International Journal of Science and Research Archive

eISSN: 2582-8185

Cross Ref DOI: 10.30574/ijsra

Journal homepage: https://ijsra.net/

(Research Article)

Effects of pumpkin leaf (*Telferia occidentalis*) and scent leaf (*Ocimum grattisimum*) meal additives on external and internal egg characteristics of laying chickens

Frederick Ugbesia Igene * and Joy Utomo Apeh

Department Of Animal and Food Sciences, Faculty Of Agriculture, Natural Resources and Food Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

International Journal of Science and Research Archive, 2025, 15(01), 703-711

Publication history: Received on 03March 2025; revised on 08 April 2025; accepted on 12 April 2025

Article DOI: https://doi.org/10.30574/ijsra.2025.15.1.1054

Abstract

Telferia occidentalis (fluted pumpkin leaf) and *Ocimum gratissimum* (scent leaf) meals were added as additives in the diets of laying chickens to assess the external and internal characteristics of the eggs. A total of 420 Isa-brown point-of-lay pullets were randomly allocated in a completely randomized design to seven dietary treatments (T1 - T7). T1 served as the control diet with no inclusion of test ingredients; pumpkin leaf meal (PLM) and scent leaf meal (SLM). In other treatments or diets, PLM and SLM were included per 100kg feed as follows; T2 250g PLM, T3 250g SLM, T4 500g PLM, T5 500g SLM, T6 250gPLM+250gSLM, and T7 500g PLM+500g SLM. Data were collected on egg production in three phases (cycles) of egg laying. Phase one was marked as egg production period during which the birds were between 18 and 28 weeks old, phase two spanned from 28 to 38 weeks old, while phase three covered the laying periods from 38 to 48 weeks old. At the end of each laying cycle, four eggs were taken per replicate per treatment for assessment of internal and external characteristics. Egg weight, egg width, egg shell surface area and shell thickness were significantly (P>0.05) low in the control eggs in all laying cycles. Yolk weight was highest (P<0.05) in T5 (12.97g) in the first laying cycle. Yolk heights were only significant (P<0.05) in second and third cycles and respectively highest in T6 19.17 and T1 (19.47mm). Albumin height was significantly affectected only in the third cycle and was highest in the control eggs (11.73mm). In cycle one, Haugh unit was significantly highest in T4 (108.57) while in cycles 2 and 3 it was highest in T3 (181.99 and 181.54 respectively). In conclusion, the eggs from laying birds fed supplemented diets had improved external and internal qualities as compared to those from control group especially at the second and third laying cycles. These results suggest that *Telferia occidentalis* and *Ocimum gratissimum* can be used as natural alternatives to the imported synthetic antibiotics in the diets of laying chickens. This might in addition to saving foreign exchange in Nigeria since antibiotics and other poultry drugs are imported, will also enhance the quality of eggs consumed.

Keywords: *Telferia occidentalis*; *Ocimum gratissimum*; Additives; Laying Chickens; Eggs

1. Introduction

Egg quality is a general term which refers to several standards which define both internal and external quality. External quality is focused on shell cleanliness, texture and shape, whereas internal quality refers to egg white (albumen) cleanliness and viscosity, size of the air cell, yolk shape and yolk strength.

Internal egg quality involves functional, aesthetic and microbiological properties of the egg yolk and albumen. The proportions of components for fresh egg are 32% yolk, 58% albumen and 10% shell (Leeson, 2007). The egg white (albumen) is formed by four structures. Firstly, the chalaziferous layer or chalazae, immediately surround the yolk, accounting for 3% of the white. Next is the inner thin layer, which surrounds the chalazae and accounts for 17% of the white. Third is the firm or thick layer, which provides an envelope or jacket that holds the inner thin white and the yolk.

*Corresponding author: Frederick Ugbesia Igene

It adheres to the shell membrane at each end of the egg and accounts for 57% of the albumen. Finally, the outer thin layer lies just inside the shell membranes, except where the thick white is attached to the shell, and accounts for 23% of the egg white (USDA, 2000).

Egg yolk from a newly laid egg is round and firm. As the egg gets older, the yolk absorbs water from the egg white, increasing its size. This produces an enlargement and weakness of the vitelline membrane; the yolk looks flat and shows spots.

Poor egg shell quality has been of major economic concern to commercial egg producers, with estimated annual losses in the USA of around 478 million US dollars in1988. In Australia in 1998, the impact was of the order of 10 million Australian dollars per year. Information obtained from egg grading facilities indicates that 10% of eggs are downgraded due to egg shell quality problems. In Mexico in 2005 it was estimated that the egg industry lost between 30 and 35 million US dollars, based on average figures of 2.5% broken eggs and 4% weak shells. These losses occur only between laying and packing, not taking into account losses in transit to the end consumer (DSM USA, 2006).

To maintain consistently good shell quality throughout the life of the hen, it is necessary to implement a total quality management programme throughout the egg production cycle.

It has been always recognized that the hen has the most extraordinary method of obtaining and depositing calcium (Ca) in the entire animal kingdom. An egg has an average of 2.3g of calcium in the shell, and almost 25mg in the yolk. A modern hen laying 330 eggs per cycle will deposit 767g of calcium; assuming a 50% calcium retention rate from the diet, the hen will consume 1.53kg of calcium per cycle.

Exterior egg quality is judged on the basis of texture, colour, shape, soundness and cleanliness according to USDA (2000) standards. The shell of each egg should be smooth, clean and free of cracks. The eggs should be uniform in colour, size and shape.

There are five major types of shell problems in the egg industry: 1. cracks due to excess pressure; 2. cracks due to thin shells; 3. body-checks; 4. pimpled or toe holes, and 5. shell-less eggs.

When a producer complains about an increase in downgrade eggs, the first thing required is to determine which types of problems have increased. In a processing plant with 97% A-quality eggs, a typical distribution of the different types of shell problems (downgrade) might be 2.13% stains, 0.85% blood spots, 0.85% meat spots, 61% pressure cracks, 9.8% thin shell cracks, 6.8% body-checks, 13.6% pimpled and 5.1% toe holes. If the percentage of any type of shell problem is abnormally high, then that is the problem needing attention.

One of the challenges in commercial layer production is how to keep a healthy flock and enhance maximum production of quality meat and eggs. Thus, farmers often resolve to the use of antibiotics and other drugs to maintain the health of their birds and increase growth and egg production. However, these frequently come with consequences of cost implications and drug residues in poultry products (Jawad *et al.*, 2014). Abbas *et al.* (2012) reported the use of herbs and plant products as alternatives to drugs and boosters in keeping a disease-free poultry farm. Also, Onu (2012) observed increasing interest in the anti-oxidant ability and benefits of phytochemicals in vegetables and other tropical herbs as feed ingredients in poultry. However, among the common vegetables that are rich in phytochemicals and antioxidant substances are *Telferia occidentalis* (fluted pumpkin leaf) and *Ocimum gratissimum* (scent leaf).

In this study *Telferia occidentalis* (fluted pumpkin leaf) and *Ocimum gratissimum* (scent leaf) meals were added as additives in the diets of laying chickens to assess the external and internal characteristics of the eggs.

2. Material and methods

2.1. Experimental design and management of birds

A total of four hundred and twenty (420) Isa-brown point-of-lay pullets were used for this study. The birds were randomly allocated to seven (7) dietary treatment groups with a total of sixty (60) birds per treatment. Each treatment was replicated three (3) times with 20 birds per replicate. This experiment was laid out in a completely randomized design. The birds were raised on a deep litter house and fed commercial layer mash with or without supplemented pumpkin and scent leaf meals throughout the experimental period.

Routine vaccination against Newcastle disease was strictly adhered to during the study. This was combined with adequate bio-security measures to prevent outbreak of infectious diseases. Other necessary routine management practices including de-worming and delousing were done. The birds had *ad libitum* access to feed and water throughout the period of the experiment.

2.2. Experimental feed / ingredients

These included pumpkin leaf meal, scent leaf meal and commercial layer mash.

2.2.1. Collection and Processing of pumpkin leaf meal and Scent leaf meal

The test ingredients which are the pumpkin leaf (*Telferia ocidentails*) and scent leaf (*Ocimum gratissimum*) were obtained from Ega market in Idah, Kogi State, Nigeria. The leaves were destalked, and immediately air-dried on a clean concrete floor in a well-ventilated room. It was left to dry for about fourteen days until moisture content becomes stabilized at 12%. The air-dried leaves were milled using harmer milling machine of 0.02 mesh size. The milled *Telferia occidentalis* leaf meal (PLM - Pumpkin Leaf Meal) and *Ocimum gratissimum* leaf meal (SLM - Scent Leaf Meal) were collected in jute bags separately and tightly tied to prevent the attack of insects and pests. They were kept in a clean ventilated room prior to the feed formulation to ensure that their qualities are maintained. Samples were taken from the bagged pumpkin leaf meal and scent leaf meal were taken for proximate analysis, vitamin and mineral determination. Thereafter the pumpkin leaf meal and scent leaf meal were incorporated into commercial layers feed at different levels of inclusion.

2.2.2. Experimental diets

Seven dietary treatments were prepared using the commercial layer mash with the test ingredients (pumpkin and scent leaves) added as additives.

Treatment 1, control diet with no inclusion of test ingredients (PLM and SLM); Treatment 2, 250gPLM/100kgfeed; Treatment 3, 250gSLM/100kgfeed; Treatment 4, 500gPLM/100kgfeed; Treatment 5, 500gSLM/100kgfeed; Treatment 6, 250gPLM+250gSLM/100kgfeed, Treatment 7; 500g PLM+500gSLM/100kg feed.

2.3. Data collection

Data collection was done in three phases. Phase one was marked as egg production period during which the birds were between 18 and 28 weeks old, phase two spanned from week 28 to 38 weeks old, while phase three covered the laying periods from 38 to 48 weeks old. Data collection on performance and egg quality traits thus lasted for thirty (30) weeks. Number of eggs collected and egg weights were taken daily. For external and internal characteristics' data , 4 eggs were randomly picked per replicate per treatment at the end of each cycle and assessed as follows.

External egg qualities: These include:

- Egg weight (g): This was measured as the average weight of the eggs using 0.1g sensitive scale.
- Egg length (mm): This was measured using 0.01mm digital venier caliper.
- Egg width (mm): This was also measured using 0.01mm digital venier caliper.
- Shell weight (g): This is the weight of the air dried egg shell. It was taken by using 0.1g sensitive scale.
- Shell thickness (mm): This was measured using 0.01mm digital micrometer screw gauge.
- Note: All the external egg qualities were taken at the end of each phase except the egg weights which were taken on daily basis.

Internal egg qualities: These include:

- Yolk weight (g): The weight of the egg yolk was measured using 0.1g sensitive scale.
- Percentage yolk weight: This was determined by expressing the yolk weight as the percentage of the egg weight.
- Yolk diameter (mm): This is the diameter of the yolk and was measured using 0.01mm venier caliper.
- Yolk height (mm): This is the height of the yolk when placed gently on a flat plate and will be measured using a tripod micrometer.
- Yolk index: The yolk index was calculated according to the equation (Cicek and Kartalkanat, 2009).

$$\text{Yolk index} = (\text{Yolk height (mm)}/\text{yolk diameter mm}) \times 100$$

- Albumen weight (g): The weight of the egg albumen was measured using 0.1g sensitive scale
- Percentage albumen weight: This was determined by expressing the albumen weight as the percentage of the egg weight.
- Albumen diameter (mm): This is the average value of the length of the two diagonals of the egg albumen. The albumen diagonal length was measured using 0.01mm digital venier caliper.
- Albumen height (mm): This is the height of the egg albumen when placed gently on a flat plate and was measured using a tripod micrometer.
- Haugh units: Haugh units were calculated from records of egg weight and albumen height as an indicator of interior egg quality (Wu *et al.,* 2007).

$$\text{Haugh unit} = 100 * \log_{10} (H-1.7W^{0.37} + 7.56)$$

Where:
H = height of the albumen and
W = egg weight.

2.4. Statistical analysis

The data collected from egg internal and external qualities in the three egg production cycles were separately subjected to one way analysis of variance (ANOVA) using general linear model incorporated in SPSS version 16 (SPSS, 2011). Significant means were separated using Duncan multiple range test, incorporated in the same software at 5% level of significance.

3. Results and discussion

The external characteristics of eggs in layers fed diets containing different levels of dried pumpkin and scent leaf meals; T_1(Control), T_2(250gPLM), T_3(250g SLM), T_4(500g PLM), T_5(500g SLM), T_6 (250g PLM + 250g SLM) and T_7 (500g PLM + 500g SLM) were carried out in the first, second and third laying cycles and the results are presented in Tables 1, 2 and 3.

Table 1 External Characteristics of eggs in laying birds fed diets containing different levels of dried pumpkin leaf and scent leaf meals at first laying cycle (18-28 weeks)

Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**	**T_7**
Egg weight (g)	52.49 ± 2.04^{c}	51.84 ± 3.72^{c}	56.28 ± 2.90^{ab}	55.60 ± 2.84^{b}	59.09 ± 2.19^{a}	55.75 ± 2.74^{b}	56.98 ± 3.30^{ab}
Egg length (mm)	53.17±1.99	52.70±0.70	53.33±1.59	51.73±1.17	50.90±0.85	52.67±0.75	53.40 ± 1.10^{NS}
Egg width (mm)	40.23 ± 1.07^{b}	40.70 ± 0.83^{ab}	42.60 ± 0.11^{a}	41.10 ± 0.15^{ab}	41.07 ± 0.41^{ab}	40.90 ± 0.67^{ab}	40.97 ± 0.64^{ab}
Egg shell surface area (mm^2)	6866.80 ± 0.47^{b}	6857.52 ± 2.70^{b}	7234.99 ± 5.77^{a}	6773.14 ± 6.83^{c}	6647.65 ± 1.44^{d}	6881.30 ± 7.45^{b}	7001.10 ± 6.10^{a}
Egg shape index	0.76±0.02	0.77±0.01	0.80±0.025	0.80±0.02	0.81±0.01	0.78±0.01	0.70 ± 0.01^{NS}
Shell weight (g)	6.39±0.82	6.12±0.39	6.66±0.23	6.60±0.46	6.68±0.12	6.23±0.20	6.27 ± 0.30^{NS}
Shell thickness (ml)	0.40 ± 0.02^{b}	0.40 ± 0.05^{b}	0.44 ± 0.06^{b}	0.43±0.03	0.60 ± 0.08^{a}	0.51 ± 0.03^{ab}	0.44 ± 0.04^{b}

Means in the same row with different superscripts are significantly different (p<0.05 Note: PLM = Pumpkin leaf meal, SLM= Scent leaf meal, NS= Non-significant.T1: (Control), T2: (250g PLM/ 100Kg feed), T3: (250g SLM/100kg feed), T4: (500g PLM/100kg feed), T5:(500g SLM/ 100kg feed), T6: (250g PLM and 250g SLM mixture/ 100kg feed), T7: (500g PLM and 500g SLM mixture/ 100kg feed), ±SME: Standard error of mean.

Table 2 External Characteristics of eggs in layers fed diets containing different levels of dried pumpkin leaf and scent leaf meals at second laying cycle

Parameters	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Egg weight (g)	56.63±4.00[b]	56.35±2.83[b]	61.32±1.74[a]	55.90±0.73[b]	54.03±1.15[b]	56.98±2.36[b]	58.11±1.99[a]
Egg length (mm)	54.67±2.00	54.20±0.70	54.83±1.59	53.23±1.17	53.40±0.85	54.17±0.75	54.90±1.10[NS]
Egg width (mm)	41.73±1.07[b]	42.20±0.83[ab]	44.10±0.12[a]	42.60±0.15[ab]	42.57±0.41[ab]	42.40±0.67[ab]	42.47±0.64[ab]
Egg shell surface area (mm^2)	7314.19±3.81[c]	7304.90±9.52[c]	7694.32±3.20[a]	7217.86±1.93[d]	7088.28±7.0[e]	7329.47±3.50[c]	7453.05±3.87[b]
Egg shape index	0.76±0.02	0.78±0.01	0.81±0.02	0.80±0.02	0.81±0.01	0.78±0.01	0.77±0.01[NS]
Shell weight (g)	7.59±0.82	7.32±0.39	7.86±0.23	7.80±0.46	7.88±0.12	7.43±0.20	7.74±0.30[NS]
Shell thickness (ml)	1.58±0.24[c]	1.67±0.10[b]	1.55±0.15[c]	1.77±0.08[a]	1.80±0.10[a]	1.48±0.11[d]	1.47±0.10[d]

Means in the same row with different superscripts are significantly different ($p<0.05$) Note: PLM = Pumpkin leaf meal, SLM= Scent leaf meal, NS= Non-significant T_1: (Control), T_2: (250g PLM/ 100Kg feed), T_3: (250g SLM/100kg feed), T_4: (500g PLM/100kg feed), T_5:(500g SLM/ 100kg feed), T_6: (250g PLM and 250g SLM mixture/ 100kg feed), T_7: (500g PLM and 500g SLM mixture/ 100kg feed).

Table 3 External characteristics of eggs in laying birds fed diets containing different levels of dried pumpkin leaf and scent leaf meals at third laying cycle (38-48 weeks)

Parameters	T1	T2	T3	T4	T5	T6	T7
Egg weight (g)	60.28±1.63[b]	60.09±2.22[b]	60.54±1.45[b]	60.66±2.37[b]	63.07±2.03[a]	59.64±2.62[b]	61.75±3.33[b]
Egg length (mm)	54.87±1.28[c]	56.50±1.34[a]	56.17±1.60[a]	55.03±0.93[b]	56.50±1.76[a]	52.47±1.51[d]	54.57±1.75[c]
Egg width (mm)	43.87±0.81	43.47±0.95	43.13±0.22	44.07±0.66	43.67±0.37	43.37±0.90	44.80±0.62NS
Egg shell surface area (mm2)	7663.97±7.33[c]	7860.17±2.45[a]	7751.35±3.25[b]	7719.93±3.46[b]	7889.31±4.20[a]	7219.14±3.29[d]	7766.40±6.60[b]
Egg shape index	0.80±0.02	0.77±0.01	0.77±0.02	0.80±0.01	0.77±0.02	0.83±0.04	0.82±0.02NS
Shell weight (g)	8.05±0.03	7.49±0.25	7.74±0.29	7.95±0.45	8.11±0.55	7.78±0.23	7.98±0.60NS
Shell thickness (mm)	1.48±0.09[f]	1.54±0.17[e]	1.80±0.10[a]	1.77±0.04[b]	1.61±0.02[d]	1.59±0.18[d]	1.71±0.15[c]

Means in the same row with different superscripts are significantly different ($p<0.05$) Note: PLM = Pumpkin leaf meal, SLM= Scent leaf meal, NS= Non-significantT_1: (Control), T_2: (250g PLM/ 100Kg feed), T_3: (250g SLM/100kg feed), T_4: (500g PLM/100kg feed), T_5:(500g SLM/ 100kg feed), T_6: (250g PLM and 250g SLM mixture/ 100kg feed), T_7: (500g PLM and 500g SLM mixture/ 100kg feed).

Tables 4, 5 and 6 show the internal characteristics of eggs of laying birds fed diets containing different levels of dried pumpkin leaf and scent leaf meals ;T_1(Control), T_2(250gPLM), T_3(250g SLM), T_4(500g PLM), T_5(500g SLM), T_6 (250g PLM + 250g SLM) and T_7 (500g PLM + 500g SLM) in the first, second and third laying cycles.

Table 4 Internal Characteristics of eggs in laying birds fed diets containing different levels of dried pumpkin leaf and scent leaf meals at first laying cycle (18-28 weeks)

Parameters	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Yolk weight (g)	$11.12±0.42^{b}$	$12.52±0.50^{ab}$	$12.76±0.54^{ab}$	$12.09±0.80^{ab}$	$12.97±0.45^{a}$	$11.63±0.47^{ab}$	$12.51±0.30^{ab}$
Yolk Height (mm)	19.57±0.83	19.80±1.01	18.27±0.52	18.80±0.60	18.57±0.71	18.90±0.32	$18.80±0.10^{NS}$
Albumen Height (mm)	11.13±0.87	11.27±1.39	10.87±0.81	12.13±0.82	11.07±0.55	10.83±0.87	$11.00±0.59^{NS}$
Yolk diameter (mm)	$38.00±0.70^{ab}$	$35.80±0.87^{b}$	$37.13±1.18^{b}$	$37.13±0.63^{b}$	$37.83±0.29^{ab}$	$36.87±0.58^{b}$	$39.60±0.40^{a}$
Albumen Diameter (mm)	$61.57±0.37^{ab}$	$64.10±3.01^{ab}$	$67.33±0.48^{a}$	$57.30±1.33^{b}$	$65.37±4.22^{ab}$	$56.60±4.48^{b}$	$60.80±1.81^{ab}$
Haugh Unit	$105.31±3.58^{b}$	$105.81±4.33^{b}$	$103.63±2.91^{c}$	$108.57±2.45^{a}$	$103.90±2.64^{c}$	$103.58±3.03^{c}$	$104.14±1.81^{c}$

Means in the same row with different superscripts are significantly different ($p<0.05$)Note: PLM = Pumpkin leaf meal, SLM= Scent leaf meal, NS= Non-significant. T_1: (Control), T_2: (250g PLM/ 100Kg feed), T_3: (250g SLM/100kg feed), T_4: (500g PLM/100kg feed), T_5:(500g SLM/ 100kg feed), T_6: (250g PLM and 250g SLM mixture/ 100kg feed), T_7: (500g PLM and 500g SLM mixture/ 100kg feed).

Table 5 Internal Characteristics of eggs in laying birds fed diets containing different levels of dried pumpkin leaf and scent leaf meals at second laying cycle (28-38 weeks)

Parameters	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Yolk weight (g)	12.86±0.83	14.70±0.28	14.24±0.54	13.56±1.00	12.79±0.72	13.44±0.32	$13.32±0.17^{NS}$
Yolk Height (mm)	$16.33±0.84^{b}$	$18.03±0.28^{ab}$	$18.87±0.64^{a}$	$17.23±0.58^{ab}$	$17.77±0.82^{ab}$	$19.17±0.41^{a}$	$18.67±0.67^{a}$
Albumen Height (mm)	9.27±0.13	10.30±1.08	11.90±1.34	11.13±1.00	10.77±0.79	10.63±0.63	$11.50±1.22^{NS}$
Yolk diameter (mm)	$37.00±1.22^{b}$	$39.07±0.78^{a}$	$38.67±1.23^{a}$	$37.63±0.92^{b}$	$38.33±1.11^{a}$	$39.80±0.35^{a}$	$39.00±0.55^{a}$
Albumen Diameter (mm)	$65.00±0.16^{a}$	$64.12±2.0^{b}$	$66.62±3.50^{a}$	$62.12±0.99^{c}$	$62.95±1.49^{c}$	$65.55±0.59^{a}$	$65.15±0.75^{a}$
Haugh Unit	$177.51±3.75^{b}$	$177.58±4.47^{b}$	$181.99±1.45^{a}$	$175.95±1.76^{c}$	$178.18±3.33^{b}$	$180.73±3.14^{a}$	$176.51±0.43^{c}$

Means in the same row with different superscripts are significantly different ($p<0.05$) Note: PLM = Pumpkin leaf meal, SLM= Scent leaf meal, NS= Non-significant T_1: (Control), T_2: (250g PLM/ 100Kg feed), T_3: (250g SLM/100kg feed), T_4: (500g PLM/100kg feed), T_5:(500g SLM/ 100kg feed), T_6: (250g PLM and 250g SLM mixture/ 100kg feed), T_7: (500g PLM and 500g SLM mixture/ 100kg feed).

Table 6 Internal characteristics of eggs in laying birds fed diets containing different levels of dried pumpkin leaf and scent leaf meals at third laying cycle (38-48 weeks)

Parameters	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Yolk weight (g)	14.66±0.46	14.96±0.28	14.66±0.93	14.15±0.51	14.33±0.35	14.37±0.53	15.54±0.66^{NS}
Yolk Height (mm)	19.47±0.69^{a}	18.30±0.29^{ab}	17.23±0.35^{c}	19.07±0.12^{ab}	17.90±0.21^{bc}	18.60±0.66^{ab}	19.13±0.47^{ab}
Albumen Height (mm)	11.73±0.43^{a}	8.93±0.24^{b}	10.63±0.35^{ab}	11.33±1.25^{ab}	10.13±0.66^{ab}	10.07±1.21^{ab}	9.47±0.09^{ab}
Yolk diameter (mm)	40.57±0.13	41.40±0.46	41.23±0.73	40.13±0.99	39.53±1.21	40.433±0.69	41.33±1.68^{NS}
Albumen Diameter (mm)	65.52±1.21	68.15±3.24	69.23±2.61	64.70±0.95	65.40±3.58	65.30±1.44	68.87±2.70^{NS}
Haugh Unit	177.57±1.16^{c}	181.70±1.57^{a}	181.54±4.18^{a}	175.34±2.08^{d}	179.23±2.68^{b}	179.48±1.91^{b}	180.63±1.52^{ab}

Means in the same row with different superscripts are significantly different (p<0.05) Note: PLM = Pumpkin leaf meal, SLM= Scent leaf meal, NS= Non-significant T1: (Control), T2: (250g PLM/ 100Kg feed), T3: (250g SLM/100kg feed), T4: (500g PLM/100kg feed), T5:(500g SLM/ 100kg feed), T6: (250g PLM and 250g SLM mixture/ 100kg feed), T7: (500g PLM and 500g SLM mixture/ 100kg feed).

Poor egg quality has been of major economic concern to commercial egg producers, with estimated annual losses in the USA of around 478 million US dollars (Wu *et al.,* 2007). Yet egg quality, both external and internal qualities can be influenced by a number of factors such as age, physiological state of birds, breed and nutrition. In the current research, egg weight, egg shell surface area, and shell thickness were significantly affected (P<0.05) in laying chickens offered pumpkin leaf (PLM) and scent leaf meals (SLM) supplemented diets. However, the egg strength, egg shell shape index and shell thickness were not significantly different (P>0.05) among treatments during the three laying cycles considered. The heaviest egg weight was recorded in the egg of laying chickens fed T_5 (500g SLM/100kgfeed) at first and third laying cycles (59.09 and 63.07g). The eggs of the laying chickens fed T_3 (250g SLM) recorded the heaviest egg weight (61.32g) and the widest egg width (44.10mm) at the second laying cycle. In addition, other external egg qualities examined such as egg length, egg shell surface area and shell thickness were more influenced in the eggs of laying chickens fed 250g SLM feed and 500g SLM feed when compared to other treatments. This implies that the additive (SLM) has positive influence on the egg weight and egg width. According to Mgbemena and Amako (2020), scent leaf is very rich in energy and protein and this might have augmented the energy content in the feed and thus resulted in improved egg weight and other external egg traits. This is in agreement with the report by Vakili and Majidzadeh (2016) that the largest eggs weight was observed from hens fed flaxseed diet with thyme or fennel extracts which significantly differed from other treatments. However, Hossein *et al.* (2023) reported contrary results when the authours observed that the external egg characteristics of laying hens were not significantly influenced by the supplementation of laying hen diets with a herb mixture. In another similar study, Laudadio *et al.* (2015) concluded that the dietary inclusion of high-polyphenols levels obtained from extra-virgin olive oil in layer hens could increase the rate of egg production and increase egg weight, eggshell quality and egg traits in the medium-phase of production. The results obtained on external egg qualities in this study suggest that the additive (particularly SLM) could be used especially at 250g SLM/100kg feed and 500g SLM/100kg feed at all stages of egg production to improve the external egg qualities.

Internal egg quality involves the proportions of components (yolk and albumen) of fresh eggs (Leeson, 2007). In this current study, the egg internal qualities were significantly increased (P<0.05) by the supplementation of laying chicken diets with pumpkin leaf meal (PLM) and scent leaf meal (SLM) at first, second and third laying cycles. Specifically, the egg of laying chickens offered T_5,500g SLM diet had the heaviest yolk weight (12.09g) at first laying cycle, but was statistically comparable to other treatments except the control that was least (11.12g). The laying chickens given T_7, 500gPLM+500gSLM feed had the widest yolk diameter (39.66mm) although comparable to the control. The albumen diameter was widest (67.33mm) in the eggs of laying chickens fed 250gSLM diet while the haugh unit was highest (108.57) in the eggs of laying chickens fed T_4, 500g PLM diet. This suggests that the additives (PLM and SLM) must have improved the energy and protein contents of the feed and thereby providing enough for egg formation and large size egg. This result is in concert with the findings of Fasuyi *et al.* (2005) who reported significant increase in internal egg characteristics of layers fed varying dietary inclusions of siam weed leaf meal. In the second laying cycle, except the yolk weight, all the internal egg characteristics were significantly increased (P<0.05) in the eggs of laying chickens fed supplemented diets than the control. This implies that the additives (PLM and SLM) are effective enough to improve internal egg qualities at both first and second laying cycles in laying chickens. According to Nworgu (2007), pumpkin leaf is very rich in energy and protein while Mgbemena and Amako (2020) reported that scent leaf contains reasonable amount of energy and protein. Therefore, the additives had positive effect on the laying chicken diets. In the third laying cycle, the yolk height and albumen height were comparable in control and supplemented diets, but the eggs from laying chickens fed 250g PLM/ 100Kg feed and 250g SLM/100kg feed had the highest haugh units than the control and other treatments

4. Conclusion

In this research, most of the external and internal qualities of the eggs were significantly increased in laying chickens offered pumpkin leaf (PLM) and scent leaf meals (SLM) supplemented diets . Specifically the heaviest egg weights were recorded in the eggs of laying chickens fed 500g SLM/100kg feed at first and third laying cycles while the eggs of laying chickens fed 250g SLM feed recorded the heaviest egg weight and the widest egg width at the second laying cycle. In addition, other external egg qualities examined such as egg length, egg shell surface area and shell thickness were best in the eggs of the 250g SLM feed and 500g SLM chickens.

The egg internal qualities were greatly influenced in all the cycles. Specifically, the egg of laying chickens offered 500g SLM had the heaviest yolk weight at first laying cycle. The laying chickens given 500g PLM had the widest yolk diameter while the albumen diameter was widest in the eggs of laying chickens fed 250g with the haugh unit being highest in the 500g PLM fed birds.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Abbas, R. Z., Tassile, T. T., Jerome, B., Michael, P. and Carlos, E. I. (2012). Alternative plant protein sources for pigs and chicken in the tropics. Nutritional value and constraints; a review. Journal of Agriculture and Rural Development in the Tropics and Sub tropics, 113(3): 101 – 123.

[2] Cicek, T. and Kartalkanat, A. (2009). Comparason of village eggs and commercial eggs in terms of egg quality. Journals of Animal Veterinary Advances, 8: 2542-2552.

[3] DSM.(2006). Fortification Guidelines, DSM Nutrition Products Inc., Parsippany, NJ, USA.

[4] Fasuyi, A .O., Fajemilehin, S. O. K. and Omojola, A. B. (2005). The egg quality characteristics of layers fed varying dietary inclusions of siam weed (*Chromolaena odorata*) leaf meal (SWLM). International Journal of Poultry Science, 4 (10): 752-757.

[5] Heath, J. L. (1977). Chemical and related osmotic changes in egg albumen during storage. Poultry Science. 56:822–828.

[6] Hosseini, H., Esmaeili, N., Sepehr, A., Zare, M., Rombenso, A., Badierah, R. and Redwan, E.M. (2023). Does supplementing laying hen diets with a herb mixture mitigate the negative impacts of excessive inclusion of extruded flaxseed? Animal Bioscience, 36(4): 629-641

[7] Jawad, A., Balayesh, W. R., Rami, A., Waleed, R., Hatem, S. and Nathan, W. L. (2014). The influence of extraction solvents on the anticancer activities of Palestinian medicinal plants. Journal of Medicinal Plant Research, 3.9 (2012): 408-415.

[8] Laudadio, V., Ceci, E., Lastella, N. and Tufarelli, V. (2015). Dietary high-polyphenols extra-virgin olive oil is effective in reducing cholesterol content in eggs. Lipids in Health and Disease, 14(1): 1–7.

[9] Leeson, S. (2007). Vitamin requirement: is there basis for re-evaluating dietary specifications? World`s Poultry Science Journal. 63, 255-266.

[10] Mgbemena, N. M. and Amako, N. F. (2020). Comparative analysis of the phytochemicals, proximate and mineral compositions of scent leaf (*Ocimum gratissimum*) and bitter leaf (Vernonia amygdalina) leaves. International Journal of Biochemistry Research and Review, 29(7): 1-9.

[11] Onu, P.N. (2012). Effect of aqueous extract of Telfeira occidentalis leaf on the performance and haematological indices of starter broiler, Int. schorlarly Reearch. Network, Veterinary Science, vol.12, article d7265i5 (doi:10,5402/2012/7265i5)

[12] SPSS Inc. (2011). SPSS Inc. Predictive Analytics Software Portfolio, Grand Pack 18.

[13] USDA.(2000). United States Department of Agriculture, Egg-grading manual, Washington: Department of Agriculture (2000). 56p.(Agricultural Marketing Service, 75).

[14] Wu, G., Bryant, M. M., Gunawardana, P. and Roland Sr, D. A. (2007). Effect of nutrient density on performance, egg components, egg solids, egg quality and profits in eight commercial Leghorn strains during phase one. Poultry Science, 86:691-697. www.worldbank.org/en/contry/nigeia/overview 26/08/2021

[15] Nworgu, F. C. (2007). Economic importance and growth rate of broiler chickens served fluted pumpkin (*Telferia occidentalis*) leaves extract, *African Journal of Biotechnology*, 6(2): 167–174.