Short Communication

Effect of contact with male on the physical and chemical qualities of eggs of black harco layers

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Abstract

A group of 30 Black HARCO laying hens were reared together with 3 mature cocks, while another group were reared in an adjacent pen without cocks. Thus, while the first group of hens had full physical contact (including mating) with the males, the second group was restricted only to auditory and visual contacts with the males. Twelve eggs were selected at 2 - weekly interval within a 12 - week period from each group and chemically analyzed for total protein, cholesterol in the yolk were determined by colourimetric methods while the shell calcium concentration was determined by a titrimetric method. Egg yolk cholesterol was higher ($P < 0.05$) in hens exposed to full physical contact with the males (16.78 vs 14.20 mg/ml) whereas egg yolk protein, albumen protein and egg shell calcium concentrations were not significantly different ($P > 0.05$) between the 2 groups. Egg weight, egg components weights and hen day egg production were also lower in those hens exposed to full contact with the males. Physical contacts (including mating) between the cock and hen resulted in higher yolk cholesterol and lower physical qualities of eggs produced under such management system.

Keywords: Harco layers, egg quality, cock's presence

Introduction

Stimulation from the male is not a requirement for egg production in the domestic fowl and turkey, unlike in most species of non-gallinaceous birds (Lehrmann, 1959).

However, egg production has been shown to be higher in turkey hens housed in the presence of toms than those reared in complete isolation from the male (Jones and Leighton, 1987 and Felt *et al.*, 1992). Likewise, chicken hens reared either with cocks (i.e. full physical

contact including mating) or adjacent to the cocks (i.e. visual and auditory contacts only) came into lay earlier and resulted in more eggs per hen during the early laying period as compared to females kept without any form of contact with the male (Widowsk *et al.*, 1998). On the other hand, Bhagwat and Craig (1979) found that hens living in contact with males had decreased egg weight and body weight gain compared to hens with only visual and auditory contacts. Renden and Pieson (1982), also observed reduced body and egg weight as from

the 62 week of age in naturally mated dwarf broiler hens compared to those individually caged away from male.

These earlier studies apparently had focused on the physical qualities of eggs from layers exposed to various forms of contact with the male. It would be of importance to know how such rearing system also affect the chemical qualities of the eggs which thus serve as the main focus of the present study. This will serve as a prelude towards a better understanding of the reproductive performance and behaviour of breeder hens and hens on extensive or free range management system such as the Nigerian local chicken.

Materials and methods

Sixty (60) 46 - week old Black Harco pullets and 31 Harco cocks were used for this study. The pullets were divided into 2 groups of 30 birds each and kept in separate but adjacent deep-litter pens. The 3 cocks were reared with one of the pullet group to give a ratio of 1 male to 10 females. Thus while this group of pullets had full physical contact (including mating) with the males, the other group had only visual and auditory contacts with the males. The experiment lasted the first 12 weeks of 1998.

Nest boxes were provided in the pen while feed and water were given ad-libitum. The layer's mash (Table 1) contained 2650 KcalME/kg and 17% CP. Eggs laid in the last 3 days of every 2 week period were pooled from which 12 eggs were selected for each group. Selected eggs were individually weighed and separated into the physical component parts i.e. eggshell, egg yolk and albumen. Protein concentration of the egg yolk and albumen were determined by the Biuret colourimetric method, and the cholesterol concentration of the egg yolk by the Zlatkis colourimetric method, while the eggshell was analysed for total calcium using the Clark and collip titrimetric method. All methods were as described by Varley (1969).

For protein determination, 4ml of the biuret reagent (8gm of sodium hydroxide pellet, 3 gm of copper sulphate, 9gm of sodium potassium tartrate, and 5 gm of potassium iodide salts in 1 litre of distilled water) was added to 0.05ml of the test (albumen or yolk) and standard samples in separate test tubes. The mixtures were allowed to stand for 10 minutes after which the optical densities were measured at 520nm using the WPA-C075 Colourimeter.

Egg yolk cholesterol concentration was determined by adding 2 ml of freshly prepared ferric acetate buffer (1gm of ferric chloride salt in 1 litre of concentrated glacial acetic acid solution) to 0.02ml each of the egg yolk and standard cholesterol samples. The mixtures were incubated in the dark for 30 minutes after which the optical densities were read in the

Table 1 *Composition of Layer's mash*

Ingredient	% Composition
Maize	38.0
Corn bran	15.0
Wheat Offal	3.0
Groundnut cake	11.0
Palm Kernel cake	11.75
Cotton seed cake [†]	5.0
Fish meal	6.0
Bone meal	1.50
Oyster Shell	8.0
Methionine	0.15
Vitamin/Mineral Premix ^a	0.40
Salt	0.20

^a Bio-mix premix containing per kg: Vit: A (2,500,000 I,ii); Vit. E (6,000mg); Vit K3 9400mg); Vit, B1 (1,000mg), Vit, B2 91,200mg); vit B12 (2mg); naicin (8,00mg); pantothenic acid (2,000mg); Vit B6 (800mg); Folic acid (200mg) Biotin (10mg); Cholin Chlorine (50,000mg); Maganese 920,000mg); Iron (10,000mg); Cobah (50mg); Selenium (20mg) and Anit-oxidant (40,000mg),

[†]Ferrous Sulphate (0.01%) included to counter the effect of gossypol in the cotton seed cake.

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colourimeter at 5ml of concentrated hydrochloric acid, inside the water bath. The undissolved shell membrane was removed, air-dried and weighed. The solution was diluted to 50ml with distilled water, from which 2ml was taken and titrated, while still in a boiling bath, against 0.01 N permanganate solution to the first permanent faint pink colour. Two ml of distilled water was equally titrated as the blank sample. All chemical analysis were done within 24 hours of eggs selection. The data obtained was subjected to t-test statistical analysis using the Statistical Analysis System Software (SAS, 1986).

Results and discussion

The biochemical components of egg investigated in this study i.e. egg yolk and albumen protein, egg yolk cholesterol and eggshell calcium, as well as the physical qualities of the eggs are given in Table 2. The concentration of protein in the egg yolk and albumen as well as the calcium concentration of the eggshell were not different ($P>0.05$) whether the hens had full physical contact with the cocks or restricted only to audiovisual contact with the cocks. But, egg yolk cholesterol concentration was significantly lower ($P<0.05$) in hens restricted to audiovisual contact with the males as compared to those with full physical contact (14.20 vs 16.78mg/mf). Thus physical contact, including mating appears to play a significant role in the secretion of cholesterol into the egg yolk. Chand (1979) had observed a higher, but not significant, ($P>0.05$) cholesterol concentration in the fertile as compared to the infertile eggs obtained from the same group of White Leghorn layers. Also, Arkipor (1982) noted that the larger portion of the lipids metabolized in the post-hatched chicks was cholesterol. Therefore it could imply that hens exposed to mating contact with

the cock in anticipation of incubation and possible hatching secrete more cholesterol into the yolk. However, since the fertility of the eggs in this study were not determined, the actual mechanism through which the egg yolk cholesterol of the hens in full physical contact with the male was increased could not be ascertained. It could also involve a complex play of hormonal, physiological and environmental factors.

The growing concern about the cholesterol content of table eggs (Mcnamara, 1997) will certainly override the beneficial effect of male presence on egg production reported by some workers (Felts *et al.* 1992 and Widowski *et al.*, 1998). While some reports (Bair and Marrina, 1978 and Ambrosen and Rotenberg, 1982) has indicated a decrease in the cholesterol of eggs with increasing age of the layer, others have reported the contrary (Fletcher *et al.*, 1998 and Ahn *et al.*, 1997). However, there is a consensus that the cholesterol content of eggs vary between breeds, strains and species of layers (Washburn, 1979 and park *et al.*, 1992). Sheridan *et al.*, (1982) attributed the strain differences in egg yolk cholesterol content to egg weight and % yolk both of which shows a positive correlation with egg yolk cholesterol. On the other hand, Washburn (1979) reported an inverse relationship between the egg yolk cholesterol concentration and the rate of egg production. Observation on the Nigerian local hens with lower hen-day egg production, egg weight and yolk weight showed that egg yolk cholesterol concentration was lower in the local hens ($p<0.50$) compared to Black Harco layers under the same intensive management system (Ola *et al.*, 1999). Thus, it could be concluded that the relationship between egg yolk cholesterol content and yolk weight or egg production are in consistent.

Table 2 Some physical and biochemical components of eggs of black harco hens reared either with or adjacent to cocks

Parameter	Hens with Cocks	Hens Adjacent to Cocks
Yolk Protein (g/dl)	16.56 $\pm$ 0.53	16.51 $\pm$ 0.56
Yolk Cholesterol (mg/ml)	16.78 $\pm$ 0.75 ^a	14.20 $\pm$ 0.86 ^b
Albumen Protein (g/dl)	9.88 $\pm$ 0.23	9.47 $\pm$ 0.21
Shell Calcium (%)	24.99 $\pm$ 0.68	26.19 $\pm$ 0.21
Egg Weight (g)	53.58 $\pm$ 1.22 ^b	57.19 $\pm$ 1.07 ^a
Yolk Weight (g)	14.93 $\pm$ 0.29 ^b	15.78 $\pm$ 0.25 ^a
% Yolk	27.24 $\pm$ 0.79	27.64 $\pm$ 0.35
Albumen Weight (g)	33.18 $\pm$ 0.88 ^b	35.63 $\pm$ 0.47 ^a
% Albumen	61.78 $\pm$ 0.3	62.25 $\pm$ 0.40
Shell Weight	5.47 $\pm$ 0.13 ^b	5.78 $\pm$ 0.08 ^a
% Shell	10.24 $\pm$ 0.15	10.11 $\pm$ 0.13
Albumen Yolk	2.22 $\pm$ 0.04	2.27 $\pm$ 0.05
Hen-day Production (%)	59.99 $\pm$ 1.78 ^b	75.99 $\pm$ 1.77 ^a

^{ab} Means on the same row with different superscripts differed significantly (P<0.05).

White leghorn pullets exposed to cock from 20 weeks of age at ratios between 1:8 and 1:24 had lowered hen-day and hen housed egg production and egg weight at all ratio of exposure compared to those housed away from the cocks (Al-Rawl, 1980). The reproductive performance of the Nigeria local hens has also been shown to improve significantly under intensive or semi intensive management i.e. away from male interference (Oluyemi, 1990).

The presence of the male and possibly mating is known to result in broodiness in the hen with the consequent reduction in rate of egg production. However, how this factor affect certain physical and chemical qualities of the eggs is yet to be fully understood and reported. Generally, commercial layers are not reared together with the cocks during the laying period, but the Nigerian local hens are kept on the free range together with the cocks. Therefore, an in-depth study of the effect of the cock on egg production and the cholesterol contents of eggs from different management system will be of interest.

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