YOLK CHOLESTEROL CONTENT IN EGGS FROM THE MAJOR DOMESTIC STRAINS OF BREEDING HEN

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Summary

A survey of the cholesterol content of eggs obtained from commercial sources in Korea was conducted.

Eggs from 17 different strain birds were obtained from the Poultry Random Sample Test Station at Ansung, Kyonggi province. Yolk cholesterol contents, determined by the colorimetric procedure, were obtained from three consecutively laid eggs from birds of about 63 weeks of age. The overall mean of cholesterol value was 17.25 mg/g of wet yolk and ranged from 16.40 to 18.18 mg/g yolk.

Analysis of t-test between white shell eggs and brown shell eggs showed no difference in cholesterol content: however, the white shell eggs were somewhat high in cholesterol (17.41 vs. 17.08 mg/g yolk). Significant differences ($p < 0.05$) were found in yolk cholesterol contents among strains within the breed.

(**Key Words** : Egg, Yolk Cholesterol, Breeding Hen)

Introduction

Cholesterol content of chicken eggs continues to receive considerable attention (Becker et al., 1977; Cunningham, 1977; Naber, 1976; Washburn and Nix, 1974), since the cholesterol levels in eggs are a concern to people who are trying to lower their intake of dietary cholesterol. Avian eggs contain large amounts of cholesterol located exclusively in the yolk. While most of the cholesterol exists as free cholesterol, a minor proportion is present as cholesteryl ester (Bitman and Wood, 1980).

Reports on chicken egg cholesterol values show considerable variation. Miller and Denton (1962) found 15.5 to 17.5 mg cholesterol/g yolk, whereas Harris and Wilcox (1963) reported values from 22 to 26. Feeley et al. (1972) reported a mean value of 14.8 mg and Rangachar et al. (1970) found that yolk cholesterol from several breeds of chickens had a mean value of 12.9 mg/g.

More recently, Cotterill et al. (1977) found 270 mg cholesterol per yolk or 14.3 mg/g yolk, while Bair and Marion (1978) in a study of yolk cholesterol in eggs from various avain species found that cholesterol averaged 243 mg per egg or 14.0 mg/g of yolk among various lines of chickens, which included 7 inbred lines and 15 various breed. Turk and Barnett (1971) showed that egg strains tended to have lower egg cholesterol values than did broiler strains, both when expressed as per egg and also as per gram of whole egg.

Most of the existing egg cholesterol literature is based upon the use of nonspecific colorimetric methods to determine cholesterol. These methods usually involve reaction of the sterol nucleus with strong acids which react generally with other materials present in the crude extract (Sweeney and Weihrauch, 1976).

The purpose of this study was to obtain the cholesterol content of commercial sources, and to compare cholesterol content between white and brown shell eggs obtained from the major domestic strains of breeding hen.

Materials and Methods

Eggs from eight strains of commercial white shell egg layers and nine strains of commercial brown shell egg layers of the same age and under

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the same environmental and dietary conditions were obtaind during July, 1990 from the Poultry Random Sample Test Station at Ansung, Kyonggi province (table 1).

TABLE 1. DOMESTIC STRAINS OF BREEDING HEN USED IN THIS SURVEY

White birds	Brown brids
Dekalb Warren	Dekalb Warren
–	Lohman
Hy-line	Hy-line
Babcock	-
–	ISA Brown
Manina	Manina
Kookjong 921[1]	–
Kookjong 922[1]	–
–	Hisex[2]
–	Arbor Acres[2]
–	Nick Chick[2]
Shaver[2]	Shaver[2]
Hypeco[2]	–

[1] Chick exhibited by the National Animal Breeding Institute.
[2] Imported chicks.

Chicks of commercial strains were housed at 846 cm^2/bird or 2 birds per pen, and fed commercial rations (Seoul layer, No. 16) and water *ad libitum*. The chicks received an 17-h light: 7-h dark photoregimen. The number of hen were three birds from each strain. Each sample contained three consecutively laid egg yolk and were weighed, and pooled by bird to measure the cholesterol content. All yolks were rolled on a paper towel to remove any adhering albumin. Yolk cholesterol was analyzed by the colorimetric procedure of Bair and Marion (1978).

The measurement data on yolk cholesterol content in eggs from the major domestic strains of breeding hen was randomly recorded in an alphabetical order. A sample of 1 g was weighed and thoroughly blended together. Yolk lipids were extracted by the chloroform-methanol (2:1, v/v) according to the method of Folch et al. (1957). All samples were run in triplicate. A comparision of cholesterol levels was made to determine if significant differences existed between breeds; the t-test was used to examine the cholesterol values between white shell eggs and brown shell eggs. And analysis of variance were used for identifying the variation in cholesterol contents among strains within the breed. Means were compared by a multiple range test (Duncan, 1955).

Results and Discussion

Analysis of t-test between two types of shell layers showed no difference in cholesterol content.

The average cholesterol value on white birds was 17.41 mg/g of yolk (table 2), whereas average for brown birds was 17.08 (table 3). Yolk cholesterol measurements for 17 strains ranged from 16.40 to 18.18 mg/g of yolk, the lower value

TABLE 2. EGG WEIGHT, YOLK WEIGHT AND CHOLESTEROL VALUES (MEANS ± S.D.) IN EGGS FROM 8 DIFFERENT WHITE STRAIN OF BREEDING HEN

Strain	Whole egg weight[1]	Yolk weight[1]	Cholesterol[2]
	(g)	(g)	(mg/g of yolk)
A	62.49 ± 2.98^{b}	17.98 ± 0.51	17.44 ± 0.12^{bc}
B	66.67 ± 2.45^{ab}	18.77 ± 0.52	17.92 ± 0.33^{ab}
C	64.18 ± 1.87^{ab}	18.22 ± 0.32	16.94 ± 0.53^{cd}
D	63.79 ± 1.08^{ab}	17.82 ± 0.33	17.75 ± 0.42^{ab}
E	64.55 ± 1.91^{ab}	18.78 ± 0.57	18.18 ± 0.16^{a}
F	64.04 ± 2.49^{ab}	17.56 ± 0.99	16.40 ± 0.37^{d}
G	66.96 ± 2.46^{a}	18.17 ± 0.17	16.97 ± 0.12^{cd}
H	65.34 ± 1.93^{ab}	18.05 ± 0.83	17.68 ± 0.32^{ab}
Average	64.75	18.17	17.41

[1] Values are the means of three consecutively laid eggs from three birds by each strain.
[2] Valuse are the means of three replicate from one pooled sample by each strain.
Means with the same letters in the same column are not significantly different at 5% level.

TABLE 3. EGG WEIGHT, YOLK WEIGHT AND CHOLESTEROL VALUES (MEANS ± S.D.) IN EGGS FROM 9 DIFFERENT BROWN STRAIN OF BREEDING HEN

Strain	Whole egg weight[1]	Yolk weight[1]	Cholesterol[2]
	(g)	(g)	(mg/g of yolk)
I	66.19 ± 1.25^{ab}	16.93 ± 1.30	16.82 ± 0.29^{bc}
J	67.09 ± 3.45^{ab}	18.96 ± 1.20	16.52 ± 0.30^{c}
K	68.35 ± 1.48^{a}	18.44 ± 1.39	17.22 ± 0.21^{ab}
L	65.05 ± 1.56^{ab}	18.95 ± 1.28	17.74 ± 0.23^{a}
M	68.89 ± 0.64^{a}	18.34 ± 1.01	17.38 ± 0.46^{ab}
N	63.79 ± 2.04^{bc}	17.44 ± 1.23	17.28 ± 0.41^{ab}
O	66.20 ± 1.04^{ab}	18.21 ± 1.17	16.44 ± 0.16^{c}
P	65.84 ± 4.71^{ab}	17.27 ± 0.23	17.41 ± 0.26^{ab}
Q	60.73 ± 0.56^{c}	17.71 ± 1.13	16.94 ± 0.39^{bc}
Average	65.79	18.03	17.08

[1] Values are the means of three consecutively laid eggs from three birds by each strain.
[2] Valuse are the means of three replicate from one pooled sample by each strain.
Means with the same letters in the same column are not significantly different at 5% level.

coming from hens whose eggs had brown. On the other hand, the variation of cholesterol among strains within the breed showed there were strain differences ($p < 0.05$) of cholesterol content by analysis of variance.

The overall mean of 17.25 mg cholesterol per gram of yolk found in this study was somewhat higher than most values reported by other researchers (Bair and Marion, 1978; Bair et al., 1980; Cotterill et al., 1977; Feeley et al., 1972; Rangachar et al., 1970). Beyer and Jensen (1989) revealed that, in general, the cholesterol content of eggs has been overestimated using a common colorimetric method for cholesterol detection. More recently in a study by Holden et al. (1989), the cholesterol level of eggs was estimatd at 208 mg/egg.

Almost all of the data are based upon colorimetric determinations and most give cholesterol values of 12 to 18 mg/g yolk. Achard et al. (1934) found 17.50 mg/g in chicken eggs. Much higher levels, 29, 21, 20 to 27, and 21 to 24 mg/g yolk have been reported by Combs and Helbacka (1960), Daghir et al. (1960), Chand et al. (197 2) and Chand and Sapra (1973), respectively. It is likely that some of the variability and the higher values reported in the results cited are due to overestimate generated by the widely used nonspecific Liebermann-Burchard acid-colorimetric technique (Bitman and Wood, 1980).

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