Available online www.jsaer.com

Journal of Scientific and Engineering Research, 2018, 5(5):1-6

ISSN: 2394-2630
CODEN(USA): JSERBR

Research Article

Egg Quality Factors of Isa Brown Laying Chickens Fed Processed Tropical Sickle Pod (*Senna obtusifolia*) Seed Meal Based-Diets

Augustine, C.

Department of Animal Production, Faculty of Agriculture, Adamawa State University, Mubi, Adamawa State, Nigeria

Abstract The high cost of conventional poultry feed ingredients has triggered intensive research on cheaper alternative feed ingredients that could replace the costly feed resources. It is in view of the above that a feeding trial was conducted for 16 weeks to investigate the effects of feeding processed *Senna obtusifolia* seed meal based-diets on the egg quality factors of ISA Brown laying chickens. Six experimental diets were compounded to contain 0% *Senna obtusifolia* seed meal (T1) and 20% each of the raw, boiled, soaked, sprouted and fermented *Senna obtusifolia* seed meal designated T2, T3, T4, T5 and T6, respectively. One hundred and eighty (180) ISA brown laying chickens aged 36 weeks were housed in battery cages and assigned to the six (6) dietary treatments in group of thirty (30) laying chickens in a completely randomized design. Each replicate pen contains 10 chickens. Data were collected on egg weight, egg specific gravity, shell weight, shell thickness, percent shell, yolk index albumin index, haugh unit and egg shape index. Data collected were subjected to analysis of variance using computer software package (Statistix 9.0). The results indicated non-significant ($P<0.05$) influence of the diets on both external and internal egg quality factors. The egg specific gravity, shell weight, shell thickness, Haugh unit and egg shape index recorded in this study ranged from 1.07-1.085, 4.05-4.59 g, 0.25-0.27cm, 72.43-74.36%, respectively and 72.09-72.82. In conclusion, inclusion of 20% each of the raw, boiled, soaked, sprouted and fermented *Senna obtusifolia* seed meal did not significantly influence both the external and internal quality factors of ISA Brown eggs.

Keywords Egg quality factors, laying chickens, processed *Senna obtusifolia*.

Introduction

The role of the Nigerian layer industry in the supply of eggs cannot be over-emphasized. [1] further buttressed that poultry production is a major source of meat and egg to many households and families in Nigeria. Commercial layer production has been reported to be the most significant sources of quality protein and income as compared with other livestock in Nigeria [2]. Despite the contribution of the layer chicken industry in meeting the nutritional need of many Nigerians, the scarcity and high cost of conventional feeds and feed ingredients still remain a major challenge to the growth and development of the chicken layer industry. In this regard, the use of under-exploited feed resources will be an effective measure to address the feed crises that have long engulfed the poultry industry in Nigeria.

Senna obtusifolia is one of such alternative lesser-known legumes that can be exploited in Nigeria. *Senna obtusifolia* is an annual or biennial shrub growing up to 2.5 m tall, but usually less than 2m in height. The leaves are pinnate and alternately arranged along the stem, born on petioles 15-20 mm long. The flowers are yellow (10-15 mm across) while the fruit is slender, strongly curved downward (sickle shape), pod (6-18 cm long and 2-6 mm wide). The seeds (3-6 mm long) are dark brown in colour, shiny in appearance with rhomboid or irregular shape [3].The chemical composition of the seeds as reported by [4] and [5]revealed that they have good protein content (29.54 and 23.40%) and fair distribution of amino acids. Unfortunately, the authors further revealed that the seeds contain anti-nutritional factors which might limit nutrient utilization and adversely affect overall performance of laying chickens and egg quality factors. Feeds and feed quality are important factors that affect egg production and egg quality. [6] reported the adverse effects of anti-nutritional factors on egg production and egg quality factors. Egg quality factors are directly related to the ability of the eggs to withstand storage, handling and transportation conditions and also the freshness and desirability of the eggs by consumers [7, 8]. At the moment, base-line information on the best processing method(s) that will enhance optimal utilization of *Senna obtusifolia* seed meal with little or no depreciation on egg quality factors seems to be inadequate. Therefore, more studies are required to bridge this information gap. It is in view of the above, that this study was conducted to evaluate the effects of feeding raw or processed *Senna obtusifolia* seed meal on egg quality factors of ISA Browm laying chickens.

Materials and Methods

Location of the Study Area

The research was conducted at the Poultry Unit of the Department of Animal Production Livestock Teaching and Research Farm, Adamawa State University, Mubi. Mubi is located between latitudes 9°30' and 11° North of the equator and longitudes 13° and 13° 45^{I} East of the Greenwich meridian. The temperature regime in Mubi area is warm to hot throughout the year. However, there is usually a slight cold period between November and February. There is a gradual increase in temperature from January to April. The minimum and maximum temperatures of the area are 18.1°C and 32.8 °C, respectively. The mean annual rainfall ranges from 900-1050 mm [9].

Experimental Stock and their Management

One hundred and eighty (180) ISA Brown strain of laying chickens aged 36 weeks old were housed in battery cages. The laying chickens were adapted for one week on the experimental layer diets and were thereafter managed using standard routine layer management practices. The experiment lasted for 16 weeks.

Experimental Diets

Six (6) experimental layer's diets were compounded to contain 0% SOSM (T1) and 20% each of the raw, boiled, soaked, sprouted and fermented *Senna obtusifolia* seed meal designated T2, T3, T4, T5 and T6, respectively. Diet T1 served as the positive control while diet T2 was the negative control. The composition of the experimental diets is presented in Table 1.

Experimental Design

One hundred and eighty (180) laying chickens were assigned to the six (6) experimental diets in a group of thirty (30) chickens each in battery cages in three replicates of 10 chickens each in a completely randomized design (CRD).

Table 1: Ingredient Composition and Calculated Analysis of the Experimental Layer Diets

	Level of inclusion of raw or processed SOSM					
Ingredient (%)	**T1 0%SOSM**	**T2 20%RSOSM**	**T3 20%BSOSM**	**T4 20%SKSOSM**	**T5 20%SPSOSM**	**T6 20%FSOSM**
Maize	45.00	45.00	45.00	45.00	45.00	45.00
RSBM	16.00	7.00	7.00	7.00	7.00	7.00
SOSM	0.00	20.00	20.00	20.00	20.00	20.00
Fishmeal	2.10	2.10	2.10	2.10	2.10	2.10
GNC	8.00	8.00	8.00	8.00	8.00	8.00
Maize offal	18.00	7.00	7.00	7.00	7.00	7.00
Salt	0.35	0.35	0.35	0.35	0.35	0.35
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00

Limestone	7.00	7.00	7.00	7.00	7.00	7.00
Methionine	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis						
Crude protein	17.08	17.13	17.01	16.49	17.06	17.63
Crude fibre	4.36	5.45	3.79	4.21	3.79	4.07
Energy (kcal/kg)	2693.70	2694.58	2673.57	2649.42	2670.54	2616.22
Calcium	3.75	3.76	3.77	3.76	3.77	3.78
Phosphorus	0.89	0.95	0.95	0.89	0.96	0.88

Metabolizable energy (ME) calculated according to the formula of [10] ME = 37 x % CP + 81 x % EE + 35.5 x % NFE, RSBM = Roasted soya bean meal SOSM = *Senna obtusifolia* seed meal, GNC = Groundnut cake, RSOSM = Raw *Senna obtusifolia* seed meal, BSOSM = Boiled *Senna obtusifolia* seed meal, SKSOSM = Soaked *Senna obtusifolia* seed meal, SPSOSM = Sprouted *Senna obtusifolia*seed meal and FSOSM = Fermented *Senna obtusifolia* seed meal CP = crude protein, EE = Ether extract, NFE = Nitrogen-free extract.

Parameters Measured

Egg Quality Factors

Egg quality factors were determined by sampling five (5) freshly laid eggs per replicate at the end of every week. The freshly laid eggs were weighed using a sensitive electronic digital scale to determine the mean weight of each egg. The eggs were broken around the equator carefully to keep the yolk and albumin intact. The internal contents of the eggs were carefully placed on a plane glass surface. The pin of a vernier Caliper was immersed into the centre of the yolk and the calibrated bar of the caliper was pressed down until the base of the bar touches the top of the yolk .The height (cm) of the yolk was then read and recorded. The albumin height was also read in similar manner and recorded. For the yolk width, the caliper's two gripping prongs were opened to touch both sides of the yolk. The width (cm) was read from the calibrated bar. This was similarly done for the albumin width.

The shell thicknesses (cm) was obtained by taking samples from the top, middle and bottom of shell and were measured by placing each of the shell sample between the prongs of the micrometer screw gauge and was pressed very tight before the width is read. The average of these three values was taken as the thickness.

Egg Shape Index

Egg shape index was determined by measuring the egg breath and length and was computed using the formula below:

$$\text{Egg shape index} = \frac{\text{breath of egg (cm)}}{\text{Length of egg (cm)}}$$

Shell Weight and Percent Shell

The shell weight was obtained by properly sun-drying the broken shells of each egg and weighed using a sensitive electronic digital scale. The percent shell was computed using the formula outlined below:

$$\text{Percent shell (\%)} = \frac{\text{Weight of shel}}{\text{Weight of egg}} \text{x } 100$$

Yolk index, albumin index and Haugh unit

Yolk index, albumin index and Haugh unit were computed using the formula outlined below:

$$\text{Yolk index} = \frac{\text{Yolk mean height}}{\text{Yolk mean width}}$$

$$\text{Albumen index} = \frac{\text{Albumen height}}{\text{Albumen width}}$$

Haugh unit was calculated according to the formula of [11] Haugh unit = 100 log (H + 7.57 — $1.7W^{0.37}$
Where:

H = albumen height in millimetres
W = weight of egg (g)

Determination of Egg Specific Gravity

Specific gravity of the eggs was determined using the procedure of [12] which is based on Archimedes principle of floatation. Eight graduated measuring bowls each containing three litres of water were used. Different levels of salt were used to determine the specific gravity of the eggs. Known quantities of common salt (NaCl) were dissolved in each bowl (Table 2). Eggs obtained from each treatment were immersed in the containers arranged serially asshown below and in any of the solution where eggs floated, they were considered to have the same specific gravity. The mean specific gravity for each treatment was computed as the average for all the eggs sampled in the treatments.

Table 2: Egg Specific Gravity Determination [12]

Container No.	Quantity of salt in grams/3 litres of water	Specific gravity
1	298	1.065
2	320	1.070
3	324	1.075
4	365	1.080
5	390	1.085
6	414	1.090
7	438	1.095
8	462	1.100

Results and Discussion

The results of external and internal egg quality characteristics of laying hens fed raw and processed *Senna obtusifolia* seed meal are presented in Table 3. The results revealed non-significant (P>0.05) effects of the treatment diets on the external egg quality factors (shell weight, percent shell, egg specific gravity and shell thickness) except Haugh unit which indicated significant (P<0.05) differences. The similarities recorded for most of the external qualities of the eggs from the different treatment groups were in agreement with the findings of [13] who fed laying chickens with up to 20% processed *Lablab purpureus* seed meal. These external qualities are indicators of shell condition and strength and therefore, the eggs laid from the different treatment groups have similar shell conditions and strength. This may be due to the abundance of the minerals (calcium and phosphorus) supplied by the mineral sources (bone meal and limestone) and the feed ingredients which might have masked the adverse effects of the anti-nutritional factors especially oxalates and Phytates which have direct adverse effects on calcium and phosphorus utilization. This might have been responsible for the uniform egg shell formed in all the treatment groups. [14] observed that soluble complexes are favoured when nutrient concentration is in excess of that of the anti- nutritional factors which is in line with the findings of this study. However, the shell thickness (0.25 - 0.26 cm) recorded in this study was close to the recommended thickness (0.33 cm) reported by [15]. The author further added that shell of such thickness can withstand handling conditions without breakage.

The egg shape index of the different treatment groups were also not significantly (P>0.05) affected by the different dietary treatments an indication that the eggs collected from the different treatment groups were of similar shape. moreover, the range of 70.65 - 72.82 obtained in this study fell within the normal range of 72 -76 for chicken eggs reported by [16]. This shows that the eggs laid in the different treatment groups were of normal and good shape. [8] opined that eggs of normal shape fit well into egg trays and make less transit loss during transportation or enhances setting in egg trays during incubation and hatching of day-old chicks.

The internal egg qualities of the laying chickens fed the different experimental diets were not (P>0.05) influenced by the different experimental diets except for the Haugh unit which was significantly (P<0.05) lower in laying chickens fed the raw, soaked and boiled *Senna obtusifolia* seed meal based-diets. However, the range for the Haugh unit (71.86 - 75.74) obtained in this study is within the classification category AA (72 and above) reported by [17] and this is an indication of very good interior qualities of the eggs. The values recorded for the albumin index and yolk index in this study are close to the reference range of 0.12 - 0.37 and 0.41- 0.44, respectively as reported by [13]. The results generally indicated that inclusion of up to 20% of raw or processed *Senna obtusifolia* seed meal had no adverse effects on the internal qualities of the eggs since the values for the egg qualities seem to be on the desirable side. This was further buttressed by [17] who reported that high values for Haugh unit, albumin and yolk indices are indications of desirable keeping qualities of the eggs.

Table 3: Egg quality factors of Laying Chickens Fed Processed and Raw *Senna obtusifolia* Seed Meal (Experiment 5)

	Level of inclusion of raw or processed SOSM						
Parameters	**T1 0%SOSM**	**T2 20%RSOSM**	**T3 20%BSOSM**	**T4 20%SKSOSM**	**T5 20%SPSOSM**	**T6 20%FSOSM**	**SEM**
Egg weight (g)	59.96	53.08	58.88	58.96	58.26	58.45	
Egg specific gravity	1.074	1.074	1.073	1.070	1.085	1.080	0.03
Shell weight (g)	4.38	4.09	4.59	4.05	4.23	4.47	0.08
Shell thickness (cm)	0.25	0.25	0.26	0.27	0.27	0.25	0.20
Percent shell (%)	9.51	9.31	9.00	8.76	8.59	9.13	0.25

a, b, c = Means in the same row with different superscripts are significantly different (P<0.05);
NS = Not significant (P>0.05); * = Significant at 95% level of confidence; SEM = Standard error of the means; RSOSM = Raw *Senna obtusifolia* seed meal; BSOSM = Boiled *Senna obtusifolia* seed meal; SKSOSM = Soaked *Senna obtusifolia* seed meal; SPSOSM = Sprouted *Senna obtusifolia* seed meal; FSOSM = Fermented *Senna obtusifolia* seed meal.

Conclusion

The outcome of this study revealed that inclusion of 20% each of the raw, boiled, soaked, sprouted and fermented *Senna obtusifolia* seed meal in the diets of ISA brown laying chickens did not significantly influenced both the external and internal egg quality factors of the eggs except for the Haugh unit.

Acknowledgements

The author is grateful to the Management of Adamawa State University Mubi and the Tertiary Education Trust Fund (TET fund) of the Federal Government of Nigeria for providing funds for this research.

References

[1]. Dunya, A.M., Raji, A.O and Alade, N.K. (2011). Frequency of plumage colour in indigenous domestic fowls in Borno State of Nigeria. In: *Proceedings of the 17th Annual Conference of Animal Science Association of Nigeria*, Abuja. Pp75-77.

[2]. Ijaiya, A.T., Egena, S.S.A and Omohain, D. (2012). Egg production of Japanese quails (*Coturnixcoturnix japonica*) fed dietary levels of fermented cassava (*Manihot spp.*) peal meal. 17th *Annual Conference of Animal Science Association of Nigeria (ASAN),* Abuja, Nigeria, Pp377-380.

[3]. Agnes, L. (2011). Invasive species compendium online data sheet. *Senna obtusifolia* (sickle pod). CABI publishing, 2011. *www.cabi.org/isc.* Accessed 21 August, 2017.

[4]. Ingweye, J. N., Kalio, G. A., Ubua, J. A. and Umoren, E. P. (2010). Nutritional evaluation of wild sickle pod (*Senna obtusifolia*) seeds from Obanliku, South-Eastern, Nigeria. *American Journal Food Technology,* 5: 1-12.

[5]. Augustine, C., Kwari, I.D., Igwebuike, J.U and Adamu, S.B. (2017). Evaluation of chemical composition of raw and processed tropical sickle (pod) seed meal. *International Journal of Agricultural Science and Technology, Faculty of Agriculture, Trakia University, Stara Zagora, Bulgaria*, 9(2): 110-113.

[6]. Kaya, H., Celebi, S., Macit, M. and Geyikolgu, F. (2011). The effects of raw and physically processed common Vetch seed (*Vicia sativa*) on laying performance, egg quality, metabolic parameters and liver histopathology of laying hens. *Asian- Australasian Journal of Animal Science*, 24(10): 1425-1434.

[7]. Adeogun, I. O. and Amole, F.0. (2004). Some quality parameters of exotic chicken eggs under different storage condition. *Bulletin for Animal Health and Production in Africa,* 52(1): 43 - 47.

[8]. Rath, P.K., Mishra, P.K., Mallick, B.K. and Behura, N. C. (2005). Evaluation of different egg quality traits and interpretation of their mode of inheritance in white leghorns. *Veterinary World*, 8(4): 449 - 452.

[9]. Adebayo, A.A. (2004). *Mubi Region a Geograhical Synthesis*Paraclete publishers Yola, Nigeria 133 Pp.

[10]. Pauzenga, U. (1985). Feeding parent stock. *Zootecnia International* Pp22- 25.

[11]. Haugh, R.R (1937). The Haugh unit for measuring egg quality. *United State of America Poultry Magazine*, 43:552-573.

[12]. Hamilton, R.M.G. (1982). Methods and factors that affect the measurement of egg shell quality. *Poultry Science*, 61(10): 2022-2039.

[13]. Ragab, H.I., Abdelati, K.A., Kijora, C. and Ibrahim S. (2012). Effect of different levels of the processed *Lablab purpureus* seeds on laying performance, egg quality and serum parameters. *International Journal of Poultry Science*, 11(2):131 - 137.

[14]. Hagerman, A.E and Kiucher, K.M. (1986). Tannin protein interaction. In: *Plant Flavanoids in Biology and Medicine. Biochemical, Pharmacological and Structure-activity Relationships.* Editors: Cody, V., Middleton E.Jr., Harbone, J. and Alanr-Liss. New York, Pp. 67-76.

[15]. Stadelman, W.J. (1995). Quality identification of shell eggs In: Stadelman, W.J. and Cotterill, O.J. editors, *Egg Science and Technology*, 4th revision. Food products press Binghamton, New York, USA Pp39 - 66.

[16]. Altunta, E. and Sekeroglu, A. (2007). Effects of egg shape index on mechanical properties of chicken eggs. *Journal of Food Engineering*, 85: 606 - 612.

[17]. United States Department of Agriculture (USDA) (2000). Agricultural marketing services USA, America. 75:1-50.