnised for its medicinal properties, particularly its anti-inflammatory and antioxidant effects (Gupta *et al*, 2018). Recent studies have explored the potential benefits of turmeric in poultry nutrition, including its impact on intestinal health and egg quality.Low supply and high cost of animal proteins such as beef, pork, mutton, chevon, poultry, egg and milk has brought about an acute shortage of animal protein in the diet of most Nigerians. This is mainly due to the high cost of conventional feed ingredients used in livestock production (UN, 2018).

Animal production has been severally highlighted as very pivotal to food security and the development of any nation. Ending poverty and hunger as well as improving health is one of the key goals of the United Nation's

*Corresponding author: fc.ezeoke@coou.edu.ng; +2348067182660

Sustainable Development Goals (SDGs) officially known as transforming our world: the 2030 Agenda for Sustainable Development (UN, 2018). To achieve these goals, roles of animal production cannot be relegated to the background. Average daily protein intake in Nigeria is less than 9 g of animal protein per capita per day as compared to over 50 g per capita per day in North America and Europe (Bakoji, 2013). FAO recommendation for daily protein consumption is put at 60 g per person out of which 35 g is expected to be from animal sources (Lee, *et al*., 2018). However, (FAOSTAT, 2018) asserted that the average per capita protein intake in Nigeria was 51.7 g from which only 8.6 g came from animal sources, where as in developed countries, the average per capita protein intake was over 70 g with more than 55 g of animal protein. To alleviate this situation, practice of animal production in all entireties both at family and commercial levels must be explored.

To alleviate these situations all animal protein resources must be put to use. High cost of domestic chicken and its product necessitates harnessing the resources of other poultry species, small sized, easy to manage and less cost intensive poultry species like quail needs research attention. Quail eggs are highly nutritious. Despite their small size, they are packed with essential nutrients capable of healing certain ailment (Hewlings, 2017). These eggs are a rich source of high-quality protein, containing all the essential amino acids needed for growth and repair. Quail eggs contains important bio-active compound which may provide leads to discovery of more antimicrobials,promoting pharmacological improvements for treatment of various diseases (Gupta *et al.,* 2018). They are abundant in vitamins such as A, B_{12}, and D, which support vision, red blood cell production, and bone health. Quail eggs also provide important minerals like iron, calcium, and phosphorus. Overall, quail eggs offer a nutrient-dense option, contributing to a well-rounded and healthy diet (Gupta *et al.*, 2018).The medicinal values of quail eggs make them a feed resources of interest as, the harmful effects of antibiotics and drug resistance of some microorganisms and emergence of new diseases calls for alternative disease treatment measures (Gupta *et al*, 2018). In the case of quails,prevalent intestinal worms such as roundworms (*Ascaridia spp.*), cecal worms (*Heterakis spp.*), threadworms (*Capillaria spp.*), and tapeworms (*Raillietina and Choanotaenia spp.*) causes clinical problems for poultry. Clinical signs associated with high worm burdens can include diarrhea, depression, reduced weight gain, weight loss, anemia, worms in eggs, and decreased egg production.

There is need for alternative worm treatment measures that will not hamper on productivity. Turmeric (*Curcuma longa*), a domestic spice that has the various applications in the medicinal biology (Gupta *et al*., 2018) Tumeric produce a specific bioactive compound called *Curcumin*, a polyphenolic phytochemical with anti-inflammatory, anti-microbial, anti-cancerous and antioxidant properties. Turmeric is a natural antiseptic and antimicrobial solution for intestinal worms (Gupta *et al.,* 2018). Research has shown that dietary inclusion of turmeric can reduce interstinal parasites in poultry (Lee *et al.*, 2018). In addition to killing intestinal worms, it can also be effective against nausea, gassiness, bloating and abdominal pain. Getting these symptoms can be an indication of presence of intestinal worms. Additionally, turmeric has been found to improve egg quality characterics, such as yolk color, shell strength and albumen quality (Hewlings, 2017). Quails are an important poultry species, and their production is increasing globally. However, intestinal parasite and poor egg quality remain significant challenges in quail production. According to (Gupta *et al.*, 2018), feeding of turmeric rhizome powder in poultry diet helped to improve the morbidity and mortality of broiler chickens and is safe for the public health with no side effects (Lee *et al.*, 2018). The study aims to evaluate the effect of dietary inclusion of turmeric (C*urcuma longa*) on the intestinal parasite and egg quality characteristics in quails.

MATERIALS AND METHODS

Location and Area of the Study

The experiment was carried out at the poultry unit session of the Department of Animal Science Teaching and Research Farms, Faculty of Agriculture, Nnamdi Azikiwe University, Awka, Anambra State which is within the forest vegetation zone of the Southeastern part of Nigeria at latitude 6' 5" 10.1" N and longitude 7' 08" 31.9" E. The mean daily maximum temperature is usually 27ºC all over the year although it could reach 34º C in March and lowest during the harmattan months of December and January. The mean rainfall according to the local meteorology station which has maintained a record since 1978 reveals a mean rainfall of about 1600mm with a relative humidity of 80% at dawn .

Preparation of Experimental Pen

The battery cages were washed, fumigated with 20ml of formaldehyde solution, and the surface and the water drinkers were also washed. On arrival of the point of lay (POL) they were transferred to the cage and fed with (Hybrid layer mesh) and water.

Sourcing and preparation of the experimental material and test ingredients.

Fresh turmeric used for this experiment, were purchased from Eke-Awka market, Awka South. The turmeric was cut into slices and oven dried at a regulated temperature of 87^0C to retain the property of the turmeric plant. The

dried turmeric was churned into powdered with a blender (MODEL HR1751) for 10 minutes in the Food Science and Technology Laboratory Nnamdi Azikiwe University Awka. The blended Turmeric was kept stored in an airtight container. A Dewormer (Bactro-expeller) was bought from a Johom Veterinary Spot (Ziks Avenue, Awka) to deworm some.

Procurement and acclimatization of experimental quails

A total of 45 point of lay Japanese quail layers (*Coturnix japonica*) were purchased from "Jinik farms and transported down to the experimental site. They were housed in the layer's battery cage unit of the Animal Science, Research and Teaching farm in Nnamdi Azikiwe University Awka. The birds were allowed to acclimatize for one week before administering experimental drugs and treatments.

Experimental design

The experimental design used was Completely Randomized Design (CRD). Each part of three tiers battery cages housed birds on each of the respective treatment labelled T1, T2, T3, while each tier represents a replicate each labelled T1R1, T1R2, T1R3: T2R1, T2R2, T2R3: T3R1, T3R2, T3R3. The already purchased forty-five (45) quail birds were randomly allocated to these treatments and each replicate having five quail birds.

Management of experimental quails

Feeding: The quails were fed ad-libitum with (Hybrid layers mesh).

Watering: The first treatment comprised quails subjected to turmeric treatment; the second group of quails were placed on dewormer (Bactro-expeller); while the third group of quails were control without any treatment inclusion. 3 grams of turmeric powder were mixed in one (Lee *et al.*, 2018) liter of water daily for each treatment and shared among the replicate for quail subjected to turmeric treatment. The second groups of quails were dewormed with 1tea spoon (4.2g) of dewormer (Bactro-expeller) on the first and sixth week respectively. They were given water ad-libitum.

Sanitation: The drinkers and feeders were washed and cleaned every morning and faeces scrubbed and disposed at the faeces unit of the farm.

Data collection

The eggs were picked daily and labelled accordingly.

External Egg Quality Traits

Egg weight (EWT)= It was measured in grams by weighing the egg laid by all hens of the same Experimental diet, on weekly basis using (KT-121 ATEVON) weighing scale.

Egg Length (EL)= It was measured in centimeters (cm) and was taken on the longest egg parts using Vernier calipers.

Egg width (EWI)= It was measured in centimeters (cm) and was taken on the widest egg parts using Vernier calipers.

Shell Thickness (ST)= It was measured in millimeter (mm) using micrometer screw Guage.

Internal Egg Quality Trait

Yolk weight (YWT)= Each egg was cracked neatly with a table knife and the yolk was separated from the albumen into two Petri dish, then the Petri dish containing the yolk was placed on the digital scale and the reading was taken grams (g)

Yolk height (YH)=It was measured by dipping the rod of the Vernier calipers into the petri dish containing the yolk and reading from the Vernier calipers in cm after the egg was cracked and the yolk separated from the albumen in a separate Petri dish. It was measured in Centimeters (cm)

Yolk width (YW) =was measured as the the distance from one end of the chalazae to the other using a Vernier caliper. It was measured in centimeters (cm)

Yolk index (YI)= was determined as the ratio of YH (yolk height) to YW (yolk width).

Yolk Ratio (YR)= was determined by dividing the yolk weight by the Egg weight times 100%.

Albumen Weight (AWT)= Each egg was cracked nearly with a table knife and the yolk was separated from the albumen into two Petri dish, then the Petri dish containing the albumen was placed on the digital scale and the reading was taken in grams (g).

Albumen Height (AH)= It was measured by dipping the rod of the Vernier calipers into the petri dish containing the albumen and reading from the Vernier calipers in cm after the egg was cracked and the yolk separated from the albumen in a separate Petri dish. It was measured in centimeters (cm)

Haugh unit (HU) (%) = it was computed as 100 log (H+7.57-1.7W0.37),

Where H was the observed albumen height and

W, the observed weight of egg (Lee *et al*, 2018).

Intestinal Mucosa

Equipment used: Normal saline, cover ship slide, Petri dish, surgical blade.

The quail were weighed, sedated with chloroform and dissected, and the intestinal mucosa were removed, scrapped and placed in Normal saline (saline water) in petri dish. A drop of the intestinal mucosa suspended in normal saline was placed on a microscope slide, then covered with a glass slip and viewed under microscope at x 10 magnification.

Proximate Analysis.

The Proximate analysis was carried out on sample of the Turmeric using the guide provided by AOAC (2023). The analysis was done to know the moisture content, ash, crude protein, crude fiber, ether extract / fat, nitrogen free extract and dry matter content of the test material (turmeric). It was carried out at the Biochemistry Laboratory of the faculty of Biosicence at Nnamdi Azikiwe University Awka , Anambra state.

Phytochemical Analysis

Phytochemical analysis was carried out to determine the presence of saponin, flavonoid, phenol and alkaloid using the method of (Lee *et al*, 2018), and (Hewlings, 2017) respectively. It was carried out at the Biochemistry laboratory of the faculty of Bioscience at Nnamdi Azikiwe University Awka, Anambra state.

Statistical Analysis

Data collected was subjected to analysis of variance (ANOVA), Where significant differences were observed between treatments, means was compared using Duncan's New Multiple Range test (DNMRT) and SPSS-2023 software was used to analyse the data.

RESULTS AND DISCUSSIONS

Results

A total of 456 eggs were collected of which 204 were from quails subjected to turmeric treatment, 156 from quail placed on Dewormer and 96 eggs collected from quail on control treatment.

Proximate analysis.

Table 1 shows that turmeric contains a dry matter (91.00), moisture content (8.92), Ash content (2.85), crude fibre (4.60), crude protein (9.40), fat (6.85), Carbohydrate (67.38).

Proximate composition of turmeric

The result in Table 1 shows that turmeric contains 8.92% moisture, 2.85% ash, 91% dry matter, 4.60% crude fibre.it also contains 2.85 crude Protein and 67.38% carbohydrate. The result from this study agreed with the report of (Gupta *et al*, 2018) which reported that turmeric is an excellent source of protein and carbohydrate. The 2.85% ash shows that turmeric contains a reasonable amount of minerals. The fiber (4.60%) present in turmeric will help to cleanse the digestive tract of its consumer by removing potential carcinogens from the body and prevent the absorption of excess cholesterol (11).

Table 1. Proximate Composition of Turmeric.

Content(%)	%Composition
Moisture content.	8.92
Dry matter.	91.00
Ash content	2.85
Crude fibre.	4.60
Crude protein	9.40
Fat	6.85
Carbohydrate.	67.38

Phytochemical analysis

The result in Table 2 The phytochemical evaluation of turmeric rhizomes conducted by (Gupta *et al*., 2018) indicated presence of Alkaloids and Flavonoids and the absence of saponin and tannin, as compared to our result that shows the presence of saponin at 2.3%. The disparity found in this study can be due to the processing method used and the specie specific of turmeric. It shows that turmeric has antimicrobial, anti-inflammatory and antioxidants property because of the presence of alkaloid, phenol, flavonoids, tannins, saponin. Alkaloids showed that turmeric could be used in curing headache associated with hypertension, chronic catarrh. The result of the study agreed with the report of (Gupta *et al*., 2018) that makes turmeric an excellent feed additive /supplement for livestock especially ruminant and non- ruminant animals.

Table 2 Phytochemical Composition of Turmeric.

Parameter	Quantitative (%)
Phenol	4.51
Flavonoids	4.55
Tannins	0.53
Saponin	4.11
Alkaloids	6.60

Effect of turmeric on intestinal parasites.

From the results of Table 3 shows that treatment fed with turmeric has predominant intestinal parasite of *Strongyloide*s spp, while the treatment fed dewormer

(Bactro Expeller) recorded non intestinal parasite. The result shows that turmeric has no effect on intestinal parasites. It is shown statistically that there was no significant difference, and that dewormer performed well than turmeric as worm expeller on gut parasite.

Table 3: Effects of turmeric on intestinal parasites.

Treament.	Weight of birds.	Length of intestine	name of parasite	no of worms
Turmeric	130.0g	50inches	*Strongyliodes spp*	2
Dewormer.	140.6g	62inches.	Nil.	0
Control.	170.0g	60inches.	*Ascardiaspp*	1

Table 4 shows that quail subjected to turmeric-based diet recorded 2 worms count and quail placed on Control recorded one worm count and Dewormer with zero worm count.

Table 4: Turmeric-based diet and use of worm expeller on gut parasites.

Treatment.	Parasite.	Number of worms.	%Occurance
Turmeric.	*Strongyloides.*	2	100
Dewormer.	*Ascaridia.*	Nil.	0

Internal and External Egg Parameters of Quails fed with the Experimental Diet.

Table 5 shows the effect of turmeric and dewormer (Bactro-Expeller) on the external egg quality parameter of Japanese quails fed the Experimental diets. The turmeric supplementation group produced more eggs than the control group, which may be related to the bioactive components in turmeric. These findings of the present investigation were in agreement with that of (Hewlings, 2017) which stated that turmeric powder has a considerable impact on egg production in laying chicken. Egg weight showed significant difference among the external egg quality parameters of Japanese quail fed the experimental diets.

Table 5: Effect of turmeric-based diet on egg laying performance of quails.

Parameter	Control	Turmeric	Dewormer	±SEM
Eggwidth(cm)	2.46	2.52	2.55	0.04
Egg weight (g)	0.33^{b}	0.38^{ab}	0.47^{a}	0.02
Egglength(cm)	3.30	3.54	3.30	0.03
Egg shell thickness(mm)	8.33	8.72	8.45	0.13

^{abc}: means on the same row with different superscript differ significantly (P<0.05).

The Haugh unit (HU) is an objective measure of egg quality based on the logarithmic function of albumen height and egg weight. Hu values are almost the same for the dietary treatments. From Table (6) the result indicated that albumen height, Yolkindex,Yolk weight showed significant differences (P<0.05). Haugh unit value for all the treatments were above 90%, none of the treatment recorded values lower than the 75% haugh unit required for excellent quality eggs, According to United States Department of Agriculture (USDA-FAS, 2010) and (Gupta *et al.*, 2018). The albumen quality across dietary treatments was indicated by the Haugh unit value (95.82, 95.56 and 95.70). The result agreed with the findings of (Hewlings, 2017) and Akintunde *et al.* (2017) that Haugh unit was not influenced mainly by diet but that it was influenced by albumen consistency which is dependent on the age of hen, genetics and storage of the egg.

Table 6: Internal Egg quality parameters of Japanese quail feed the Experimental Diet

Parameter	Control	Turmeric	Dewormer	+-SEM
Yolk weights(g)	4.46	4.49[ab]	5.20[abc]	0.11
Yolk lenght(cm)	3.94	3.84	3.90	0.04
Yolk width(cm)	2.16	2.18	2.24	0.02
Yolk index	2.09	2.95[ab]	3.38[abc]	0.18
Yolk ratio	1.84	1.56	0.98	0.08
Albumen weight(g)	4.46	4.64	4.80	0.12
Albumen height (cm)	5.22	5.45	5.64	0.13
Haugh unit	95.82	95.56	95.70	0.24

[a,b,c:] *Means on the same row with superscript differ significantly (P < 0.05)*

CONCLUSION AND RECOMMENDATION

In conclusion this study reveals that *Curcuma longa* are good source of crude protein, crude fiber, ash, carbohydrate, moisture content which have the potential of being combined in livestock nutrition as feed supplement or additives for improved health and body growth. Turmeric showed presence of some important phytochemicals like alkaloids, tannins, phenolic compound, saponins and flavonoids and also improved egg production.From the results of the study, it can also be concluded that quail can be fed with turmeric in their water without any detrimental effect on their performance and quality. It can also be concluded that turmeric had no effect on the control of intestinal parasites such as *Ascaridaspp* and *Strongyloidesspp* and therefore should not be used as preventive and control measures. From the conclusion, quail can be fed with turmeric in their water without any detrimental effect on their performance, quality. and that turmeric had no effect on the control of intestinal parasites such as *Ascaridaspp* and *Strongyloidesspp* and therefore should not be used as preventive and control measures. Further research is needed to determine the optimal dosage and duration of *Curcumins* supplement and its long-term effect on birds' health, productivity and their abilities to control and expel intestinal worm from quails.

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Authors Contributions

CIE initiated the project title and monitored the experiment. FCE reported the findings of the experiment into journals article. CJE conducted the experiment. BNE and NJE corrected the worked.

Ethical Statement

Not applicable

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