



Original Research

Performance and Egg Quality of Laying Birds Fed Varying Levels of Oil Palm Slurry-Wheat Offal Meal Based Diets

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Abstract

The study was conducted to evaluate the effect of Oil Palm Slurry-Wheat Offal (OPS:WO) meal based diets on the performance and egg quality of laying birds. OPS:WO were combined at (1:1) and (1:1.5), and used for partial replacement of maize in treatment 2 (T2) and treatment 3 (T3) respectively. 90 laying birds were equally and randomly distributed among the 3 treatments of three replicates each. Birds were raised for 12 weeks during which feed consumption, egg production, egg quality parameters were monitored. Heday production was significantly ($P < 0.05$) different with highest value (78.39) recorded from T2 while least value (66.79) recorded from the control. Production cost was also in favour of T2. Significant ($P < 0.05$) difference in egg shell and egg shape index were recorded, while all other egg quality parameters were not significant ($P > 0.05$). It could be established that processed OPS:WO could be used as feed ingredient in laying diet.

Key words: Egg Production, Egg Quality, Layer, Non-Conventional, Oil Palm Slurry

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Introduction

The problem of poultry in Nigeria is mainly on the scarce and/or very expensive conventional feedstuffs like maize, sorghum, soya meal and groundnut cake to mention few. Feeding is an important part of raising chicken which makes up the major cost of production, good nutrition has positive influence on the bird's performance and its products (Emiola and Ologhobo, 2006). The increasing cost of feed resources in livestock production has been identified as a serious impediment in meeting the demand for animal protein particularly in developing countries (Adejinmi *et al.*, 2000). The use of agro-industrial by products to substitute the scarce and expensive conventional feed stuffs towards reducing feed cost has been widely recognized (Atteh and Ologbenla, 1993). However, Mango seeds (for example) contain some anti-



nutritional factors such as tannin, phytic acid, oxalic acid, tyrosin inhibitors etc which reduces its utilization due to their low digestibility, palatability and /or acceptability (Rafiu *et al.*, 2014), Reduction in tannin effects through processing and vitamins supplementation however improved their utilization in the diet of the birds (Rafiu *et al.*, 2016).

There have been numerous attempts to convert palm oil mill effluent into a viable animal feed resource. The use of artificial drying method has been discontinued due to excessive fuel cost and the large capital investment required. Same experience was recorded during the conversion of fresh palm oil mill effluent into a potential feed stuff through fermentation (anaerobic, thermophilic and acidophilic), followed by concentration (centrifugation or decantation down to 15-20% DM) (Chavapartit, 2006). However its utilization cannot be overlooked because of its high metabolizable energy level of 21.7MJ/Kg among other nutrients (Atuahene *et al.*, 2000). Further drying can be done by absorption on dry feeds such as cassava roots, dehydrated grass or palm kernel meal, or by conventional drying methods (Chavalparit, 2006).

Wheat offal, a potential agro industrial by-product is of importance to replace a portion of maize or used conventionally in layer's diets. This observation would make economic sense, since maize, the conventional energy source, has become scarce and expensive due to high demand caused by competition for its use as human food and industrial raw material versus low production rate (Modise *et al.*, 2006). The use of oil palm slurry for feeding of laying bird could also be a way of utilizing this by-product of oil milling industry and reduces its environmental pollution. Hence, this study is aimed at substituting maize with oil palm slurry-wheat offal mixture at different level,

Materials and Method

Experimental Site

The experiment was carried out at faculty of Agricultural Science, Teaching and Research Farm, Ladoko Akintola University of Technology, Ogbomoso, Oyo State, Nigeria.

Test Ingredient and Its Preparation

Oil palm slurry was obtained from a local palm oil mill industry at Iresa Adu, Oko, Surulere local government, Ogbomoso and wheat offal was purchased from a reputable feed mill in Ogbomoso town, Oyo State.

Wet oil palm slurry was collected from effluent tank. It was sieved with small water to remove the shaft in the slurry. Then transferred into a jute sack and left for 72 hours for the water to drain and fermentation process to take place. The semi-solid, fermented OPS was then mixed with wheat offal which serves as absorbent and for easy drying at ratio 1:1 and 1:1.5 (OPS: WO), on dry matter bases. The mixture (OPS: WO) was then sundried on a sack for 7 days repeatedly till constant weight was attained. After drying, the

OPS: WO was then grinded to ensure thorough mixing and easy picking by the birds, before packing into an air tight container.

Experimental Diets

Three experimental diets were formulated based on the OPS: WO combinations. Laboratory analysis of the diets and OPS: WO combinations were carried out and reported as shown in the Table 1 below-

Table 1: Experimental diet of layer bird fed varying level of OPS: WO

Ingredients	T1(Control)	T2(1:1)	T3(1:1.5)	OPS:WO (1:1)	OPS:WO (1:1.5)
Maize	50	40	40		
OPS:WO	-	10	10		
Soya Bean Meal	5	5	5		
Wheat Offal	15	15	15		
Groundnut Cake	13.1	13.1	13.1		
Fish Meal	3	3	3		
Bone Meal	3	3	3		
Oyster Shell	10	10	10		
Lysine	0.2	0.2	0.2		
Methionine	0.2	0.2	0.2		
Salt	0.25	0.25	0.25		
Premix	0.25	0.25	0.25		
Total	100	100	100		
Laboratory Analysis					
Dry matter (%)	92	91.12	91.68	93.1	92.44
Crude protein (%)	17.29	17.46	17.95	9.1	12.95
Ether extract (%)	4.32	4.57	4.73	6.54	8.29
Crude fibre (%)	5.74	5.58	7.05	12.48	8.6
Ash (%)	8.76	8.41	12.17	6.02	2.91
NFE	55.89	55.1	49.78	58.96	59.69
ME(Kcal/kg)	2974.18	2972.7	2814.94	3270.46	2960.17

Experimental Birds

Ninety, 12 weeks in laying birds were used for experiment. They were distributed randomly into three treatments of three replicate each, at 30 birds per treatment and 10 birds per replicate. Each group was allocated to one experimental diet.

Management of Experimental Animals

The birds were housed in battery cage. Vaccination and medication programme were strictly adhere to. The birds were fed (to satisfactory) the experimental diets and water throughout the feed trial period.

Data Collections

Data such as daily feed intake, daily egg production were collected and recorded on daily basis while egg analysis was done on weekly basis.

Statistical Analysis

All data obtained were subjected to analysis of variance (ANOVA) using SPSS version 21 software. Mean were separated using Duncan multiple range test of the same software.

Result and Discussion

Table 2 shows the result of performance characteristics of laying birds fed varying OPS: WO based diets. All parameters (HDP, average daily feed intake and production cost) were significantly ($p < 0.05$) influenced in favour of OPS:WO inclusion as feed ingredient. Highest value of HDP was recorded at T2 (78.39) while the least value (66.79) was recorded from the control (T1). The highest value of Average daily feed intake (134.55g) was recorded at T2 while the least value (120.42) was recorded at T1. The highest value (₦94.40) of feed cost per kilogram was recorded at T1 while the least value (₦92.45) was recorded at T2. The highest value (₦509.12) of feed cost per 30 eggs was recorded at T1 while the least value (₦475.93) was recorded at T2. The highest value (₦203.64) of feed cost per dozen egg was recorded at T1 while the least value (₦190.37) was recorded at T2 (1:1 OPS: WO mixture), though statistically ($P > 0.05$) similar to T3 (1:1.5 OPS: WO). The egg performance characteristics of the layer birds fed with 20% inclusion level of Oil palm slurry-Wheat offal based diets was significantly ($P < 0.05$) better than the control. This significant ($p < 0.05$) difference observed among the treatments on the basis of the Hen-day production and feed intake may be attributed to the potential of slurry that had element of palm oil which enhances the taste, flavour and energy of the diet thus increase the acceptability. This is in agreement with the findings of Donkoh and Attoh-kotoku (2009) who reported that monogastric animal will consume diets in which maize portion has been wholly replaced by oil palm slurry and thrived favourably well.

Oil palm slurry as the treatment also has positive effect on the feed cost of the birds. i.e. the use of oil palm slurry is less expensive compare to the use of maize in the production of feed for laying birds, especially in a way very economical for layers farmer even when comparing the expenses on feed production to the egg produced by the laying birds. There is a wide range of positive effect which helps poultry farmers to have maximum profit.

Table 2: Egg performance characteristics of laying birds fed OPS: WO based diets

Parameter	T1(control)	T2(1:1)	T3(1:1.5)	SEM
HDP	66.79 ^b	78.39 ^a	76.43 ^a	1.46
ADFI(g)	120.42 ^b	134.55 ^a	133.33 ^a	1.84
Feed Cost Kg (₦)	94.40 ^a	92.45 ^c	92.87 ^b	0.16
F Cost 30 eggs (₦)	509.12 ^a	475.93 ^b	486.17 ^{ab}	16.12
Feed Cost Dozen egg (₦)	203.64 ^a	190.37 ^b	194.47 ^{ab}	10.17

^{a,b} means the same row with different superscripts were significantly ($p < 0.05$) different; HDP = Hen day production, ADFI = Average daily feed intake.

Table 3 shows the egg quality characteristics of layer birds fed with varying levels of oil palm slurry-wheat offal (OPS:WO) based diets. A significant ($P<0.05$) difference was recorded in mean values of egg shell proportion and egg shape index while other egg quality parameters were less affected ($P>0.05$).

Proportion of shell weight was positively ($P<0.05$) influenced by OPS: WO with 20% inclusion level of 1:1, OPS: WO combination taken the lead, though statistically ($P>0.05$) similar to 1:1.5 OPS: WO combination. This established the fact that egg obtained from OPS:WO based diets were more stronger than the control due to their better breaking strength as a result of better thickness and density (Gongruttananun, 2011). Egg shell quality has always been a problem in the layer industry especially in the last stage of the laying period. Numerous studies have been conducted to solve the problems of poor shell quality. Many of these studies have focused on the energy content, calcium and iron content of the feed. Shell strength has a great importance from an economic point of view, since broken eggs are discarded, causing money loss. Shell mechanical properties are crucial also for shelf life and safety of eggs and eggs products (Hrnčár *et al.*, 2013). Oil palm slurry utilization thus seems to enhance the egg shell quality by providing adequate nutrient in form of calcium and phosphorus to strengthen egg shell (Atuahene *et al.*, 2000).

The highest value (0.67) of Egg Shape Index (ESI) was recorded at treatment 1, which is the control while the least value was recorded at treatment 2 (0.60) though statistically ($P>0.05$) similar to T3 (1.1.5 OPS: WO). Egg shape index is defined as the ratio of width to length of the egg, and it is an important criterion in determining egg quality. ESI has positive relationship with albumen quality (Çiçek-Rathert *et al.*, 2011), shell thickness, egg albumen length, egg yolk width, egg yolk height and egg yolk colour (Sekeroğlu *et al.*, 2000), egg width or egg length (Abanikannda *et al.*, 2007; Olawumi and Ogunlade, 2008; Çiçek-Rathert *et al.*, 2011;). However, Alkan *et al.* (2010) reported a contrary opinion (a significant negative correlation) between the egg shape index and shell thickness. In this current work, ESI was observed to be independent of other parameters, though not significant but eggs from OPS: WO based diet especially 1:1 had better values except albumen weight. Inclusion of oil palm slurry even up to 20 percent in layer diets had no significant effect on egg weight. This had confirmed the results of the earlier experiments reported by Atuahene *et al.* (1987) and Lots (2015).

There were no significant differences in haugh unit among the different levels of palm oil slurry. However, the haugh units were apparently decreased with increasing age of the birds mixing ratio of OPS: WO. The use of Haugh units has been accepted as a measure of the quality of the albumen and shelf life in various studies of egg quality. The Haugh unit value of fresh eggs decreases with increasing age of the hen (Hrnčár, *et al.*, 2013), and the albumen height decreases as birds age, as well (Ershad, 2005). According to Genchev, (2012), energy content of the feed and storage time negatively influence the quality of eggs and significantly reduce the Haugh unit, because of the continuous loss of CO_2 . Gerber *et al.* (2012) report that the temperature and relative humidity are the most important factors that affect egg quality during storage.

Dauda *et al.* (2006), evaluating the effect of temperature (ambient and refrigerated) and storage time on egg quality, verified that the increase of storage time caused reduction in Haugh unit and egg weight. They also reported that the storage time affects the quality of eggs, exerting a negative influence on the Haugh unit. Effect of inclusion of palm oil slurry on shell thickness was reported in the experiment, it was not affected among different dietary treatments and apparently higher (13.99) in T2 and lower (13.45) shell thickness was in T3.

Effect of palm oil slurry on yolk quality expressed as yolk index was reported in the experiment. There was no significant difference among treatments. The highest (0.47) yolk index was in T2 and lowest (0.43) was noticed in T3 diets.

Table 3: Egg quality characteristics of laying birds fed OPS-WO based diets

Parameter	T1(Control)	T2 (1:1)	T3 (1:1.5)	SEM
Egg Weight	58.05	59.51	57.77	0.97
%Yolk Weight	18.8	25.84	24.13	2.01
%Alb Weight	66.24	60.64	61.53	1.84
% Shell weight	7.23 ^b	8.25 ^a	7.74 ^{ab}	0.18
HU	96.45	97	95.42	1.37
Yolk Index	0.46	0.47	0.43	0.1
Yolk: Alb	0.3	0.46	0.43	0.42
Yolk Colour	2.75	1.63	2.67	0.23
Shell Thickness	12.45	13.99	13.45	0.33
ESI	0.67 ^a	0.60 ^b	0.63 ^b	0.08
SSA	73.01	74.16	72.71	0.84

^{a,b} means the same row with different superscripts were significantly ($p < 0.05$) different; Alb: Albumen, HU: Haugh unit, ESI: Egg shape index, SSA: Shell surface area

Conclusion

It could be concluded from the result of this study that (OPS:WO) at 20% replacement level of ratio 1:1 can be included in the diet of layer birds as it gave best performance in terms of average feed intake, hen day production and feed cost. 20% maize replacement level with OPS: WO is recommended because there was no risk but improved feed intake, egg production performance or egg quality were observed.

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