EFFICACY OF *XYLOPIA AETHIOPICA* EXTRACT IN IMPROVING QUALITY INDICES OF LAYING HENS

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ABSTRACT
A study spanning twelve weeks aimed to assess the efficacy of Xylopia aethiopica extract on the egg quality indices of laying hens. The study utilized a total of 120 laying hens, six weeks in lay. Xylopia aethiopica extract was separately diluted in 4 liters of water at varying levels: 0 ml, 100 ml, 200 ml, and 300 ml. The laying hens were divided into four groups, each comprising 30 birds, in a completely randomized design. Each group was subdivided into three replicates, each consisting of 10 birds. Result on the external egg qualities of the laying hens indicated significant ($p<0.05$) differences on egg weight, shell thickness, shell weight, and egg breaking strength compared to the control. The group administered with 300 ml of Xylopia aethiopica extract recorded the highest significant values ($P<0.05$) across these four parameters. No significant differences ($p>0.05$) were observed in the internal egg qualities evaluated. It could be concluded that the administration of Xylopia aethiopica extract to laying hens enhances egg weight, shell thickness shell weight, and egg breaking strength of the birds.

Key words: Egg quality, Egg weight, Laying hens, *Xylopia aethiopica*, Spice extract

INTRODUCTION

Monogastric animals, including poultry species, are recognized for yielding superior animal products like meat and eggs (Essien and Udedibie, 2007; Christopher *et al*., 2023). Achieving optimal productivity in poultry necessitates the incorporation of feed additives into their diets. Among these additives, antibiotics have been historically employed to expedite growth, improve feed efficiency, and mitigate disease outbreaks. However, the utilization of antibiotic growth promoters has been associated with the development of microbial drug resistance in animal products, thereby triggering apprehensions about public health (Okon *et al*., 2023a). This has led to the adoption of plant-derived compounds, referred to as phytogenics, including herbs and spices, as a viable substitute for antibiotic growth promoters. Several of these locally sourced spices and herbs are cost-effective and readily accessible (Ekpo and Okon, 2022; Okon *et al*., 2022). Notably, spices and herbs offer both nutritional and medicinal benefits to humans (Essien *et al*., 2022). Their robust aromas enhance food palatability (Dougkas *et al*., 2019), stimulate the secretion of natural digestive enzymes for improved digestion (Zhang *et al*., 2009), boost immune system responses, and possess diverse properties such as antibacterial, anti-inflammatory, anti-cancerous, antioxidant, anti-ulcer, and anti-diabetic attributes (Jamroze *et al.,* 2023). Spices and herbal products, available in various forms like rhizomes, leaves, bulbs, seeds, and fruits, can be integrated into poultry feed either as ground components or extracts (Ekpo *et al.,* 2022). Among the locally accessible spices in Southern Nigeria is *Xylopia aethiopica*, commonly referred to as selim pepper. It is enriched with active compounds such as piperine and xylopic acid. Piperine plays a role in enhancing the absorption of essential nutrients like selenium, vitamin B?, beta-carotene, and curcumin, along with minerals (Murlidhar and Croswami, 2012). The fruits of *Xylopia aethiopica* are recognized as a natural remedy for various ailments such as fever, cough, worm expulsion, and piles (Vijayam and Thampuran, 2000). Its therapeutic potential is attributed to its composition of bioactive compounds like flavonoids, steroids, alkaloids, phenols, saponins, and tannins (Essien, 2021; Solomon *et al*., 2022; Okon *et al.,* 2023b). To effectively utilize *Xylopia aethiopica*, it can be incorporated into poultry feed in dried, whole, ground form, or as an extract. This study aimed to assess the impact of *Xylopia aethiopica* extracts on the egg quality parameters of laying hens.

MATERIALS AND METHODS

Experimental location

The experiment was conducted in the poultry unit of the Department of Animal Science, Akwa Ibom State University. Obio Akpa, Campus. The area is situated between latitude $5^0$17'N and $5^0$27'N and longitude $7^0$21'E and $7^0$58'E. (SLUS-Ak, 1994).

Procurement and processing of *Xylopia aethiopica* extract

Dried *Xylopia aethiopica* fruits were purchased from Uyo, Uyo Local Government Area of Akwa Ibom State, Nigeria. The fruits were sun dried for 2 days, ground into powder using a manual blender, and store in an air-tight container till usage. *Xylopia aethiopica* powder (100 g) was soaked in 1 litre of warm water (40-50^0c) and left overnight. In the morning the extract was drawn with a syringe at the rate of 100 ml, 200 ml, and 300 ml into a 4-litre drinking trough containing clean water and administered to the birds orally.

Experimental diets, birds and design

A laying hen's diet containing 18 % crude protein and 2578 kcal/kg of energy was formulated for the birds. One hundred and twenty laying hens (Isa brown) at six weeks in lay were used for the experiment. The birds were divided into four groups of thirty birds and labeled T_1 T_2 T_3 and T_4. Each group was subdivided into three replicates of 10 birds each. The birds were fed the same diet. The *Xylopia aethiopica* extract was orally administered to each group or treatment. The control (T_1) was offered drinking water free of the extract, while T_2 T_3, and T_4 were offered 100 ml, 200 ml, and 300 ml of diluted *Xylopia aethiopica* extract (XAE) per 4 litres of water. The birds were served fresh clean water after the exhaustion of the extract. A deep litter system of management was used for the experiment. Wood shavings were used as litter material and strict sanitation practices were adopted. The experiment lasted 12 weeks.

External egg quality Evaluation

Egg weight: six eggs were randomly collected weekly from each replicate, labeled and weighed using electronic weighing balance. Egg length: The length of each egg was measured from the pointed end to the broad end with the aid of vernier caliper. Egg width: was measured with a vernier caliper. The width was taken as the diameter of widest cross-sectional region. Egg shape index: Egg shape index was calculated as the percentage of the egg width to the length. Shell thickness: Shell of broken eggs were measured using micrometer screw gauge. The measurement was taken from the pointed end, middle and broad end of the egg and mean was obtained. Shell weight: Shell of broken eggs were sundried for three days and weighed with a sensitive top loading electric weighing balance. The shell weight was express as a percentage of the egg weight and recorded as percent shell (% shell) for individual egg. Egg breaking strength: Egg breaking strength was calculated using the formula suggested by Arad and Marder (1982) and presented as EBS = 50.86 x (EW) 0.915, where EW= egg weight (g).

Internal egg quality Evaluation

Albumen weight: Albumen of broken eggs were separated from the yolk and weighed. It was expressed as the percentage of the egg weight and recorded as percent albumen for each egg. Albumen Height: Albumen height was determined by the use of spherometer with measurement taken at albumen widest expanse and mid-way between the yolk edge and the external edge of the thick albumen. Albumen index: Albumen index was determined as the ratio of the albumen height to the diameter. Yolk weight: The yolk was separated from the albumen using a plastic separator and weighed using on electric sensitive weighing balance. Yolk width: Measurement was taken around the widest horizontal circumference using a vernier caliper. Yolk index: This was taken as the ratio of the yolk height to the width. Yolk height: Yolk height was determined by the use of a spherometer. Haugh unit: This was determined by the formular of Haugh (1937), $Hu = 100 \log (H+7.57-1.7w^{0.75})$ where H = height of albumen in mm and w = weight of eggs on grams.

Data Analysis

Data collected were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan Multiple Range Test (Duncan, 1955).

Result and Discussion

The result of the external egg qualities of laying hens administered *Xylopia aethiopica* extract is presented in Table 1. Significant difference ($p<0.05$) was observed in egg weight. Hens administered 300 ml XAE recorded the highest egg weight value (55.51 g) while the control (0 ml) recorded the lowest egg weight value (48.02 g). Egg length, egg width and egg shape index were not significantly ($p>0.05$) affected by XAE, the value obtained for shape index in this study were above 0.75 which is viewed as ideal shape index value. Smith, (1990) noted that very long and larger eggs are prone to cracking during packaging. Shell thickness and shell weight were significantly affected ($p<0.05$) by

Table 1: External egg quality characteristics of laying hens administered varying levels of *Xylopia aethiopica* extract

Parameters	T_1 (0 ml XAE)	T_2 (100 ml XAE)	T_3 (200 ml XAE)	T_4 (300 ml XAE)	SEM
Egg width (cm)	4.45	4.37	4.40	4.39	0.02
Egg length (cm)	5.43	5.63	5.51	5.37	0.03
Egg shape index	0.82	0.78	0.80	0.82	0.01
Shell thickness (mm)	0.41	0.45	0.51	0.67	0.01
Shell weight (g)	6.31^{d}	6.71^{c}	7.31^{b}	7.83^{a}	0.03
Egg breaking strength	3567.31^{d}	3613.71^{c}	3888.75^{b}	4124.07^{a}	1.02
Egg weight (g)	48.02^{d}	49.45^{c}	50.53^{b}	55.51^{a}	0.04

XAE = *Xylopia aethiopica* extract

abcd = means in the same row with different superscript are significantly different. ($p<0.05$).

Table 2: Internal egg quality characteristics of laying hens administered varying levels of *Xylopia aethiopica* extract

Parameters	T_1 (0 ml XAE)	T_2 (100 m1 XAE)	T_3 (200 ml XAE)	T_4 (300 ml XAE)	SEM
Albumen height	8.31	8.33	8.41	8.34	0.01
Albumen weight	26.23	26.41	25.86	26.46	0.03
Albumen diameter	7.20	7.31	7.30	7.24	0.01
Albumen index	1.15	1.14	1.15	1.15	0.01
Yolk diameter	3.21	3.71	3.52	3.63	0.02
Yolk weight	25.28	25.43	25.31	25.19	0.01
Yolk index	1.23	1.08	1.08	1.03	0.02
Yolk height	3.81	4.01	3.83	3.75	0.01
Haugh unit	93.03	92.68	93.07	92.75	0.02

XAE = *Xylopia aethiopica* extract

XAE. Laying hens administered XAE at 300 ml recorded the highest values (0.67 mm and 7.83 g) for the two parameters, while those in the control group recorded the least values (0.41 mm and 6.31 g), respectively. Shell thickness and shell weight exert a strong impact on the market value of eggs. Soft egg shells may reduce the market value of egg because there are prone to breakage during packaging and transportation. Shell thickness and weight may be influenced by diet composition to an extent. Diets deficient in calcium and phosphorous may produce eggs with thin shells. Thin shells may serve as a path for microbial invasion which influences hatching. In this study the increase in shell thickness and weight could be linked to the appreciable calcium and phosphorous content in *Xylopia aethiopica* fruit, as well as the ability of the spice to enhance the utilization of dietary calcium and phosphorus (Solomon *et al*., 2022). Egg breaking strength of eggs showed significant differences ($p<0.05$) in their values (3567.31, 3613.71, 3888.75, and 4124.07) for T_1 T_2 T_3 and T_4 respectively. Laying hens administered 300 ml XAE recorded the highest significant egg breaking strength values (4124.07). Egg breaking strength is known to have a positive relationship with shell thickness and shell weight. Eggs with healthy shells are able to withstand and absorb shocks and vibration during transportation to long distances. In breeding stock, good shell thickness and egg weight also support better hatchability rate. Significant differences ($p>0.05$) were not recorded in Haugh unit values across treatments. The value obtained in this study were above 0.75 which is regarded as indicator of freshness in eggs. Albumen height, albumen weight, albumen diameter and albumen index of the eggs were not significantly affected by *X. aethiopica* extract (Table 2). Albumen occupies the largest portion of egg liquid weight. The administration of XAE did not have any effect on yolk weight, yolk height, yolk diameter and yolk index. The weight and size of yolk is associated with egg weight. The yolk helps to supply nutrient to developing embryo. The yolk contains bulk of its iron, folate and

vitamins. It also contains lutein and zeaxanthin that support eye and brain health and supplies the embryo with water, protecting it from viruses, bacteria and other microbial invasion. The non-negative effect observed for internal egg qualities may be good for breeding stock as it is an indicator that fertility and hatchability will not be impaired.

CONCLUSION

This study revealed that the administration of *Xylopia aethiopica* extract up to 300 ml to laying hens has been found to enhance, egg weight, shell thickness and shell weight of the birds.

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