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Chemical Composition, Egg Laying Performance and Egg Qualities of Indigenous Layers Fed Diets Containing *Mondai Whitei*

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Abstract

Spices and herbs have long been used to help manage diseases in animals. However, they have been disregarded as a result of the use of artificial antibiotic growth promoters (AGP). Diseases can be treated with the help of the Mondai whitei plant. The Poultry Unit of the Teaching and Research Farms at the Federal University of Agriculture Abeokuta, Ogun State, Nigeria, was used for this research. This research examined the responses of 105 indigenous layers, consisting of 75 females and 30 males, to the addition of Mondai whitei at five different dietary levels: 0 mg/kg, 500 mg/kg, 1000 mg/kg, 1500 mg/kg, and 2000 mg/kg. Five dietary treatments totaling three replicates of seven birds each were given to the birds. The design of the experiment was entirely randomized. Growth performance, internal and external egg quality, and the lipid profile of the eggs in each of the three phases (I, II, and III) are among the data collected. The findings indicated that there were significant differences in average body weight, egg weight, and maturity age (p>0.05). At phase I, there were no statistically significant differences in feed intake, hen day production, FCR, weight gain, daily weight gain, or eggs per dozen (p0.05). Packed cell volume recorded highest (31.00% and 28%) at inclusion levels of 500 mg/kg and 1000 mg/kg. At phase II the packed cell volume recorded highest (30.00% and 35.67%) at the inclusion levels of 1000mg/kg and 2000mg/kg and red blood cell was highest (6.40g/dl) at the inclusion levels of 2000 mg/kg. At phase I while in phase II, total protein was highest (6.80g/dl) and at phase III it was highest (7.50g/dl) at control levels (0mg/kg) and lowest (551.87mg/dl) at inclusion levels of 1000 mg/kg. At phase I and phase II recorded higher (653.95 mg/kg) at inclusion levels of (0mg/kg) and lower (574.63 mg/dl) at 1500mg/kg inclusion levels. This study concluded that inclusion level of Mondai whitei up to 2000 mg\kg improved the weight gain and reduced total egg cholesterol at the same levels of inclusion.

Keywords: *Mondai whitei*, Herbs, antimicrobial, antibiotics, poultry.

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Introduction

The need for protein is growing as a result of population growth, and animal production is an economical and abundant way to meet this need. Nigeria is the country in Africa with the biggest population, estimated at 200 million. The average Nigerian's diet is severely lacking in animal protein, hence increasing livestock output to meet animal demands is a reasonable approach. Poultry has become a popular enterprise for small-scale farmers who contribute significantly to the national economy; therefore, it's worth to the economy cannot be overstated. Aboki *et al.* (2013) stated that the profession significantly affects Nigeria's ability to provide animal feed and increase employment opportunities. Native chickens are widely available and kept by the majority of rural residents in tropical and subtropical regions' rural areas. Native African chickens can tolerate harsh environments, flourish in remote areas, need little to no maintenance, and adjust to fluctuations in the supply of food.

Antibiotics used as growth enhancers had faced fierce criticism throughout the preceding ten years. It makes sense to be concerned about the potential drawbacks of their use, including the development of resistant microbes and potential harm to human health Rahmatnejad *et al*. (2009). This has prompted breeders to search for alternatives that eliminate adverse reactions in chickens and possible health risks to humans.

Drug residues in meat and bacterial drug resistance are two important reasons why the use of antibiotics is regulated Peric et al., (2010). Probiotics, prebiotics, and medicinal herbs have been used as natural additions in poultry feed to improve the health and immune response of chickens Peric et al., (2010). As potential sources of herbal feed additives for hens, new medicinal herbs become accessible every day (Suriya et al., 2012). Since most Nigerian villages do not have access to model feed additives that may be used to make chicken feed, *Mondai whitei* is a possible feed additive that should be looked into. This study looks at the composition, yield, and quality of eggs produced by native layers fed diets with *Mondai whitei*.

Methodology

Study Area:

This study was conducted at the Federal University of Agriculture Abeokuta, Ogun State, Nigeria's Poultry Unit of the Teaching and Research Farms. The region lies in South-Western Nigeria's humid tropical zone, where the minimum and highest temperatures are 20.66 and 35.480C, respectively. It is located around latitude 7013'49.46"N and longitude 3026'11.98"E, 76 meters above sea level. It experiences 1037mm of precipitation on average per year (Google Earth, 2015).

Sources and processing of test ingredients

Mondei whitei (Isirigun) were obtained from the local market within Ogun State Nigeria. The roots were chopped into bits followed by sun drying for 14 days (± 90% DM), and pulverized using laboratory mill (1mm sieve) to obtain a product herein referred to as *Mondai whitei* meal (MWM). The milled test ingredient was stored in an air tight container at room temperature until when needed.

Proximate analysis of *Mondai whitei* (Isirigun)

Proximate analysis of *Mondai whitei* root and experimental diets were carried out according to the methods of AOAC (2012).

Experiment diets

Five experimental diets containing five inclusion levels of *Mondai whitei* meal (MWM) were formulated. The inclusion levels of the test ingredients (MWM) mg/kg are shown below:
Diet 1-Inclusion of MWM at 0 mg/kg feed
Diet 2- Inclusion of MWM at 500 mg/kg feed
Diet 3- Inclusion of MWM at 1000 mg/kg feed
Diet 4- Inclusion of MWM at 1500 mg/kg feed
Diet 5- Inclusion of MWM at 2000 mg/kg feed

Experimental birds and management

A total of 105 indigenous chickens were used, comprising of seventy-five females and thirty males, the birds were fed *ad libitum* and managed intensively throughout the duration of the experiment (fifteen weeks).

Experiment design

One hundred and five (105) indigenous layers (Yoruba eco-type) were used for the experiment. The birds were sixteen weeks (16 weeks) old with an adaptation period of two weeks. They were assigned into five treatment groups of twenty-one (21) pullets each which was further divided into seven (7) pullets' chickens per replicate containing five females and two males in a Complete Randomized Experimental Design. First eggs were considered. Data collection commences at nineteen weeks (19 weeks) and was carried out for fifteen weeks (15 weeks). The fifteen weeks periods of data collection was grouped into 3 phases; eash phase made up of five (5) weeks thus;

Phase I	19 – 21 weeks
Phase II	21 – 26 weeks
Phase III	27 – 32 weeks

Data collection

The following data were collected

Egg production parameters / Reproductive traits

Age at first lay: This was taken as the number of days from hatch to the day the first egg is laid.

Body weight of hen at first lay: At first egg, the birds per replicate were weighed; the average body weight was used as the body weight at first egg.

Weight of first egg: This was determined by using a sensitive Mettle-Toledo® PB 3002 Electronic scale with an accuracy of 0.01g to weigh each of the first eggs laid.

Hen day production: The total number of eggs laid per replicate per day for the period of lay was recorded. On weekly basis, the percentage Hen Day egg Production (% HDP) was found, followed by the calculation of mean % HDP

$$\% \text{ HDP} = \frac{\text{Total no. of eggs laid} \quad \text{x}100}{\text{No of birds}}$$

Egg Quality Evaluation

At 5, 10, and 15 weeks after laying, four eggs per replication were sampled in order to assess the quality of the eggs. Every egg sampled was taken before noon on the same day, at each interval. Before being weighed, the eggs were thoroughly cleaned using tissue paper to get rid of any feces. Determining the quality of the eggs was done within 12 hours of egg collection. After weighing, each egg was cracked at the equatorial area, and the contents carefully emptied into a white, flat plate to determine the internal quality of the egg.

External Egg Qualities

Egg weight: A Mettler-toledo ® PB 3002 electronic scale with a 0.01g sensitivity was used to quantify this.

Egg length: The longitudinal distance between the narrow and broad ends of each egg was used to measure its length. The length of the egg was measured using a vernier caliper that had a 0.1mm precision.

Egg Width: The diameter of the widest cross-sectional region was used to measure the breadth of each egg. Vernier calipers were used for the measurement.

Egg Shape Index (ESI): This was calculated as the percentage of the egg breath (width) to the egg length (Panda, 1996). The formula is as follows.

$$\text{Egg Shape Index} = \frac{\text{Width of egg (mm)}}{\text{Length of egg (mm)}} \times \frac{100}{1}$$

Shell weights: In egg trays, the egg shell was air dried for a full 72 hours. The weight of each individual shell was ascertained using the Mettler-Toledo PB 3002 electronic balance. The yolk weight of each individual was recorded to the closest 0.01g. For each egg sample, the shell weight was recorded as a proportion of the egg weight, or percent shell (% shell).

$$\% \text{ shell} = \frac{\text{shell weight}}{\text{Egg weight}} \text{x}100$$

Shell thickness: Using a micrometer screw gauge, the thickness of each unique dried egg shell was measured to the closest 0.01mm. The shell thickness was determined by taking the mean of the three measurements at the narrow, broad, and midpoint positions.

Internal quality: Within 24 hours of oviposition, internal egg quality characteristics were determined. Using a blunt table knife, each egg was carefully cracked at the equatorial area to prevent the albumen from being ruptured, following weighing. After that, the mixture is gradually poured into a level dish to assess the inside quality of the egg.

Albumen height: Using a P6086 Spherometer, a tripod micrometer with an accuracy of 0.01mm, the albumen height was measured off the chalazae at a place roughly halfway between the inner and outer circumferences of the thick white.

Yolk weight: Using a plastic egg separator, the yolk was removed from the albumen and then weighed using an electronic balance (Mettler-Toledo PB 3002). The yolk weight of each individual was recorded to the closest 0.01g. Each egg sample's yolk percentage was recorded and reported as a percentage of the egg weight.

$$\%\text{ Yolk weight} = \frac{\text{yolk weight}}{\text{Egg weight}} x100$$

Albumen weight: For each individual egg sample, the albumen weight was calculated as the difference between the weight of the egg and the combined weight of the yolk and egg shell.

$$\%\text{ Albumen} = \frac{\text{albumen weight}}{\text{Egg weight}} \text{x}\,100$$

Yolk colour: The Hoffman-La-Roche® Yolk color fan was used to grade the yolk's color, with scores ranging from 1 (light yellow) to 15 (dark orange yellow).

Haugh Unit (HU): Using Haugh's formula (1937), the haugh unit for each individual egg sample was determined. This unit of measurement indicates the freshness of the egg based on the albumen thickness.

$$\text{H.U.} = 100\log (H + 7.5 - 1.7\, W^{0.37})$$

Where, H=Albumen height

W=Egg weight in gram Mm

Statistical analysis

The collected data were all run through a fully randomized, one-way analysis of variance, and the Duncan multiple range test was used to distinguish between the significant means.

Statistical model

$Y_{ij} = \mu + T_i + \sum_{ij}$

Y_{ij} – Dependent variable

μ - Population mean

T_i – Effect of *Mondai whitei*

$\sum_{ij}$ – Random residual error

Result and Discussion

Table I: Chemical composition of *Mondai whitei contains* in percentage

Proximate(%)	Quantity	Minerals(mg/g)	Quantity	Phytochemicals	Quantity
Dry matter	95.23	Magnesium	9.34	Tannin	0.840
Ether extract	5.00	Potassium	10.31	Steroid	0.362
Crude protein	12.38	Calcium	9.12	Saponin	1.043
Crude fibre	17.50	Phosphorus	6.85	Flavonoid	0.872
Ash	6.00	Sodium	5.61	Alkaloid	0.451
NFE	59.12	Iron	0.20		

NFE= Nitrogen free extract

Proximate composition of test ingredient (%)

The approximate ingredient composition for the test is shown in Table 1, *Mondai whitei* has dry matter content of 95.6%, Crude protein of 12.38%, ether extract of 5.00%, ash of 6.00%, Crude fibre of 17.50% and NFE of 59.12%.The mineral composition of the test ingredients has magnesium 9.34, potassium 10.31, calcium 9.12, phosphorus 6.85, sodium 5.61, iron 0.20 and manganese (0.74).The quantitative assay of phytochemical contents, *Mondai whitei* has tannin 0.840, flavonoid 0.872, steroid 0.362, saponin 1.043 and alkaloid, 0.451.

Table II: Effect of *Mondai whitei* on body weight, age at maturity and first egg weight

Inclusion (mg/kg) Levels							
Parameters/level of inclusion	0	500	1000	1500	2000	SEM	P.val
Age at maturity (days)	179.69	182.33	182.00	179.00	178.00	0.87	1.39
Egg weight (g)	33.50	37.18	30.31	34.54	38.03	0.003	0.83
Average body weight (g)	936.7	913.3	913.3	950.0	906.7	0.81	1.20

SEM= Standard error of mean

The result of *Mondai whitei* on body weight, age at maturity and first egg weight was presented in Table 2. *Mondai whitei* had no significant (p>0.05) effect on the age maturity, body weight and egg weight of the birds. Birds on inclusion levels of 500 mg/kg and 1000 mg/kg recorded higher (182.33 and 182.00 respectively) at maturity age while average body weight was highest (950g) at inclusion levels of 1500 mg/kg and also egg weight was highest (38.03) at inclusion levels of 2000 mg/kg.

Table III: Effect of *Mondaiwhitei* on the performance of indigenous layers

Inclusion (mg/kg) levels							
Parameters / level of inclusion	0 mg/kg	500	1000	1500	2000	SEM	Pval
Phase I (0-5 weeks)							
Total feed intake(g/bird)	88.67	87.33	89.33	89.00	83.00	1.10	0.25
Hen day production (%)	18.53	11.63	14.00	25.97	24.53	2.32	0.20
FCR {feed(g)/dozen eggs}	238.72	345.37	277.26	164.17	163.82	25.38	0.38
Weight gain (g)	140.00	180.00	166.67	163.33	156.67	5.06	0.13
Daily weight gain (g)	4.00	5.14	4.76	4.67	4.48	0.14	0.13
Eggs per dozen	0.43	0.27	0.33	0.61	0.57	0.05	0.20
Mortality	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phase II (5-10 weeks)							
Total feed intake(g/bird)	119.60	123.67	121.77	122.03	120.40	0.73	0.49
Hen day production (%)	34.87	35.00	28.57	39.17	34.83	1.68	0.44
FCR {feed(g)/dozen eggs}	119.35	132.28	157.19	115.84	133.28	7.65	0.51
Weight gain (g)	90.00	56.67	120.00	86.67	53.33	8.83	0.07
Daily weight gain (g)	2.50	1.62	3.42	2.48	1.52	0.25	0.08

Eggs per dozen	1.01	0.94	0.83	1.06	0.96	0.05	0.70
Mortality (%)	0.33	0.07	0.00	0.00	0.13	0.001	0.08
Phase III (10-15 weeks)							
Total feed intake(g/bird)	119.23 ^{b}	123.10 ^{a}	121.63^{ab}	119.90 ^{b}	121.00^{ab}	0.48	0.05
Hen day production (%)	21.63	16.00	17.53	16.37	21.57	1.25	0.45
FCR {feed(g)/dozen eggs}	224.29	291.54	239.45	285.71	202.99	18.33	0.52
Weight gain (g)	50.67 ^{b}	56.67 ^{b}	60.00 ^{b}	116.67 ^{a}	73.33 ^{a}	7.58	0.01
Daily weight gain (g)	1.79 ^{b}	1.62 ^{b}	1.71 ^{b}	3.33 ^{a}	2.09 ^{b}	0.21	0.02
Eggs per dozen	0.61	0.44	0.51	0.45	0.63	0.04	0.51
Mortality	0.00	0.00	0.00	0.00	0.00	0.00	0.00

^{a,b} Means with the same superscripts along the rows are not significantly different
SEM= Standard error of mea

Table 3 displays the outcome of Mondai whitei's influence on the ability of indigenous layers to lay. The effects of Mondai whitei on total feed intake, hen day production, daily weight gain, and eggs per dozen at 0–5 weeks in lay are displayed in the table. No significant (p<0.05) changes were found. Birds fed at inclusion levels of 500mg/kg was highly significant (p>0.05) for daily weight gain and birds on inclusion levels of 1000mg/kg and 1500 mg/kg recorded higher (89.33g and 89.00g) total feed intake while inclusion levels of 2000 mg/kg recorded the lowest. Egg per dozen recorded higher (0.61) at inclusion levels of 1500 mg/kg follow by 2000 mg/kg and lower in 500 mg/kg. Weight gain recorded highest (180g) at inclusion levels of 500 mg/kg while it is lower (140g) at inclusion levels of 0 mg/kg. Hen day production recorded lowest (11.63) percentage at 500 mg/kg but slightly higher 25.97% and 24.53% at inclusion levels of 1500 mg/kg and 2000mg/kg and no mortality recorded across the treatment.In phase II, the result shows that there is no significant (p>0.05) differences across the treatments. Total feed intake was highest (123.67g and 122.03g) at inclusion levels of 500 mg/kg and 1500 mg/kg and daily weight gain was high (3.42g) at inclusion levels 1000 mg/kg. In phase III, weight gain and daily weight gain were significant (p<0.05). There was no significant (p>0.05) differences in hen day production, FCR, egg per dozen and as well as mortality.

Table IV: Impact of Mondai whitei on the quality of eggs both inside and outside

Inclusion (mg/kg) levels **Parameters/level of Inclusion**	0	500	1000	1500	2000	SEM	Pval
Phase I (0-5 weeks)							
Egg weight (g)	34.25^{b}	36.74^{ab}	36.35^{ab}	34.23 ^{b}	37.78^{a}	0.49	0.05
Egg length (mm)	48.75	50.19	48.84	47.60	50.09	0.41	0.25
Egg width (mm)	35.02	35.86	36.47	35.48	34.39	0.24	0.43
Shell weight (g)	3.86	3.58	3.70	3.35	3.97	0.91	0.23
Shell thickness (mm)	0.43	0.49	0.59	0.42	0.45	0.02	0.15
Egg index shape	71.93	71.55	74.67	74.55	70.69	0.81	0.44
Album weight (g)	17.29	20.12	10.09	17.45	17.24	0.42	0.07

Albumin height (mm)	6.05	4.56	5.18	4.78	5.09	0.32	0.70
Yolk weight (g)	11.16	11.40	12.60	10.75	12.33	0.33	0.38
Yolk colour	6.33	8.67	6.33	7.00	8.67	0.40	0.11
Haugh Unit	85.91	71.46	79.58	77.23	77.83	2.71	0.63
Phase II (5-10 weeks)							
Egg weight (g)	36.97	34.97	40.24	37.22	38.78	0.72	0.17
Egg length (mm)	48.38^{b}	48.37^{b}	50.8^{a}	48.60^{b}	49.96^{ab}	0.35	0.04
Egg width (mm)	36.41	35.52	37.64	37.07	37.24	0.32	0.25
Shell weight (g)	3.86	3.73	3.99	3.32	3.99	0.11	0.25
Shell thickness (mm)	0.48	0.50	0.52	0.47	0.53	0.02	0.82
Egg index shape	75.29	73.46	74.62	76.26	74.57	0.54	0.56
Album weight (g)	18.89	17.80	21.56	20.24	19.87	0.48	0.13
Albumin height (mm)	4.94	4.86	4.77	4.67	4.88	0.15	0.99
Yolk weight (g)	12.58	11.37	12.96	12.66	12.77	0.20	0.06
Yolk colour	2.67	4.67	5.00	4.67	3.67	0.41	0.40
Haugh Unit	77.40	77.80	74.22	75.26	76.39	1.10	0.87
Phase III (10-15 weeks)							
Egg weight (g)	35.61	37.57	38.82	37.46	38.95	0.51	0.25
Egg length (mm)	49.76	50.34	49.77	49.68	50.38	0.27	0.90
Egg width (mm)	36.95	36.39	38.02	36.85	37.03	0.26	0.41
Shell weight (g)	3.99	3.84	4.25	3.37	4.13	0.13	0.24
Shell thickness (mm)	0.49	0.48	0.52	0.47	0.54	0.02	0.75
Egg index shape	74.25	72.28	76.42	74.20	73.53	0.55	0.25
Album weight (g)	18.12^{b}	19.24^{b}	20.46^{ab}	20.48^{ab}	22.19	0.48	0.05
Albumin height (mm)	5.32^{ab}	5.52^{ab}	5.38^{ab}	4.43^{b}	5.98^{a}	0.16	0.004
Yolk weight (g)	12.71	12.95	13.39	13.55	13.97	0.20	0.29
Yolk colour	11.00	7.67	8.00	8.00	9.33	0.54	0.28
Haugh Unit	78.10	81.42	79.93	73.48	83.82	0.18	0.06

^{a,b} Means with the same superscripts along the rows are not significantly different
SEM= Standard error of mea

Table 4 displays the external and internal egg quality of the indigenous layers. The findings showed that, at phase I, the albumin weight, yolk color, haugh unit, egg length, egg width, and shell weight were not significant (p>0.05), nor were the albumin weight, albumin height, or egg shape index. The only significant result was the egg weight (p>0.05). Phase II results showed that while there were no significant (p>0.05) variations in the haugh unit, albumin height, shell weight, egg form index, shell thickness, shell weight, and egg width, there were significant (p<0.05) differences in the egg length and yolk color. In phase III, there was a significant (p<0.05) difference in shell weight but not in egg weight, length, width, or form index (p>0.05).

The haugh unit, albumin weight, and albumin height did not differ substantially (p>0.05). At the inclusion levels of 1000 mg/kg and 2000 mg/kg, the weight of the eggs was high (38.82g and 38.95g). At inclusion levels of 1000 mg/kg, the egg shape index was at its greatest (76.42), and at inclusion levels of 500 mg/kg and 2000 mg/kg, the haugh unit was at its highest (81.42 and 83.82).

Conclusion and Recommendation

In conclusion,. The consumption of feed was enhanced when birds were fed diets containing Mondai whitei at inclusion levels of 1000 mg/kg and 1500 mg/kg. The weight gain is improved by adding Mondai whitei at dosages of 500 mg/kg, 1000 mg/kg, 1500 mg/kg, and 2000 mg/kg. Phase I inclusion levels of 1500 mg/kg and 2000 mg/kg, respectively, had an impact on hen day output; phase II inclusion levels of 500 mg/kg and 1500 mg/kg did the same. A reduction in total egg cholesterol was observed at 500 mg/kg, 1000 mg/kg, and 1500 mg/kg inclusion levels. The recommendation called for 500 mg/kg, 1000 mg/kg, and 1500 mg/kg of Mondaiwhitei to be supplemented in the diet. Adding Mondaiwhitei to bird diets increased feed consumption at inclusion levels of 1000 mg/kg and 1500 mg/kg. The addition of 500 mg/kg, 1000 mg/kg, 1500 mg/kg, and 2000 mg/kg of Mondaiwhitei improves the weight increase. Phase I saw effects on hen day production at inclusion levels of 1500 mg/kg and 2000 mg/kg, as well as 500 mg/kg and 1500 mg/kg, respectively. Total egg cholesterol decreased at 500 mg/kg, 1000 mg/kg, and 1500 mg/kg inclusion levels. The recommendation was to increase egg weight, shell weight, albumin quality, and yolk color by including 500 mg/kg, 1000 mg/kg, and 1500 mg/kg of Mondaiwhitei in the diet.

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