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EGG LAYING PERFORMANCE OF CHICKENS FED GRADED LEVELS OF DISCARDED UNDEFATTED CASHEW KERNEL (DUCK) MEAL

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Abstract

A 12-week study was carried out to determine the effect of dietary levels of discarded undefatted cashew kernel (DUCK) meal on feed digestibility and egg laying performance of layer chickens. The cashew kernel was toasted for about 10 minutes in hot iron pot. After toasting, it was allowed to cool and then milled into gritty floor, bagged and labelled DUCK meal. The DUCK meal was incorporated in layer concentrate-based diets at 4 levels (0, 50, 75 and 100 g/kg). In the digestibility trial, 12 hens were randomly assigned to the 4 dietary treatments with 3 replicates per treatment. Known quantities of the experimental diets were weighed and supplied to the hens daily for 5 days. The faeces were collected in plastic sheet placed under the wire-mesh floor of the cages using the Total Collection Method. Samples of the experimental diets and faeces were subjected to proximate analysis and subsequently used for computing the nutrient digestibility. At 29 weeks of age, 120 ISA Brown layers were divided into 4 groups with 3 replicates per group comprising 10 hens per replicate in a Completely Randomized Design during the feeding trial. Feed and water were given ad libitum from 30 to 41 weeks of age. Data collected on nutrient digestibility, egg production and physical egg characteristics were subjected to ANOVA in GenStat. Dry matter digestibility reduced ($P<0.05$) in birds fed 10% DUCK meal. Whilst protein digestibility was not affected ($P>0.05$), fat and ash digestibility improved with increasing levels of DUCK meal in the diet. There was no significant ($P>0.05$) difference in all egg production parameters measured except for hen-day egg production. Birds fed diets containing 0 and 50 g/kg DUCK meal were similar ($P>0.05$) but higher ($P<0.05$) than those birds fed 75 g/kg DUCK meal for hen-day egg production. Those birds fed 100 g/kg DUCK meal had the lowest ($P<0.05$) egg production performance. Physical egg characteristics did not differ ($P>0.05$) among treatment groups. The study concluded that DUCK meal in diets of laying chickens had no adverse effects on protein digestibility, improved fat and ash digestibility and had adverse effect on egg production beyond 50 g/kg dietary inclusion.

Keywords: **cashew kernel, egg production, toasting, undefatted**

Introduction

The poultry enterprise in most developing countries of sub-Sahara Africa has suffered more than any other livestock sub-sector as a result of the short supply of feed ingredients which by extension have contributed significantly to the high cost of finished feeds especially under the intensive system.

Consequently, in order to reduce the cost of finisher feeds essentially in poultry enterprise in Ghana, emphasis must be placed on the need to fully harness the potential of the myriad agro-industrial by-products and the so called 'wastes' as partial and where possible whole substitute for the more expensive conventional protein resources (Agbede *et al.,* 2005).

One of such wastes is discarded cashew nuts which at present constitutes a major menace around most cashew nut processing industries in the Brong-Ahafo region of Ghana. Cashew (*Anacardium occidentale*) is among the widely cultivated fruits in Brong-Ahafo region of Ghana. The fruits are squeezed and made into fruit juice while the seeds, which contain the nuts, are processed into cashew nuts, pistachio, resin and oils (Adeyeye, 2004). Although the nutritional

value of cashew nuts has long been recognized (Fetuga *et al.* 1974), cashew nut meal has in recent times assumed greater importance due to the fact that its use has been extended from human consumption to the feeding of poultry, especially in layers (Onifade *et al.,* 1998).

The upsurge in the consumption of the cashew in this region has resulted in its large-scale production for local consumption and export during which, large quantities of the kennels are broken, bruised or burnt. Such grades of nuts, which do not meet local or export requirements are usually discarded as wastes in several industrial sites in Ghana. Conceivably, rejects or the discarded nuts wastes could be exploited as alternative protein feed resources in poultry feeding.

Aduku (1993) observed that cashew nut meal has the following proximate composition viz: protein, 40.9%; fat 1.30%; crude fibre, 1.50%, Calcium, 0.06%; Phosphorous, 1.72%; Ash, 5.30%; Iysine, 0.86%; Methionine, 0.35%; Cystein, 0.32% and Tryptophan, 0.29%.

The purpose of this study was to investigate the effect of substituting soya bean meal with discarded cashew kernel meal on the egg laying performance of chickens.

Materials and Methods

Experimental location

The experiment was conducted at the Poultry Unit of the Animal Science Department, University for Development Studies, Nyankpala Campus, Tamale from December 2011 to March 2012. Nyankpala is located in the Guinea Savanna Zone on latitude 09˚ 25N and longitude 00˚ 58N at altitude 183m above sea level (SARI, 2001). The temperature fluctuates between 19˚C (minimum) and 42˚C (maximum) with a mean annual temperature of 28.3˚C. Rainfall is monomodal which occurs from April to October with a mean annual rainfall of 1200mm and a mean annual day - time humidity of 54% (SARI, 2001).

Source and processing of cashew kernel meal

The cashew kernel meal was procured from Mim in the Brong-Ahafo region of Ghana. It was milled into course grades and bagged. The cashew kernel meal was then toasted for about 10 minutes in hot iron pot. After toasting, it was allowed to cool and then milled into gritty floor and bagged for use and labeled DUCK meal.

Experimental diets and design during digestibility trials

A total of 12 hens of similar live weights at 40 weeks of age were used in the digestibility trial. The hens were randomly assigned to 12 cages with one hen per cage ($0.4mx0.3m=0.12m^2$). The DUCK meal replaced soybean meal at different levels (0, 50, 75 and 100 g/kg) on weight by weight basis. The diets were formulated to be isonitrogenous with similar caloric values (Table 1). Each hen received one of the four dietary treatments which were replicated three times in a Completely Randomized Design.

Management of hens during digestibility trials

The hens were fed the dietary treatments for the period of 12 days. The first 7 days constituted the preliminary stage of the trial and the last 5 days was data collection stage of the trial. During this period, feed and water were provided *ad libitum* and light was provided 24 h. Quantities of the diets were weighed and supplied to the hens daily. The faeces were collected in plastic sheet placed under the wire-mesh floor of the cages using the Total Collection Method. The faeces were collected daily, weighed and stored under cool temperature (4°C in refrigerator). At the end of the trial, the daily faecal sample collected from birds in each replicate cage were pooled into one sample per treatment, oven dried (70°C for 20 h), weighed, ground and stored in air-tight plastic containers for analysis.

Proximate analytical procedure

Samples of the experimental diets and faeces were subjected to proximate analysis in accordance with standard methods described by AOAC (1999) for dry matter, crude protein, crude fat, and ash. All analyses were done in triplicates.

Digestibility Coefficients

The apparent digestibility coefficients of dry matter and nutrients were calculated using the formula:

$$\text{Apparent digestibility} = \frac{\text{Nutrient consumed - Nutrient excreted in faeces}}{\text{Nutrient consumed}}$$

Experimental birds and design during feeding trial

One hundred and twenty hens at 29 weeks of age were selected and divided into 12 groups of 10 hens each and housed in a raised-floor pens (1.8 m x 0.9 m = 0.16m^2/hen). DUCK meal was substituted (w/w) for soya bean meal at four dietary levels (0, 50, 75 and 100 g/kg) in a layer diet (Table 1). Each treatment was replicated three times in a Completely Randomized Design. Feed and water were given *ad libitum* from 30 to 41 weeks of age. Light was provided 24 hours.

Table 1: Composition of experimental diets (Kg)

Ingredients	**Control**	**5% DM**	**7.5% DM**	**10% DM**
Maize	59.0	54.0	51.0	50.0
DUCK meal	0.0	5.0	7.5	10.0
Wheat bran	10.5	15.5	18.5	19.5
Soya bean meal	16.5	11.5	9.0	6.5
Layer concentrate (5%)[1]	5.0	5.0	5.0	5.0
Oyster shell	9.0	9.0	9.0	9.0
Calculated nutrient analysis				
Crude protein (%)	15.2	15.4	15.5	15.4
Fat (%)	5.8	8.2	9.5	10.7
Calcium (%)	3.8	3.8	3.8	3.8
Phosphorus (%)	0.5	0.5	0.6	0.6
Lysine (%)	0.5	0.6	0.4	0.4
Methionine (%)	0.36	0.33	0.31	0.30
ME (MJ/Kg)	11.1	11.1	11.1	11.1

[1]**Composition of 50 kg layer concentrate:** crude protein 30%, crude ash 25%, crude fiber 7.5%, calcium 4.3%, total phosphorus 2.5%, Nacl 6%, methionine 3%, meth+Cyst. 3.5%, lysine 2%, vitamins (A, D3, E, K, B1, B2, B6, B9, B12 and D) minerals (Mg, Zn, F, Cu, I and Se) and additives (pigments, mold inhibitors, antioxidant and phytase). *DM= DUCK meal*

Egg laying performance parameters measured

Feed intake was measured weekly by subtracting the left-over feed at the end of the week from the amount of feed provided using a digital electronic scale (Jadever, JPS-1050). Eggs were picked and weighed from each replicate every day at 4:00 pm using an electronic kitchen scale (SP-10016204). Hen-day egg production was calculated by dividing the number of eggs laid in a day by the total number of birds present in a replicate and multiplied by 100. The mean egg weight was calculated as the total weight of eggs collected in a day per replicate divided by the number of eggs collected per replicate. Mean egg mass per hen per day in grams was calculated from the percent hen-day egg production multiplied by the average weight of their eggs. Feed-to-egg mass ratio was obtained by dividing the mean feed consumed per hen by the mean egg mass per hen during the same period.

Statistical analysis

The dietary treatment effects on all the variables measured were subjected to Analysis of Variance (ANOVA) using GenStat 8th edition (Lawes Agricultural Trust, 2005) and differences between treatment means were isolated using the Least Significance difference test (Steel and Torrie, 1980)

Results and Discussion

The digestibility of feed as affected by the inclusion of DUCK meal is presented in table 2. There was a significant (P<0.05) reduction in dry matter digestibility at 100g/kg inclusion of the DUCK meal in the diet. This could be attributed to high fat level in the diet containing 100g/kg DUCK meal. The presence of fat in the digestive system of mono-gastric animals is known to retain feed thus reducing the dry matter intake of the feed (Husveth, 2011). There was an improvement (P<0.05) in fat digestibility of birds fed diets containing 75 and 100g/kg DUCK meal respectively over those birds fed control diet and diet containing 50g/kg DUCK meal. This could be due to the differences in fat composition between the DUCK meal and soybean meal. The improvement in ash digestibility suggests high levels of digestible minerals in the DUCK meal than in the soybean meal. Cashew nut meal contains about 1.69% Phosphorus (Ojewola *et al.,* 2004) as compared to 0.67% Phosphorus in soya bean meal (Batal *et al.,* 2010). Other minerals could be more in the DUCK meal than could be found in soya bean meal. According to Payne (1990), the digestibility of a feed is influenced by its chemical composition.

Table 2: Effect of Discarded Undefatted Cashew Kennel (DUCK) meal on apparent nutrient digestibility of laying chickens

Parameter	Control	5% DM	7.5% DM	10% DM	±SED	P. value
Dry matter (%)	78.4[a]	76.9[a]	76.5[a]	74.1[b]	1.18	0.037
Crude protein (%)	63.4	64.1	65.3	70.2	5.42	0.611
Crude fat (%)	76.8[c]	76.0[c]	90.2[b]	91.9[a]	0.70	<0.001
Ash (%)	66.8[b]	66.1[b]	76.5[a]	77.8[a]	3.12	0.009

SED= Standard error of difference, P= Probability, DM= Duck meal

Egg laying performance results as affected by increasing levels of DUCK meal is shown in table 3. There was no significant (P>0.05) differences among the parameters measured in terms of feed intake, egg weight, egg mass and feed conversion efficiency except for hen-day egg production.

Generally, hen-day egg production showed a decreasing trend as the DUCK meal was increased in the diets. Similarity in egg laying performance of birds fed control diet and those fed diets containing the 50g/kg DUCK meal may be attributed to similarity in the utilization of the nutrients in the diets.

The results of this study is in line with Cruz *et al.* (2014) and Soares *et al.* (2007) who reported that increasing level of Cashew nut meal (CNM) did not significantly affect feed intake but affected hen-day egg production when fed to laying hens and Japanese quails. However, it is in contrast with the results reported by Odunsi (2002) that increasing levels of cashew nut meal (CNM) in the diets of pullets affected feed intake but did not affect hen-day egg production. The differences may be due to species difference and also the age of the birds considered during the study.

The observed reduction in egg production could also be attributed to the fat content of the DUCK meal, as high fat in diets of laying hens can adversely affect egg production (Akande et al., 2014).

Table 3: Effect of discarded undefatted cashew kennel (DUCK) meal on egg laying performance of chicken (30-41 weeks of age)

Parameter	Control	5% DM	7.5% DM	10% DM	±S.e.d	P
Feed intake (g/bird/day)	117.8	115.5	115.0	104.7	4.28	0.061
Hen-day egg production (%)	88.7[a]	85.9[a]	81.4[b]	69.6[c]	3.10	<0.001
Egg weight (g)	59.6	59.2	58.3	58.9	1.23	0.772

Egg mass (g)	49.8	49.2	45.0	39.6	3.49	0.064
Feed-to-egg mass ratio	2.4	2.4	2.6	2.7	0.300	0.649
Mortality	0.67	0.33	1.00	0.67	0.816	0.878

SED= Standard error of difference, P= Probability, DM= Duck meal, means with the same superscript are similar (P>0.05)

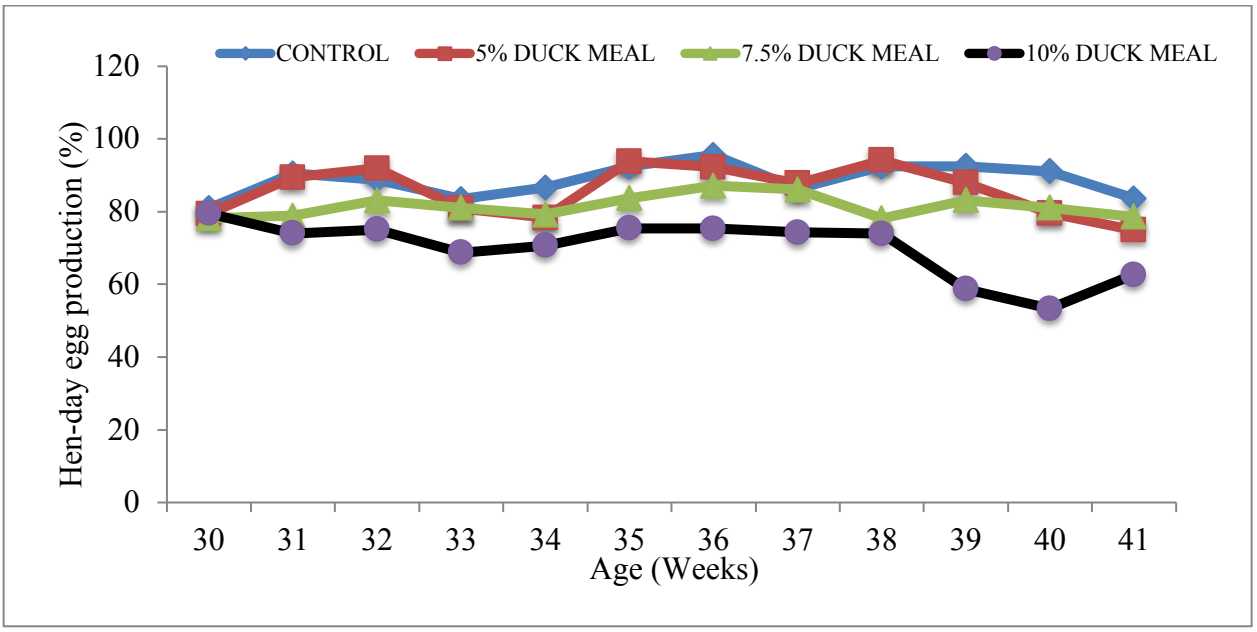

Figure 1: Effect of DUCK meal on hen-day egg production of laying chickens

There was no significant (P>0.05) difference observed in all the physical egg characteristics measured (Table 4) in this study. This observation is in line with Odunsi (2002) who observed no significant difference in physical egg characteristics of hens fed cashew nut meal in their diets. Soares *et al.* (2007) also made a similar observation in a study with Japanese quails using cashew nut meal in their diets. These observations suggest that cashew nut meal in the diets of laying flocks had no negative influence on egg physical characteristics.

Table 4: Effect of discarded undefatted cashew kennel (DUCK) meal on egg laying performance of chicken (30-41 weeks of age)

Parameter	Control	5% DM	7.5% DM	10% DM	±SED	P
Albumen height (mm)	7.60	7.67	7.60	7.73	0.541	0.993
Haugh unit score	87.7	88.9	88.6	88.9	3.04	0.972
Albumen weight (g)	36.93	36.13	35.20	35.00	1.280	0.451
Yolk weight (g)	13.13	13.27	13.73	12.87	0.340	0.157
Shell weight (g)	7.33	7.13	7.13	7.20	0.200	0.728
Shell thickness (mm)	0.43	0.44	0.44	0.45	1.383	0.361
Albumen ratio (%)	64.07	63.93	62.67	62.93	1.126	0.538
Yolk ratio (%)	22.93	23.33	24.53	23.47	0.718	0.223
Shell ratio (%)	12.87	12.67	12.93	13.20	0.503	0.768
Egg length (cm)	5.50	5.46	5.47	5.42	0.060	0.636
Egg width (cm)	6.96	4.23	4.26	4.25	1.888	0.429

SED= Standard error of difference, P= Probability, DM= DUCK meal

Conclusion

Based on the results of this study, it is concluded that undefatted cashew kernel meal in the diets of laying chickens had no adverse effect on protein digestibility, but improved fat and ash digestibility. However, its inclusion in the diets affected egg laying performance of chickens when replaced with soybean meal beyond 50g/kg in their diets.

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