THE EFFECTS OF DRIED WATERLEAF (*Talinum triangulare*) MEAL ON THE EGG QUALITIES AND ECONOMICS OF PRODUCTION LAYING HENS

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ABSTRACT

The effect of dried waterleaf (Talinum triangulare) meal (WLM) in feed of layers was tested on the egg quality and the economics of production of eggs. 64 Lohman brown pullets at the age of 24 weeks were allotted to 4 dietary treatments with 2 replicates of 8 birds each. T_1, T_2, T_3, and T_4 contained 0%, 1.0%, 1.5% and 2.0% of dried waterleaf respectively. Egg weight varied significantly ($P<0.05$) with T_3 (60.43g) and T_4 (58.71g) being significantly higher than T_2 (54.92g) and T_2 also higher ($P<0.05$) than the control, T_1 (51.52g). Shell thickness also varied significantly ($P<0.05$) and it is higher in T_3 (0.48mm) and T_4 (0.46mm) and least in the control (0.37mm) and T_2 (0.38mm). Shell weight showed no significant difference ($P>0.05$). The yolk weight showed no significant difference ($P>0.05$) though highest in T_3 (15.55g) followed by T_4 (14.79g) and least in T_1 (12.37g) which did not differ from T_2 (13.32g). Yolk height, yolk width, yolk colour and albumen weight showed no significant difference ($P>0.05$). Dried waterleaf meal at 1.5% and 2.0% had outstanding effects on egg weight, shell thickness and on the yolk weight and was beneficial in reducing the cost of production of eggs from ₦190.21 in (T_1) to ₦121.49 (T_3).

Keywords: Waterleaf *(Talinum triangulare)*, Egg quality, Economics, Layers

INTRODUCTION

The increase demand for animal protein can only be met by enormous increase in the production of chicken (Uluocak *et al.*, 2000). With the ever growing population of Nigeria, the demand for meat and eggs of chicken origin will continue. Chickens farmed for eggs are called egg-laying hens. Chicken eggs vary in colour depending on the hen, typically ranging from bright white to shades of brown and even blue, green, and recently reported purple found in South Asia, *Araucana* varieties (FAO, 2007). In 2000, there were 50.4 million tons of eggs produced in the world and an estimated 53.4 million tons of table eggs were produced during 2002 as reported by Muir and Aagrey (2003). A hen's egg production is at its peak from approximately 6 to 18 months of age (Lynn, 2013). Healthy pullets will begin laying at about 20 weeks of age. Excellent production would be considered 80% to 90%, but breed, housing, weather, management, parasite load, and nutrition can all affect rate of lay (Purina, 2007). For optimal performance of poultry, nutrient manipulation is recommended by Johri (2009), McDowell & Ward, (2009).

Waterleaf (*Talinumtriangulare*) is an herbaceous annual and perennial plant with a broad, worldwide distribution. It is mostly found in western Africa and western North America and eaten as vegetables. It is cultivated in Nigeria and Cameroon. Waterleaf (*Talinumtriangulare*) contains some minerals and phytochemical contents. The minerals includes magnesium, potassium, sodium, calcium and iron while the phytochemicals are saponin, oxalate, alkaloid, tannin and phytate (Tesleem *et al*., 2008).

Growing consumer's demand for traditional food supplements and interest in self-medication calls for extensive research into the nutritional potential of *Talinumtriangulare* and its possible side effects (Ofusori *et al*., 2008a). Waterleaf's crude protein content compares favourably with that of cowpea, peanut, millet, and cashew nuts (Egwin, 1979). Akachuku and Fawusi (1995) investigated the crude protein content of waterleaf leaves and tender stems and found it to be as high as 29.4% and 13.4%, respectively. Sridhar and Lakshminarayana (1993) also gave a report on high total lipids, essential oils, and alpha-tocopherols and beta-tocopherols in *Talinumtriangulare.* Antioxidants from waterleaf have been known to enhance brain functions (Bastianetto *et al*., 2000; Nwoha *et al*., 2007).

The vitamin C, vitamin E, and Beta-carotene, minerals (such as calcium, potassium, and magnesium), and soluble fibre (pectin) contribute to waterleaf's highly-elevated antioxidant values and its total biological effect (Akachuku and Fawusi 1995). The production of antioxidants in the body declines with age which therefore necessitates the need for nutritional supplement (Nwoha *et al.,* 2007 and Ofusori *et al.,* 2008b). Consumption of waterleaf can be recommended as food supplement to protect the brain cells and provide numerous other functions that are beneficial to the body. Prior studies have shown that consumption of vegetables and other food supplements rich in polyphenols can reduce age-related neurological disorders (Weinreb *et al.,* 2004; Dai *et al*., 2006; Nwoha *et al.,* 2007).

This research is therefore set out to determine the effect of waterleaf inclusion in the feed of layer birds with special attention on egg quality and economics of production.

This work is justified due to the rich nutrient profile of waterleaf (*Talinumtriangulare*) meal (WLM) which would be an advantage in obtaining good egg qualities.

Objectives of the Study

1. To determine the external and internal qualities of eggs of laying hens whose feed is fortified with dried WLM.
2. To determine the economics of egg production of laying chicken with feed fortified with dried WLM.

MATERIALS AND METHODS

Experimental Site: This study was carried out at the Poultry Unit of the Livestock Teaching and Research Farm of the Department of Animal Production, Kogi State University Anyigba, Dekina Local Government Area, Kogi State. Anyigba is located in the derived savannah zone of Nigeria on latitude 7^0 30^1 N and longitude 7^0 09'E. (Ifatimehin and Ufuah, 2006 .)

Experimental Diet: The basal feed used for the study was compounded on the farm according to the standard feed for layers in accordance with the

recommendations of the National Research Council (1994). All the feed ingredients were obtained from the experimental location.
The experimental diets are summarized in Table 1.

Table 1: Gross Composition of Experimental Diets for Laying Pullets Fed Waterleaf Meal (WLM)

	Treatments			
Ingredients	**T_1 (0%WLM)**	**T_2 (1%WLM)**	**T_3 (1.5%WLM)**	**T_4 (2%WLM)**
WLM	0.00	1.00	1.50	2.00
Maize	34.00	34.00	34.00	34.0
BDG	13.00	12.00	11.50	11.0
FFSBM	24.00	24.00	24.00	24.0
Maize offal	10.25	10.25	10.25	10.25
Rice offal	8.00	8.00	8.00	8.00
Bone Meal	3.00	3.00	3.00	3.00
Limestone	7.00	7.00	7.00	7.00
Salt	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Vitamin/Mineral Premix	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated nutrients and Energy				
Crude protein (%)	17.10	17.02	16.98	16.94
Crude fibre (%)	4.31	4.28	4.26	4.24
Ether extract (%)	7.25	7.23	7.21	7.19
Calcium (%)	3.88	3.89	3.89	3.90
Total phosphorus (%)	0.92	0.92	0.92	0.91
Energy (Kcal/kgME)	2594.4	2599.56	2602.14	2604.72

WLM = Waterleaf meal, BDG = Brewer’s dried grain, FFSBM = Full fat Soyabean meal.
Premix: Vitamin A 1000 IU, Vitamin D 200 IU, Vitamin E 1.01 IU, Vitamin K 0.2mg, Thiamine(B1) 0.15mg, Riboflavin (B2) 0.4mg, Pyridoxine (B6) 0.15mg, Niacine 1.5mg, Vitamin B12 0.15mg, Pantothenic acid 0.5mg, Folic acid 0.05mg, Biotin 0.002mg, Choline chloride 0.02g, Antioxidant 0.0125g, Manganese 0.008g, Zinc 0.002g, Iron 0.005g, Copper 0.0005g, Iodine 0.00012, Selenium 0.002mg, Cobalt 0.02g.

Test Ingredient and Preparation of the Material: The fresh leaves of waterleaf (*Talinumtriangulare*) were collected from different farms including the Teaching and Research Farm of Kogi State University, Anyigba. The harvested waterleaves were properly cleaned to remove dirt, weighed, chopped into pieces and dried in the glass house situated in the Faculty of Agriculture, K.S.U., Anyigba at a temperature of 43^0C for 2 weeks after which it was milled and then included in the layers feed.

Experimental Animal Design and Management: The study was carried out between the months of October and December, 2014 for 8 weeks using a completely randomized design. The birds were housed in deep litre system. A total of 64 Lohman brown pullets at point of lay (24 weeks old) were purchased from a reputable farm and used for the study. They were allotted on similar weight basis into four treatments (i.e. T_1, T_2, T_3 and T_4) and two replicates each, such that there were eight birds per replicates. T_1, T_2, T_3, and T_4 were given 0%, 10%, 15% and 20% of the milled dried waterleaf respectively, in the feed. The ratio of additions of dried waterleaf in the feed was 0g: 1kg, 10g: 1kg, 15g: 1kg, and 20g: 1kg respectively of the on-farm feed. T_1 (control) was given only the on-farm feed without waterleaf inclusion throughout the study. Completely randomized design was used for this study. The birds were housed in deep litre system.

Data Collection

Egg Quality Analysis: On weekly basis 24 eggs (i.e. 3eggs per replicate) were selected from the treatments for assessment of the internal and external characteristics.

External egg qualities: Egg weight and shell weight were taken using an electronic balance while the shell colour was observed through eye view and the colour was determined using a color chart.

Internal egg qualities: Albumen height, Yolk height and Yolk width were taken using the vernier calliper. The Albumen Weight was determined using an electronic scale

Chemical Analysis: Sample of the tested ingredient (*Talinumtriangulare)* was analysed for proximate composition according to the method of AOAC (1990) at the Biochemistry Laboratory, Ahmadu Bello University, Zaria, Nigeria.

Feed Cost: Parameters: The feed cost parameters determined were Feed cost per kg (₦/kg), Feed cost/100kg (₦/100kg), Feed consumed/egg (g), Feed/dozen egg(g) and Feed cost/dozen eggs (₦). Feed cost per Kg is based on the prevailing cost of ingredients at the time of the study.

$$\text{Feed consumed per dozen eggs} = \frac{\text{Feed intake X 12}}{\text{Total number of eggs.}}$$

StatisticalAnalysis

All data collected including cost of feed for the various treatments were analysed using a one way analysis of variance (ANOVA) according to Snedecor and Cochran (1992) using general linear model (GLM) procedures of Statistical Analysis System (SAS) Inc., (1998). Values were considered significant at $P<0.05$. Duncan Multiple Range Test was used to separate the means (Duncan 1955).

RESULTS AND DISCUSSION

The results of proximate analysis of dried waterleaf meal (WLM), effects of WLM on external quality and internal quality of eggs and the economics of production of eggs are presented in Tables 2, 3, 4 and 5 respectively.

Table 2: Proximate Composition and energy value of Dried Waterleaf Meal (WLM) fed to Laying Hens.

Determined Analysis	Dried Waterleaf Meal
Dry Matter (%)	94.56
Crude Protein (%)	30.94
Crude Fibre (%)	5.88
Ether extract (%)	1.56
Ash (%)	7.84
NFE (%)	53.78
Energy (kcal/kgME)	3530.25

NFE = Nitrogen Free Extract
ME=Metabolizable Energy, Metabolizable energy was calculated using the formula of Pauzenga (1985).

External Quality of Eggs of Laying Hens

The results of mean egg weight, shell weight and shell thickness are shown in Table 3.

Table 3: External Quality of Eggs of Laying Hens Given Dried waterleaf Meal

	Treatments					
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**	**LOS**
Egg Weight (g)	51.52^c	54.92^b	60.43^a	58.71^a	0.28	*
Shell Weight (g)	5.75	5.83	5.75	6.90	0.17	NS
Shell Thickness (mm)	0.37^b	0.38^b	0.48^a	0.46^a	0.00	*

a,b,c,d = means on same row with the same letters are not significantly different (P>0.05). * = significant. SEM = Standard error of mean, LOS = Level of significance, NS = No Significant difference.

Internal Quality of Eggs of Laying Hens

The effect of dried WLM on internal egg quality is shown in Table 4. The yolk height, yolk width, yolk colour and albumen weight were not significantly different ($p>0.05$). The yolk weight was significantly different ($p<0.05$) among all the experimental treatments. Yolk height range was from 5.28cm to 5.55cm, yolk width from 4.64cm to 4.93, and yolk weight from 12.37g to 15.55g.

Table 4: Internal Quality of Eggs of Laying Hens Given Dried waterleaf Meal

Treatment Parameters	T_1	T_2	T_3	T_4	SEM	LOS
Yolk Height (cm)	5.34	5.40	5.55	5.28	0.03	NS
Yolk Width (cm)	4.64	4.64	4.93	4.71	3.21	NS
Yolk Weight (g)	12.37^{c}	13.32^{bc}	15.55^{a}	14.79^{ab}	0.17	*
Yolk Colour	576.00	576.00	576.00	576.00	576.00	NS
ALB WT (g)	33.67	35.35	35.92	36.86	0.36	NS

a, b, c, d = means on same row with the same letters are not significantly different (P>0.05).
ALB=albumen, WT=weight. * = significant. SEM = Standard error of mean, LOS = Level of significance,
NS =No Significant difference.

Proximate Composition of Waterleaf (WLM) fed to Laying Hens.

The proximate composition of dried waterleaf is found in Table 2 (DM 94.56%, CP 30.94%, CF 5.88%, EE 1.56%, Ash 7.84%, NFE 53.78%, Energy 3530.25(kcal/kgME). The crude protein (CP) of waterleaf for this study is higher than what was reported by Akachuku and Fawusi (1995) who investigated the C P content of waterleaf leaves and tender stems and found it to be 29.4% and 13.4%, respectively. Nutritionally, waterleaf's CP content compares favourably with that of cowpea, peanut, millet, and cashew nuts (Egwin, 1979).

External Qualities of Eggs

Waterleaf inclusion levels influenced egg weight at different magnitude in the present study. Egg weights with a range of 51.52g to 60.43g were observed. T_3 (60.43g) and T_4 (58.71) were significantly higher ($P<0.05$) than T_2 (54.92) which was significantly higher ($P<0.05$) than the control (51.52). The observed values agree with the range of egg weight values observed by Ologhobo *et al*. (2014) when Moringa Leaf Meal was fed to laying chickens and was close to the value of 57g reported by McDonald *et al* (1995). However, mean egg weight values were slightly low compared with standard egg weight (58g) reported by Shenstone (1968) and Katule (1989). The reason for the low egg weight values could have been due to the fact that laying chickens used in the present study were within the first phase of egg production. The waterleaf inclusion showed no significant effect ($p>0.05$) on shell weight. However, egg shell thickness observed in this study (0.37 - 0.48 mm) is better than 0.32 mm reported by Abutu *et al.* (2008) and also slightly above the range observed by Orunmuyi *et al*. (2007). T_3 (0.48 mm) and T_4 (0.46 mm) where higher ($P<0.05$) than T_2 (0.38 mm) and T_1 (0.37 mm). T_2 and T_1 were similar. Stadelman (1977) reported that a sound egg with shell thickness of not less than 0.33 mm can pass through the market handling without any breakage. The result showed that the hens received adequate mineral supply especially calcium which aided the thickness of the shell. The egg shell thickness is an important indicator of the specific gravity (relative density) of eggs (Oluyemi and Roberts, 1983).

Internal Qualities of Eggs

The yolk height, yolk width, yolk colour and albumen weight of the eggs from hens given dried waterleaf in their feeds had no significant difference ($p>0.05$).The result shows that the quality of yolk of the control hens were close to those of the experimental hens. Yolk colour observed throughout the experiment were 576***O Nickel Yellow coded PY53 (Sennelier, 2009).

Economics of Egg Production

As shown in Table 5, the dietary inclusion of dried waterleaf meal at graded levels caused significant reduction ($P<0.05$) in total feed cost. This can be attributed to the fact that waterleaf vegetable was obtained at a cheap rate and therefore the waterleaf meal based diet were cheaper compared to the control which had no waterleaf meal inclusion.

TABLE 5: Economics of Feeding Waterleaf Meal (WLM) To Laying Pullets.

Parameters	T_1 (0%WLM)	T_2 (1%WLM)	T_3 (1.5%WLM)	T_4 (2%WLM)	SEM	LOS
Feed cost/100kg(₦/100 kg)	$10,066.00^a$	$8,218.00^b$	$8,210.00^c$	$8,202.00^d$	0.00	*
Feed cost per kg (₦/kg)	100.66^a	82.18^b	82.10^c	82.02^d	0.00	*
Feed consumed/egg(g)	157.47^a	154.95^a	123.31^b	157.82^a	0.53	*
Feed/dozen egg(g)	$1,889.64^a$	$1,859.34^a$	$1,479.64^b$	$1,893.77^a$	6.38	*
Feed cost/dozen eggs (₦)	190.21^a	152.80^b	121.49^c	155.33^b	0.52	*

a,b,c,d = means on same row with the same letters are not significantly different (P>0.05),
* = Significant, LOS = Level of significance, SEM = Standard error of mean, NS = not significant.

Feed cost per 100Kg feed varied significantly (P<0.05) between the control (₦10,066) and the WLM diet T_2 (₦8, 218), T_3 (₦8,210) and T_4 (₦8,202). The feed cost of the WLM based diet T_2, T_3 and T_4 varied significantly (P<0.05) and in parallel to inclusion level, T_4 being the cheapest at the rate of ₦8,202.

Feed cost per Kg feed followed a similar trend with feed cost per 100Kg feed with significant difference at (P<0.05), with values as follows, T_1 (₦100.66), T_2 (₦82.18), T_3 (₦82.10) and T_4 (₦82.02). Feed consumed to produce an egg varied significantly (P<0.05) between the control and T_3 and between the other WLM based diets T_2, T_4 and T_3. T_3 being the lowest at ₦123.31.

Feed cost per dozen eggs varied significantly ($P<0.05$) between control and the WLM based diets and within the WLM based diets; T_3 at ₦121.49 was significantly reduced ($P<0.05$) than T_2 (₦152.80), T_4 (₦155.33) and T_1 (₦190.21). T_2 and T_4 were similar but were significantly lower ($P<0.05$) than the control.
The result of this study agree with the findings of Ayoola and Sanda (2011) who reported highest economic yield in weight, profitability and efficiency in broilers whose feed were supplemented with vitamins A, C, E, and Selenium and Soltan (2008) who reported highest net income in the layers group that was supplemented with 780ppm organic acid.

This work also agrees with Onyimonyi *et al.* (2009) who reported that incorporation of 0.5% neem leaf meal (NLM) in the diets of broilers yielded better performance and economic benefit to farmers.
Dried waterleaf meal was beneficial in reducing the cost of egg production.

CONCLUSION AND RECOMMENDATION

The study revealed that the inclusion of dried waterleaf meal at 1.5% and 2.0% had outstanding effects on egg weight, shell thickness and on the yolk weight and was beneficial to reduction in the cost of egg production.

Based on the findings, it is recommended that poultry farmers include dried waterleaf at 15g per kg in the diet of laying hens. To achieve better financial returns, cheaper ingredients rich in protein, vitamins and minerals like waterleaf should be included in layers' diets in order to reduce cost of production.

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