Egg Quality Characteristics and Follicle Stimulating Hormone Level of Laying Birds fed *Moringa oleifera* Leaf Meal

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Abstract

The study was conducted to determine the impact of graded levels of *Moringa oleifera* leaf meal on egg production, quality and follicle stimulating hormone content of ISA laying birds of 74 week's old. Sixty (60) ISA brown layers were randomly assigned into four treatment groups designated T_1, T_2, T_3, and T_4 in a completely randomized design (CRD). *Moringa oleifera* leaf meal was oven dried at 78°C for two hours, blended to powder leaf meal and incorporated into layers mash with the following inclusion levels: Treatment 1, (Control) had 0g *Moringa oleifera* leaf meal/kg feed, T_2 contained 5g *Moringa oliefera* leaf meal/kg feed, T_3 had 10g *Moringa oleifera* leaf meal/kg feed and T_4 contained 15g *Moringa oleifera* leaf meal/kg feed. Egg production record was kept during the study while at the end of the 56 days study, two eggs and two blood samples were collected per replicate for egg quality studies and follicle stimulating hormone (FSH) assay. The egg production was also studied. The result obtained showed that the egg production was significantly ($P < 0.05$) affected by the treatment with the higher production obtained from the hens fed the moringa meal, especially T_3 diet and the lowest egg production from hens fed the T_1 diet. The shell thickness and yolk ratio were also significantly ($P > 0.05$) different amongst the treatment groups with the highest values from T_4 although not different from T_2 and T_3. However, the egg weight, yolk weight, albumen weight and yolk: albumen ratio were not significantly affected ($P < 0.05$) across the treatment groups. The follicle stimulating hormone (FSH) of the hens was significantly affected ($P < 0.05$) by the dietary treatment with T_3 having the highest value. It was concluded that egg production could be enhanced in old layers through the addition of 10g of *Moringa oleifera* leaf meal per kg feed (T_3) since it increased egg production and the FSH level.

Key words: Egg quality, FSH, Hens, *Moringa oleifera* leaf, Performance

Introduction

Poultry production in developing countries is facing some problems, one of which is an increase in the cost of feed due to high prices of protein and energy sources. Adenjimi *et al.* (2011) emphasized that the expansion of the poultry industry depends largely on the availability of good quality feed in sufficient quantity and at prices affordable to both producers and consumers. This is very important for intensive layers' enterprise which is very sensitive to nutrition as inadequacies in nutrient supply often lead to a fall in egg production and eventual cessation of lay.

With the present trend of rising prices of feed ingredients, there has been a search for non-conventional feedstuff with potentials of improving poultry performance at reduced cost (Abbas 2013). Of such non-conventional feed sources, leaf protein concentrates have been reported in many literatures (Farinu *et al.* 1999) including ethno-veterinary plants such as *Moringa oleifera* which is currently leading the list of such plants (Abbas 2013). *Moringa oleifera*, a tree belonging to the family of *moringaceae* has many uses, it is of great importance and is found throughout most parts of the tropics (Abbas, 2013). Various parts of *Moringa oleifera* (leaves, fruits, and flowers) are incorporated into the traditional food of humans in tropical and sub-tropical countries according to Nadkarni (1976).

Moringa oleifera leaves have been reported to contain crude protein 27.51%, crude fiber 19.2%, crude fat 2.23%, ash 7.13%, moisture content 76.53%, carbohydrate 43.88% and caloric value of 305.62% (Oduru *et al.*, 2008). Yemeogo *et al.* (2013), reported that on a dry matter basis, moringa leaves contained 27.2% protein, 5.9% moisture, 17.1% fat and 38.6% carbohydrate while Sarwatt *et al*. (2004) reported ots content as 80% dry matter (DM), 29.7% crude protein (CP), 22.5% crude fibre (CF), 4.38% ether extract (EE), 27.8% calcium (Ca) and 0.26% phosphorus. Ogbe and Affiku (2013) also found low levels of anti-nutrients in *Moringa oleifera* leaves, thus, its leaves tend to be preferred for use in animal diets as leaf meal (Abbas, 2013). Moringa leaf meals do not only serve as protein source but also provide some necessary vitamins, minerals and oxy-carotenoids which causes yellow colour of shank and egg yolk.

A large number of reports on the nutritional quality of *Moringa oleifera* has earned it the name "a tree of life". Jed and Fahey (2008) opined that the protein quality of moringa leaves is comparable to that of milk and eggs. Apart from nutritional and health benefits of *Moringa oleifera* which are enormous, Olugbemi *et al*. (2010) reported hypocholesterolemic properties of *Moringa oleifera* leaves, Fahey *et al.* (2001) reported the anti-microbial properties while Greg (2008) reported the natural digestive enzyme in moringa leaves. With these reports from the research on moringa leaves, this study was conducted to access the effect of *Moringa oleifera* leaf meal on egg production, quality and the follicle stimulating hormone level of the laying hens, especially the hens in late production.

Materials and Methods

Location of study:

The experiment was conducted at the Poultry Unit of the University of Port Harcourt Teaching and Research Farm, Port Harcourt, Rivers State Nigeria.

The birds, housing and management

Sixty (60) laying birds of 74 week's old acquired from the Poultry Unit of the University of Port Harcourt Research Farm were separated and housed in battery cage system. The experiment was carried out for eight weeks. During the experiment, feed was provided twice daily, water was given *ad-libitum* while other poultry management practices were maintained.

Experimental diets and design

The fresh leaves of *Moringa oleifera* were harvested from Songhai Initiative Development Rivers State and oven dried at 78°C for two hours in accordance with the methods of Wekhe and Oboh, (2007). The 60 laying birds were randomly assigned into four treatment groups designated as T_1 (control), T_2, T_3, and T_4 in a completely randomized design (CRD). The meal was incorporated into layers' mash as 0g of *Moringa oleifera* leaf meal/kg layers' mash for T_1, 5g *Moringa oleifera* leaf meal/kg layer mash for T_2, 10g *Moringa* leaf meal/kg layers' mash for T_3 and 15g *Moringa oleifera* leaf meal/kg layer mash for T_4. Each treatment of 15 birds was further divided into three replicates of five birds per each.

Data collection and analysis

Egg production record was kept during the study while at the end of the eight weeks' experimental period, two eggs were collected per replicate to study the egg parameters. Parameters such as egg weight, shell thickness, albumen weight, yolk weight, yolk ratio and yolk albumen ratio were measured. Eggs weight was measured using an electronic sensitive weighing scale while the shell thickness was obtained with the aid of the micrometer screw gauge. The yolk weight and albumen weight were measured separately with the aid of an electronic weighing balance while the yolk ratio was obtained using the mathematical expression: yolk weight ÷ egg weight × 100 and the yolk: albumen ratio was determined using: yolk weight ÷ albumen weight × 100.

Two blood samples were collected from the wing veins of two hens per replicate into sterile non-heparinized tubes and centrifuged to obtain the serum for follicle stimulating hormone (FSH) assay. The test was carried out following the procedure as described by Clinotech Diagnostic and Pharmaceuticals test kit (1999).

Data analysis

The data obtained were subjected to one way analysis of variance (SAS Institute Inc. 1999). The treatment means were compared using Duncan's procedures of the same software.

Results and Discussion

The results of the effect of *Moringa oleifera* on egg production, egg quality and follicle stimulating hormone of ISA brown layers are presented in Table 1. The study revealed that egg production was significantly (*P*

< 0.05) affected by the diets such that higher egg production was obtained from the hens fed the moringa meal, especially T_3 diet and the lowest egg production from hens fed the T_1 diet. This showed that birds fed the moringa leaf meal, especially T_3 had better egg production compared to birds on T_1, thus, an inclusion level of 5 - 10g moringa/kg feed, as feed additive, improved egg production and egg quality while its non-inclusion (T_1) was not beneficial because it resulted to lower egg productivity and poorer egg quality indices (shell thickness and yolk quality). Thus, Radovich (2009) stated that feeding chickens with moringa leaf meal improved egg production. The highest egg production in T_3 compared to T_4 (which was lower but better than the control) agreed with the finding of Ebenebe *et al*. (2013) who stated that lower levels of *Moringa oleifera* enhanced egg production and egg quality than the higher levels of inclusion.

The dietary treatment also affected the shell thickness and yolk ratio significantly such that the hens fed diet T_4 (15% inclusion) had the highest value although not different from the other treated groups (T_2 and T_3) while the control group had the lowest values was in contrast with the finding of Ebenebe *et al.* (2013) who reported that shell thickness and other egg quality traits did not show any significant differences with ISA brown breed when fed various levels of *Moringa oleifera* leaf meal. This disparity may be attributed to the age of the birds.

The diets did not affect ($P > 0.05$) the egg weight, yolk weight, albumen weight and yolk: albumen ratio across the treatment groups supported the findings of (Kakengi *et al*., 2007, Olugbemi *et al*., 2010; Abou-Elezz *et al*., 2011) who affirmed that the use of *Moringa oleifera* leaf meal up to 10% had no detrimental impact on the productive performance of laying hens. The range of egg weight (55.33 - 59.66g) obtained in this study agreed with the weight reported by Olugbemi *et al*. (2009) implying that the use of *Moringa oleifera* leaf meal had no deleterious effect on the hens' eggs. The non-significant difference obtained in the egg weight obtained was in-line with the finding of Wei *et al.* (2016) who reported that no significant difference was observed in the weight of eggs obtained from hens that were fed 5, 10 and 15% moringa leaf meal in diet. The arrays of important bioactive substances and nutritional value of moringa leaf meal (Sarwatt *et al.,* 2004) as well as the natural enzyme that aid feed digestibility in moringa as reported by (Greg, 2008) may be responsible for the result obtained in this study. The result therefore indicated that inclusion of moringa leaf at 5 -10g/kg feed maintained egg weight. However, this result is in contrast with the findings of Kakengi *et al.* (2007) who recorded heavier eggs with 5% inclusion of *Moringa oleifera* leaf in the diet as compared to 10% inclusion. It also did not tally with the finding of Paguia *et al.* (2012) who reported that there was difference in egg weights from layers fed on *Moringa oleifera* leaf and twig meals at different levels ranging from 0.2% to 0.8%.

The Follicle Stimulating Hormone (FSH) of the hens was however significantly affected ($P < 0.05$) by the dietary treatment across the groups. The FSH of the hens fed the T_3 diet was significantly higher ($4.83^a \pm 0.20$) though not different from the hens fed the T_1 diet and the least ($2.73^c \pm 0.15$) from hens fed the T_2 diet. The *Moringa oleifera* leaf meal which enhanced the FSH level of hens fed the T_3 diet (10% *Moringa oleifera* leaf meal/kg feed) was consistent with Disere (2015) who observed an increased FSH status of adult rabbit does fed graded levels of *Moringa oleifera* leaf meal. Thus, the elevated FSH profile in T_3 could be linked to the significantly higher egg production level of the hens fed the T_3 diet in this study. This result supported the findings of Kakengi *et al*. (2007) who reported that the additive effect of *Moringa oleifera* improved egg production. It thus confirmed that FSH enhances the development of the ova, that is, egg development in ovaries (Ferin, 2000). It also tallied with the report by Shanaway (1994) who stated that ovarian growth and functions are closely associated with the increase in the concentrations of plasma LH and FSH. FSH is a glycoprotein gonadotropin secreted by the anterior pituitary in response to gonadotropin releasing hormone (GnRH), which is released by the hypothalamus (Bowen, 2004). Its major function is the growth and maturation of egg before it is laid. This result, thus, support the findings of Ajuogu, *et al.*, (2015) and Yahaya *et al.*, (2015) who reported that ethno-veterinary plants like *Moringa oleifera* are employed in dietary manipulation in the form of feed additives to promote growth, enhance reproductive performance and improves the general wellbeing of animals and humans.

Conclusion

This study proves that the inclusion of *Moringa oleifera* leaf in laying birds' diet has positive effects on egg production and egg quality of ISA brown layers in late production. It could be used to support the claim for traditional usage of *M. oleifera* as a reproductive enhancing medicine as it also increased the level of FSH and egg production at 10g moringa leaf meal/kg feed. The best level of the diet (T_3) used in this study can therefore be used to keep aging birds in lay since it was shown to be an effective and safe/alternative remedy for ISA brown layers that were about to be culled.

Table 1: Effect of different levels of *Moringa oleifera* leaf meal on egg production, quality and FSH of ISA brown layers

Parameters	T_1 (0g MOLM)	T_2 (5g MOLM)	T_3 (10g MOLM)	T_4 (15g MOLM)
Egg production and quality				
Egg production	$173.67^{c} \pm 0.89$	$202.33^{b} \pm 1.45$	$232.00^{a} \pm 35.50$	$194.00^{b} \pm 6.35$
Egg weight (g)	59.00 ± 0.00	57.33 ± 1.33	59.66 ± 2.33	55.33 ± 0.33
Yolk weight (g)	14.00 ± 0.57	14.00 ± 0.57	15.00 ± 1.00	15.66 ± 0.88
Albumen weight (g)	34.66 ± 1.45	35.33 ± 1.33	36.66 ± 1.45	33.33 ± 0.33
Shell thickness (mm)	$1.03^{b} \pm 0.01$	$1.04^{ab} \pm 0.01$	$1.04^{ab} \pm 0.01$	$1.06^{a} \pm 0.01$
Yolk ratio	$23.73^{b} \pm 0.98$	$24.48^{ab} \pm 1.49$	$25.09^{ab} \pm 0.82$	$28.31^{a} \pm 1.58$
Yolk albumen ratio	0.41 ± 0.04	0.39 ± 0.01	0.41 ± 0.01	0.47 ± 0.02
Hormone				
Follicle Stimulating Hormone (mIU/mL)	$4.47^{ab} \pm 0.66$	$2.73^{c} \pm 0.15$	$4.83^{a} \pm 0.20$	$3.20^{b} \pm 0.64$

^{abc} Means with different superscript in the same row are significantly different ($P < 0.05$)

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