Direct RESEARCH JOURNALS

Direct Research Journal of Agriculture and Food Science
Vol.7 (9), pp. 271-274, September 2019
ISSN 2354-4147
DOI: https://doi.org/10.5281/zenodo.3460888
Article Number: DRJAFS99537242

https://directresearchpublisher.org/drjafs/

Full Length Research Paper

Some egg quality indices of laying hens fed varying levels of bambara nut sievate

Obih, T. K. O.* and Esiegwu, A. C.

Department of Animal Science and Fisheries, Imo State University, P.M.B 2000, Owerri, Imo State, Nigeria.
* Corresponding Author E-mail: cabofarm@yahoo.com

Received 1 September 2019; Accepted 21 September, 2019

The study conducted to determine egg quality indices of laying hens fed varying levels of Bambara nut sievate (BNS) at 0%, 5%, 15% and 20%, 360 points of lay Isa brown pullets were used in a completely randomized design. The birds were randomly allotted to four treatment groups with 90 birds in each treatment denoted as T_1, T_2, T_3 and T_4 which represented inclusion levels of 0%, 5%, 15% and 20% respectively. Each treatment was further replicated 3 times. The experiment lasted for twelve weeks starting from the point of 40% hen day production. Egg indices were determined every other week from fresh eggs collected. With the exception of eggshell weight, Albumen length and Haugh unit which were statistically different ($p<0.05$), all the other indices determined including egg weight, egg length, egg width, eggshell percentage, eggshell thickness, albumen height, albumen width, yolk heights, and yolk width were statistically similar ($p>0.05$). Results showed that egg indices measured did not maintain any particular trend as the inclusion level of BNS increased from T_1 to T_4 and inclusion of BNS in the diets of layers did not impact negatively on the quality of tested hens' eggs.

Keywords: Laying hens, egg quality indices, bambara nut sievate

INTRODUCTION

Egg is one of the most nutritious and complete food to man. It has a high biological value and in qualitative terms contains all the nutrients for growth and nourishment of the body. The global production of table eggs is observed to continuously increase. In 2013, global production of table eggs was 68.3 million tonnes (Global Poultry Trends, 2014), and is expected to exceed 70.0 million metric tonnes annually from the year 2020 (FAO, 2002). Such a high demand for table eggs is due to the high stability of the amino acid composition of egg albumen that has been acknowledged as reference protein for humans (FAO/WHO/UNU 2007). In addition, in 2006, the American Heart Association revised and reversed previous position on egg consumption and currently does not impose any restrictions on the number of eggs consumed (American Heart Association, 2006).

Eggs are not under religious and cultural constraints in most countries of the world and therefore can constitute the main source of protein to resign from the consumption of meat. FAO recommendation in 2004 acknowledged that poultry egg contains adequate quantities and qualities (in terms of limiting amino acids) of protein for meeting human nutritional requirements. However, in most underdeveloped and developing countries of the world, the emphasis is usually on quantity and not much on quality. The major constraint towards increased egg production in Nigeria has remained the exorbitant and ever increasing cost of conventional feed stuffs and ingredients (Obih and Ekenyem, 2010a). FAO (2017) had recommended the use of local feed ingredients especially agricultural by-products as substitutes for the conventional ones.

Obih and Ekenyem (2010b) suggested that such local feed ingredients must be available, can be processed easily, must be of fair nutritive value, should have low cost of procurement and should be amenable to removal of toxic/anti-nutritive factors where they exist. One of such alternative feed ingredient is the Bambara nut (*rigna subterranean (L) verdc*) sievate. This study therefore was embarked upon to evaluate the replacement value of bambara nut sievate for soyabean meal on the egg quality indices of laying hens.

MATERIALS AND METHODS

Experimental site

This study was carried out at the poultry unit of the Imo State University Teaching and Research Farm, Owerri, Nigeria. Situated on longitudes 7°, 01^{1}, 06^{11} E and 7°, 03^{1}, 0^{11} E and latitudes 5°, 28^{1}, 24^{11} N and 5°, 30^{1}, 00^{11} N (Imo State Ministry of Lands and Survey Atlas, 2004).

Preparation of experimental diets

Bambara seeds were procured from the local market and subjected to hammer milling and thereafter sieving to separate the flour from the offal. The offal was subjected to proximate analysis at the Animal Nutrition Laboratory of the Imo State University, Owerri according to AOAC, (2010). Other feed ingredients were procured from reputable vendors (crushed where necessary) and mixed according to the formulae shown in (Tables 1 and 2).

Procurement and rearing of experimental birds

A total of 360 point of lay (18 weeks old) Isa brown breed of pullets were procured from a reputable farm acclimatized for seven days and reared on deep litter in a standard tropical poultry building. Twelve pens (each to accommodate 30 pullets) were carved out of within the building. The 360 pullets were randomly divided into four treatment groups and were assigned to dietary treatments designated T_1, T_2, T_3 and T_4 containing 0%, 5%, 15% and 20% respectively. Each of the treatments was further replicated three times in a completely randomized design. Standard and sound management practices of sanitation, appropriate vaccination and medication were strictly adhered to throughout the period of this study. Water was supplied ad libitum while known weights of each treatment diet were administered to the laying hens. The study lasted for 12 weeks from the day of 40% hen day production.

Experimental design, data collection and data analysis

The experimental design was completely randomized design (CRD). Each of the twelve replicates had 30 birds. 30 eggs from each replicate were analyzed every week and at the end of the 12^{th} week for egg indices of egg weight, eggshell weight, egg length, egg width, eggshell thickness, eggshell percentage, albumen height (cm), albumen length, albumen width, yolk height, and yolk width while the Haugh unit was calculated from the formula.

$Hu = 100\log (H + 7.5 = 1.7W^{0.37})$ according to Oluyemi and Roberts, (2007).
Where H = observed albumen height (mm)
W = observed weight of egg (g)

All data collected were subjected to analysis of variance (Steel and Torrie, 1980) while differences within treatment means were separated using Duncan's Multiple range test as outlined by Onuh and Igwemma, (2003).

RESULTS AND DISCUSSION

Results of egg quality indices of laying hens fed graded levels of Bambara nut sievate (BNS) are shown in (Table 3). Results showed no significant differences ($p>0.05$) between treatment means for egg weight (g), egg length (cm), egg width (cm), eggshell percentage, eggshell thickness (mm), albumen height (mm), albumen width (cm), yolk height (cm), and yolk width (cm) whereas eggshell weight (g), albumen length (cm), and Haugh unit differed significantly ($p<0.05$) between treatment means. The eggshell weights increased with increasing % inclusion levels of BNS up 15% before it declined. Possibly, phytate (phytic acid) present in all legumes and which has a strong binding affinity for calcium, magnesium etc by preventing their absorption (Schiemmer *et al.,* 2009), may have reduced calcium availability required for egg calcification at higher inclusion levels of up 20%. However all the values for shell weight fell within the range reported by Kabir *et al.* (2014) for strains of chicken reared in Nigeria. It is estimated that a shell thickness 0.33 mm is required if the egg is to have more than 50% chances of normal market handling without breakage (Kabir and Mohammed, 2011). Albumen length differed significantly ($p<0.05$) among treatment means but did not follow any particular trend (Table 3). The values for albumen height, albumen width, yolk height and yolk width were similar ($p>0.05$) among treatment means, suggesting that all the eggs produced in this study were fresh and of standard quality and in conformity with the standard of commercial egg production guide (Ravindran and Blair, 1993). The values for yolk height which ranged from 1.77 to 2.01 cm were however higher than 1.78 cm report by Tadesse *et al.* (2015) and 1.85 cm reported by Sarica *et al.* (2012) for Isa Brown layers. The mean albumen height from this study is higher than the result reported by Fayeye *et al.* (2005), and Momoh *et al*., (2010).

Table 1. Proximate composition of bambara nut sievate (BNS).

Nutrients	Values (%)
Moisture	8.82
Crude protein	18.61
Crude fat	5.04
Crude fiber	5.18
Total ash	2.31
NFE	60.04
ME (kcal)	2973.23

Table 2. Ingredients and nutrient composition of experimental diets of laying hens.

Ingredients (%)	% inclusion levels of BNS			
	T_1 (0%)	T_2 (5%)	T_3 (15%)	T_4 (20%)
Whole Maize	50.00	50.00	50.00	50.00
Soybean meal	20.00	15.00	5.00	0.00
Bambara Nut Sievate (BNS)	0.00	5.00	15.00	20.00
Wheat offal	10.50	12.00	13.00	14.00
Palm kernel cake	6.70	5.20	4.20	3.20
Fish meal	4.00	4.00	4.00	4.00
Bone meal	8.00	8.00	8.00	8.00
Common salt	0.30	0.30	0.30	0.30
Vit./min premix (layer)	0.25	0.25	0.25	0.25
L-lysine	0.15	0.15	0.15	0.15
DL-methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated Nutrient Composition				
Dry matter	88.51	88.55	88.57	88.54
% crude protein	18.14	18.12	18.11	18.13
ME (kcal/kg)	2723.48	2727.14	2734.40	2742.12
% crude fibre	4.04	3.97	3.84	3.78
% ether extract	3.65	3.73	3.90	3.96
% calcium	3.32	3.32	3.34	3.35
% phosphorus	2.21	2.22	2.23	2.23
% Lysine	1.05	1.05	1.06	1.05
% methionine	0.47	0.47	0.48	0.47

Table 3. Egg quality indices of laying hens fed varying levels of Bambara nut sievate**.**

Parameter	T_1	T_2	T_3	T_4	SEM
Egg weight (g)	60.23	58.62	59.69	57.82	0.61
Egg length (cm)	4.14	4.14	4.19	4.16	0.02
Egg width (cm)	2.91	2.87	2.87	2.83	0.02
Eggshell weight (g)	5.27^{ab}	5.41^{a}	5.46^{a}	4.78^{b}	0.10
Eggshell percentage	8.72	9.22	9.16	8.26	0.18
Eggshell thickness (mm)	0.33	0.34	0.34	0.36	0.10
Albumen height (mm)	7.16	7.18	7.40	7.28	0.04
Albumen length (cm)	7.47^{a}	7.40^{a}	6.89^{b}	7.19^{ab}	0.09
Albumen width (cm)	6.23	6.08	5.66	5.98	0.09
Yolk height (cm)	1.77	1.87	2.01	1.78	0.04
Yolk width (cm)	3.93	3.99	3.90	4.05	0.03
Haugh unit	83.91^{b}	84.59^{ab}	85.65^{ab}	85.73^{a}	0.32

Means with different superscripts on the same horizontal row are significantly different ($p<0.05$) **SEM:** Standard Error of Mean.

Generally, the albumen has a major influence on egg quality and large proportion of firm thick white albumen indicate high egg quality and ultimately lead to high Haugh unit (Silversides and Budgelit, 2004). Albumen height and Haugh unit have correlative relationship (Oluyemi and Roberts, 2007). The Haugh unit is the gold standard of quality testing and a measure of egg protein quality based on the height of the albumen. The Haugh unit should not be less than 70 (Oluyemi and Roberts 2007). The Haugh unit range of 83.91 – 85.73 obtained in

this study suggest that BNS maintained good albumen and its value since, the value of the Haugh unit increased with increase in % inclusion rate of BNS.

Conclusion

Results from this study showed that Bambara nut sievate supported all indices for good quality egg especially the Haugh unit and could therefore be component of layer hen rations.

Authors' declaration

We declared that this study is an original research by our research team and we agree to publish it in the journal.

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