

Relation between Yolk Cholesterol and some Economic Characters in Chickens

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FIFTEEN hens from each of white Leghorn, white Baladi and Fayoumi breeds were used in this experiment. Four eggs from each hen were used to measure egg weight, yolk weight and the cholesterol content in the yolk.

Cholesterol content of egg yolk mg/g was as high as 14.58 in Fayoumi, 13.65 in White Baladi and 13.40 in White Leghorn.

In all breeds high egg production was associated with a decrease in yolk cholesterol values.

The Baladi breed had higher negative correlation between cholesterol per g. of yolk and egg number, while lower estimates were found in White Leghorn.

Hens with high egg yolk cholesterol showed relatively higher hatchability, which indicated by the positive correlation.

Among the etiological factors thought to influence the development of cardiovascular disease are the elevated levels of cholesterol (Whist and Schaler 1968).

Yolk cholesterol level is affected by several dietary, genetical, physiological and environmental factors. High cholesterol levels in the diet have been linked with increased incidence of atherosclerosis (Friedon, 1968). The literature contains little data on the variations of the cholesterol in eggs found in normal commercial channels. Watt and Merril (1963) found a value of 550 mg cholesterol 100g of edible egg contents as an average cholesterol level of eggs. Miller and Denton (1962) found a value ranged between 15.5 - 17.5 mg cholesterol per g egg yolk depending upon the breed of bird and season of year. Harris and Wilcox (1963) reported values of 24.0 to 26.1 mg cholesterol per g of yolk in their studies. Schiavo (1963) also reported 24.4 to 24.8 mg cholesterol per g of yolk. Collins *et al.* (1953) however, found only 32.5 to 37.3 mg

cholesterol per g of dry yolk in one trial and 24.4 to 30.3 mg cholesterol per g of dry yolk in another trial, Chung *et al.* (1965) found 1.42% cholesterol in the yolk of eggs or approximately 536 mg 100g edible egg. Fisher and Leveille (1957) found 55 to 66 mg cholesterol per g. of yolk fat. Edwards *et al.* (1960) and Washburn and Nix (1974) found significant strain differences among laying hens in the amount of cholesterol per egg.

Turk and Bennett (1971) showed that turkey, duck and Coturnix quail eggs were found to have a high cholesterol concentration than in chicken eggs, and reported values of 9.33, 8.84 and 5.53 mg cholesterol/g of eggs respectively. Washburn and Nix (1974) showed that there was no statistically significant phenotypic correlation between yolk cholesterol level and hatchability, fertility, specific gravity or mortality. Also they found a significant correlation between yolk cholesterol level and egg production, but this correlation was of low magnitude. Also, Cunningham *et al.* (1974) showed a significant negative correlation between rate of production and egg yolk cholesterol level. He also reported a significant positive correlation between percent hatch and egg yolk cholesterol.

The purpose of the present study was to determine the yolk cholesterol in the different breeds and its relationship to some economic characters.

Materials and Methods

Fifteen hens from each of white leghorn, white Baladi and Fayoumi breeds were used in this experiment. All hens were first reared on the experimental station at the Faculty of Agriculture in Cairo University from sexual maturity until the end of the experiment.

After hens were in production for three months, four eggs for each hen were used to measure egg weight, yolk weight and yolk cholesterol content.

Hens were trap-nested daily for 365 days after sexual maturity. 40 eggs for each hen three hatches were set for incubation hatchability was recorded as a percent of chicks from fertile eggs. The data was analyzed using the means of each hen. Phenotypic correlations were calculated between cholesterol per g of yolk and egg number, egg weight, yolk weight, hatchability and yolk cholesterol.

Chemical analysis

The rapid technique of extraction of egg yolk cholesterol modified by Washburn and Nix (1974) was used. In this procedure 15 ml of 2 : 1 chloroform methanol was added to 1 g egg yolk, the sample shaken by hand, 5 ml of H₂O added and hand shaken again. After centrifugation, the aqueous methanol layer removed and the chloroform layer was filtered. Total cholesterol content of the samples was determined according to the method described

by Courchaine *et al.* (1959). The absorbance of the purple colour was measured at 550 nm against a blank reagent using a Unicam sp/800 spectro-photometer. A standard curve was conducted using pure dry cholesterol and results were calculated as mg cholesterol per gram yolk.

Results and Discussion

Cholesterol content of egg yolk as mg/g for the Fayoumi breed was the high (14.58) followed by white Baladi (13.65), then white eghorn (13.40) as shown in Table 1. The differences between the three breeds were not significant in either mg cholesterol/g yolk or total cholesterol/ yolk. The cholesterol content of yolk of the studied breeds was less than those reported in the literature (Watt and Merrill, 1963; Miller and Dentor, 1962; Hennis and Wilcox 1963, 1963, and Sciaro, 1963 and Collins *et al.*, 1963).

The difference in cholesterol values between the three breeds may be related to their genetic basis.

The values obtained in this experiment were in agreement with Turk and Barnett (1971) who reported that egg production strains have lower cholesterol values than broiler strains since Baladi and Fayoumi breeds are considered a mixture of egg and meat strains, while white leghorn is essentially an egg breed.

TABLE 1 Means of various physiological traits in the three breeds.

Traits	W. Leghorn mean \pm S.E.	W. Baladi mean \pm S.E.	Fayoumi mean \pm S.E.
mg cholesterol/ g of yolk	13.40 \pm 0.38	13.65 \pm 0.61	14.58 \pm 0.61
mg cholesterol yolk	227.8 \pm 7.82	207.3 \pm 9.16	237.4 \pm 9.13
Egg number . .	182.6 \pm 9.83	174.2 \pm 10.49	164.6 \pm 14.64
Egg weight . .	53.8 \pm 0.72	46.5 \pm 0.96	48.9 \pm 0.73
Yolk weight . .	17.0 \pm 1.17	15.3 \pm 0.35	16.3 \pm 0.28
Hatchability . .	67.8 \pm 4.13	71.5 \pm 4.70	70.0 \pm 3.76

In all breeds the simple correlation values indicate that increasing rate of production caused a decrease in egg yolk cholesterol level (Table 2). High correlation between cholesterol per g of yolk/egg number was obtained in Baladi breed, while lower correlation was found in white leghorn. Bartov *et al.* (1971) also, noted a negative relationship between yolk cholesterol and rate of production.

TABLE 2. Phenotypic correlations between mg cholesterol per g of yolk and various physiological traits in the different breeds.

Traits	White laghorn	White baladi	Fayoumi
Egg number	- 0.112	- 0.417	- 0.271
Egg weight	+ 0.040	± 0.254	± 0.386
Yolk weight	w 0.027	- 0.328	- 0.461
Hatchability	+ 0.107	+ 0.102	± 0.240
mg cholesterol yolk	± 0.865*	+ 0.840*	+ 0.917*

* $P < 0.1$

Egg weight and total yolk cholesterol were positively correlated with yolk cholesterol level. Also percent hatch was positively correlated with yolk cholesterol level, indicating that hens with high yolk cholesterol may exert some what higher hatchability. Connor *et al.* (1969) showed that 90% of the cholesterol in the brain of the chicken embryo is synthesized but the cholesterol in the remainder of the body comes from the yolk of the egg, suggesting the possibility that the cholesterol level in the yolk might be related of embryonic development and consequently effect the hatching of chickens. Meanwhile, yolk weight was negatively correlated with cholesterol per g of yolk. High correlation estimates were observed in Fayoumi breed followed by white baladi and white Leghorn respectively. All these correlation were not significant except that between cholesterol per gram of yolk and total yolk cholesterol.

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Egypt. J. Anim. Prod. **19**, No. 1 (1979)

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العلاقة بين كوليستيرول الصفار وبعض الصفات الاقتصادية في بعض الأنواع من الدجاج

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استخدم في هذا البحث خمسة عشر دجاجة من كل من دجاج اللجهورن الابيض والبلدى الابيض والفيومي . بعد حوالي ثلاثة شهور من انتاج أربعة بيضات من كل دجاجة - أخذت التقدير وزن البيضة ووزن الصفار ومحتويات الصفار من الكوليستيرول وكانت النتائج كما يلي :

١ - يحتوى الصفار من الكوليستيرول لكل من الفيوم والبلدى والجهورن كان ١٤٥٨ ، ١٣٦٥ ، ١٣٤٠ مليجرام لكل جرام من الصفار .

٢ - في الأنواع التي درست معامل الارتباط أوضح أنه بزيادة نسبة البيض سبب انخفاض في مستوى الكوليستيرول في الصفار .

٣ - يوجد ارتباط عال بين الكوليستيرول في الصفار وعدد البيض وذلك في البلدى أما في اللجهورن كان الارتباط منخفض .

٤ - يوجد ارتباط موجب بين كوليستيرول الصفار وعدد البيض وذلك ونسبة الفقس . وهذا كان واضحا حيث أن الدجاج الذى أعطى بيض به نسبة عالية من الكوليستيرول كانت نسبة الفقس في هذا الدجاج عالية .