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EFFECT OF DIETARY LEVELS OF COWPEA (*Vigna unguiculata*) SEEDS ON EGG QUALITY

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ABSTRACT: *The objectives of this study were to evaluate the effect of including 3 dietary levels of grain meal cowpea (Vigna unguiculata) 0, 5, 10 and 15% on external and internal egg characteristics. Seventy two laying hen of 28 weeks age were randomly allocated into 4 dietary treatments of 0, 5, 10 and 15% levels of cowpea seeds, which were further replicated 6 times in completely randomized design. Feed and water supply were offered to birds ad libitum while standard management practices were adopted. The results showed that the external parameters like maximum length and width, shell thickness and shell % and egg weight were significantly (P<0.05) affected by dietary treatments. Egg shape index was not significantly (P>0.05) influenced by dietary treatments. Internal quality characteristics were not significantly (P>0.05) affected by dietary treatments except for albumin weight, albumin percentage, yolk index and yolk colour. It is concluded that commercial egg characteristics such as egg weight is satisfactory maintained with 5 to 1`0% inclusion of cowpea grain meal in balanced diets for layers.*

ORIGINAL ARTICLE

Key words: *Cowpea Levels, Layers, Eggs*

INTRODUCTION

The rapid increase in the world population and acute protein shortage particularly, in developing countries has necessitated the urgent need for a means of increasing food production especially cheap and good source of protein. Rich sources of quality protein for the body are mainly animal sources such as poultry (Oloyede et al., 2007). The major hindrance however, to commercial poultry production is the high cost and unavailability of the standard commercial feeding stuff. A need therefore arises for the search into the possible ways of obtaining maximum production in poultry with minimum expenditure, so that the products can be sold at relatively low prices with similar or even better nutritional quality than convectional ones. The legumes as a group show tremendous potential for production of protein for poultry in under developed countries (Leon et al., 1993). Cowpeas are a good source of proteins, minerals and energy (Kochhar et al., 1998). Cowpeas are an excellent food for some individuals because contain no cholesterol and low fat (Eheart et al., 1988). Also protein from cowpeas seeds can be recovered in six solubility fractions and high content of amino acids (Kochhar et al., 1988; Aremu, 1990).

The incorporation of cowpeas protein in the formulation of diets for egg production is limited due to the presence of anti-nutritional factors which may affect the physiological status of layer. However, the levels of inclusion of this legume must be adjusted (Robinson and Singh, 2001). The objective of this study is to evaluate the effect of including different dietary levels of raw grain meal cowpea (*Vigna unguiculata*) on internal and external egg quality.

MATERIALS AND METHODS

The experiment was conducted in Poultry Unit, Faculty of Animal Production, Khartoum University. It extended for 4 months in which ambient temperature range between 28-45^{o}C (Metrological Department, Shambat).

Eggs were collected twice a day in the morning and afternoon and the percentage of hen day egg production were estimated, eggs weight were recorded for all the replicate groups. Eggs were weighed on electronic digital balance. The hen-day egg production percentage were calculated from the total number of eggs actually collected, expressed as percentage of the expected number of eggs for each group per week over 12 weeks period.

Experimental birds

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Total of 28 weeks of age Hisex laying hen were purchased from Coral Company. The birds were previously vaccinated against Marks disease at hatching. They were also vaccinated against (Gumboro) at two weeks of age, New Castle disease at 3 weeks of age and at 11 weeks against fowl pox. The debeaking process was done at 31 weeks of age. Seventy two laying hens were approximately selected for this experiment. Selection was based on the individual body weight. The birds were subjected to adaptation period of two weeks before data collection. The hen day egg production was about 70%. The live body weight ranged from 1300-1500g. The birds were divided into 4 groups (18 birds/ treatment). They were further sub-divided into 6 replicate groups of 3 birds each.

Experimental housing

One battery was used in this experiment. It was cleaned and disinfected using formalin. The batter consists of six lines as four cages each. Birds of each replicate were assigned randomly in 24 cages on 3 tiers wire blocks (50×42×40 cm) of laying batter with 3 birds in each cage.

Experimental Diets

Four iso-caloric and iso-nitrogenous diets were formulated according to nutrient specifications of the standards as recommended by National Research Council (NRC, 1994), as follows: Ration (A) control diet contained 0% level of cowpea seeds, (B) containing 5%, (C) containing 10%, (D) containing 15% of raw cowpea seeds. Each treatment group was randomly assigned to one of the four diets. Feed samples were analyzed for proximate composition according to the methods indicated in the AOAC methods of analysis (1990). The ingredients calculated and determined nutrients content of the experimental layers diets are shown in Table 1.

Table 1 - Composition of experimental layers diets containing dietary levels of cowpea (*Vigna unguiculata*) seeds

Treatments / Ingredients	Dietary cowpea seeds with different treatments ingredients			
	0 (A)	5 (B)	10 (C)	15 (D)
Sorghum	64.50	64.50	64.50	64.50
Groundnut	6.84	6.84	6.79	6.79
Sesame meal	6.00	6.00	0.00	0.00
Wheat bran	10.00	5.00	6.00	1.05
Super concentrate	5.00	5.00	5.00	5.00
Oyster shell	7.00	7.00	7.05	7.00
Salt	0.40	0.40	0.40	0.40
Di-calcium phosphate	0.26	0.26	0.26	0.26
Calculated analysis %				
Me (Mj/kg)	11.90	11.99	11.96	11.88
Crude protein	17.67	16.34	17.05	17.37
Crude fat	5.50	6.50	5.60	6.00
Crude fiber	3.34	3.34	3.94	3.90
Calcium	3.35	3.45	3.26	3.32
Av. Phosphorus	0.49	0.49	0.48	0.48
Methionine	0.36	0.36	0.32	0.31
Lysine	0.69	0.69	0.69	0.76
Determined analysis % (DM-Basis):				
Dry matter	95.05	95.54	93.40	94.15
Crude protein	17.33	18.01	18.70	18.62
Ether extract	6.67	7.33	8.10	6.32
Crude fiber	5.21	6.56	6.078	6.20
Nitrogen free extract	57.64	55.88	50.78	54.01
Ash	8.20	7.76	8.42	7.60
ME (Mj/kg)	12.34	12.55	12.55	11.90

Management:

The birds in each cage were supplied with one drinker. The cages were equipped with 2 feeders. They were kept clean. Droppings were cleaned every day. Birds of all treatments groups received similar care and management. Sixteen hours light (daylight + 4 hours artificial light) were maintained throughout the experimental period. Feed and water were provided ad libitum.

Egg quality management:

Each two weeks external and internal quality characteristics of eggs were measured. Two fresh eggs from each replicate group were weighed. Then the maximum length and maximum width were measured. The shell thickness was also measured by taking samples of shell from top, middle and bottom of egg using 0.2mm vernia caliper (Hitutoyo, Japan). The shell weight was also measured. The shell weight/egg weight was calculated to determine the shell percentage.

Sample eggs from each replicate were broken with a blunt knife, contents poured on a piece of flat glass dish and different components were separated and weighed. The albumin height, mm was taken by 0.2mm vernia caliper on the middle of thick albumin in both sides opposite to the chalaza as an average of two sides. The yolk height, mm, albumin and yolk diameters, cm were measured using 0.2mm vernia caliper. The albumin and yolk

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indices were calculated as the proportion of the height of each to the diameter. Albumin yolk index was calculated as the proportion of albumin weight/yolk weight. Albumin and yolk percentage were calculated the proportion of weight of each/egg weight. Haugh unit was calculated by using following formula

$$\text{Haugh unit} = 100 \log H - \left[\frac{G\,(30W^{0.37} - 100}{100} + {}^{1}/_{9}\right]$$

Where:

H=Albumin height (mm); G= A constant (32) related to the constant of gravitation; W= Weight of egg (g)

Yolk colour scores were recorded as described by Roche yeolk colour fan regarded from 1 to 15.

RESULTS

The effect of dietary treatment on overall external quality characteristics of eggs from layers hen are shown in Table 2. No significant (P>0.05) dietary effect for egg shape index weight of egg sample was significantly (P<0.05) affected by the dietary treatments. It was found to be significantly (P<0.05) higher for birds fed the control diet compared to the others. The lowest value observed for birds that fed diet with15% cowpea seeds. Maximum length and width were significantly (P<0.05) influenced by dietary treatments. It was found to be higher for birds that received the control diet and 5% cowpea seeds than other dietary treatments. Shell weight, shell thickness and shell % were significantly (P<0.05) influenced by dietary treatments. Birds fed the control diet observed to have significantly (P<0.05) higher shell weight and shell percentage compared to the other treatments. The lowest values were observed in birds fed 15% cowpea seeds. The effect of dietary treatments on overall internal quality characteristics of eggs from layer hens is shown in Table 3. No significantly (P>0.05) dietary effect for all internal quality characteristics during the experimental period except for albumin weight, albumin percentage, yolk index and yolk colour score. Albumin weight was significantly (P<0.05) higher in birds fed 5% cowpea seeds than others groups. Albumin percentage was significantly (P<0.05) higher in birds fed 15% cowpea seeds compared to other dietary treatments. Yolk index was significantly (P<0.05) higher for birds fed 5% cowpea seeds compared to others. Yolk index for birds fed the control diet, 10 and 15% cowpea seeds were not significantly (P>0.05) different. Yolk colour score was found to be significantly (P<0.05) higher for birds received 15R cowpea seeds.

Table 2 - External quality characteristic of eggs from layers fed dietary levels of cowpea (*Vigna unguiculata*) seeds during experimental period 31st – 42nd week of age)

Parameters	Levels of cowpea seeds %			
	0 (A)	5 (B)	10 (C)	15 (D)
Egg wt (g)	49.18^{a}	47.51^{ab}	45.27^{c}	45.19^{c}
Maximum length (cm)	5.40^{a}	5.39^{a}	5.27^{b}	5.18^{bc}
Maximum width (cm)	4.30^{ab}	4.29^{ab}	4.21^{b}	4.12^{bc}
Shell weight (g)	5.60^{a}	5.57^{b}	5.56^{b}	4.12^{bc}
Shell thickness (mm)	0.391^{a}	0.328^{ab}	0.320^{c}	0.320^{c}
Egg shape index	0.792	0.803	0.780	0.770
% shell	12.30^{a}	12.26^{ab}	11.89^{bc}	11.74^{c}

Table 3 - Internal quality characteristics of eggs from layers fed dietary levels of cowpea (*Vigna unguiculata*) during experimental period (31st - 42nd) week of age

Parameters	Levels of cowpea seeds %				
	0 (A)	5 (B)	10 (C)	15 (D)	±SEM
Albumin height (mm)	8.72^{a}	8.51^{a}	8.25^{a}	8.22^{a}	0.09
Albumin diameter (cm)	7.20^{a}	7.20^{a}	7.17^{a}	7.128^{a}	0.08
Albumin weight (g)	29.11^{b}	32.40^{a}	30.05^{b}	27.89^{c}	0.78
Albumin index	0.120^{a}	0.116^{a}	0.118^{a}	0.115^{a}	0.005
Albumin %	63.38^{ab}	63.65^{ab}	62.28^{bc}	65.11^{a}	0.76
Yolk height (mm)	120.09^{a}	10.69^{a}	10.67^{a}	10.48^{ab}	0.20
Yolk diameter (cm)	3.41^{a}	3.32^{a}	3.28^{a}	3.36^{a}	0.04
Yolk weight (g)	11.80^{a}	11.53^{a}	11.35^{a}	11.04^{a}	0.38
Yolk index	0.312^{b}	0.328^{a}	0.311^{b}	0.316^{ab}	0.008
Yolk %	26.34^{a}	25.71^{a}	24.18^{a}	23.87^{a}	0.72
Yolk colour	1.15^{c}	1.15^{c}	1.30^{b}	1.42^{a}	0.09
Haugh unit	98.90^{a}	99.20^{a}	98.87^{a}	98.99^{a}	0.46

DISCUSSION

Means values of external quality characteristics of eggs from 31st – 42nd week of age layers fed dietary levels of cowpea seeds revealed the dietary treatments had no effect on egg shape index. Egg weight, shell weight, shell thickness and shell percentage were higher in birds supplemented with the 5% cowpea seeds and the control diet, compared to that received 10 and 15% cowpea seeds, these results similar to the finding reported by Igbasan and Gunter (1997) who noticed a reduction in egg weight sample, egg production, egg mass and shell quality by increasing level of field peas in layers diet. The authors attributed this effect to the poor feed intake and loss in

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body weight which lead to poor egg production during long period of time-whereas, the reduction of shell quality maybe due to calcium and phosphorus chelation by phytate in cowpea seeds (Lon et al., 2000).

The effect of dietary levels of cowpea seeds on internal characteristics of eggs of layers revealed that albumin height, albumin diameter, albumin index, yolk height, yolk diameter, yolk weight, yolk percentage and haugh unit did not appear to be affected by the dietary treatments. In the current study, albumin weight, albumin % and yolk index were higher in the birds received 5% and control diets compared to others dietary treatments which were similar. Egg yolk colour was improved as the level of cowpea increased. A similar observation was reported by Igbasan and Gunter (1997), this may be due to the presence of carotenes in seeds.

CONCLUSION

Cowpea has a good nutritional profile and has been used successfully in poultry feed but in low levels. Inclusion of high level (15%) affected the internal and external egg characteristics due to the presence of anti-nutritional factor.

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