COMPARISON OF FATTY ACIDS AND CHOLESTEROL RATIO IN DIFFERENT TYPES OF BIRD EGGS

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SUMMARY

A total of 72 of different types of bird eggs of native breed's (balady), farm birds (white shell, brown shell, double yolk), quill and duck. They were collected from different supermarket in Cairo Governorate (12 samples for each type). Each 3 eggs of each type were pooled and examined as one sample. They were examined for Cholesterol contents and Fatty acids composition. Also, studying the quality of different types of bird's eggs as a source of good quality lipid, effect of breed of bird on cholesterol contents as well as measuring fatty acids pattern specially (EPA and DHA) n-3 polyunsaturated fatty acids

Results revealed that the quill's eggs has the lowest cholesterol ratio followed by native breeds (balady) eggs then duck eggs. On the other hand, the highest cholesterol ratio was recorded in double-yolk egg followed by white-shell egg and finally the brown-shell egg.

The fatty acids composition of different types of tested eggs showed that the concentration levels of the different fatty acids in quill and balady egg revealed three trends namely, constant (insignificant changes). The percentage of $C_{14:0}$; $C_{16:0}$; $C_{18:3}$; $C_{20:0}$; $C_{20:1}$ and $C_{22:1}$ showed insignificant changes. The percent share of acids $C_{18:0}$, $C_{18:1}$ and $C_{18:2}$ underwent highly significant increases. On the other hand, $C_{16:1}$; $C_{20:5}$ n-3;$C_{22:5}$ n-3 and $C_{22:6}$ n-3 were highly significantly decreased.

Moreover, monioneic fatty acids were significantly higher in quill and balady egg than white and brown-shell, double yolk and duck eggs. Polyioneic and total n-3 series polyunsaturated fatty acids were significantly lower in quill and balady egg.

INTRODUCTION

Eggs had been used as food by human beings since early antiquity , its nutritive value not only excellent for body maintenance , but also as a good source of high quality animal proteins and fats. Therefore, eggs are incorporated into many different foodstuffs that are prepared commercially on a large scale. Their high nutrient content, low caloric value and ease digestibility make eggs valuable in many therapeutic diets for adults (*Burley and Vadehara, 1989*).

Cholesterol content of chicken egg has recently received far more attention than before due to increase in cardiovascular diseases in man mainly arthrosclerosis, hypertension and coronary heart disease. Egg yolk is considered one of the richest source of cholesterol in human diet (*Sims, 1994*).

Hen's egg is a complex biological and chemical entity. In essence, the egg consists of a minute center of life (for the fertilized egg), immersed in an enormous amounts of innominate food substances, in turn, enclosed by protective structures. During the assessment of its potential as a food product, the avian egg's complexity is a major challenge for food scientists and nutritionists eager to elucidate its biochemical processes (*Noble, 1987*) . Furthermore, in determining the quality of food products, consumer concerns are increasingly important within the framework of a general quality concept (*Demeter, 1997*). Direct egg quality characteristics can be categorized into external appearance traits and internal quality traits. The latter characteristics include mainly properties related to albumin as well as egg yolk quality, e.g., nutritional value, physicochemical value, sensory properties and safety and health aspects (*Sims, 1998*).

The role of dietary cholesterol and fatty acid composition in the etiology of cardiovascular diseases and other ailments remains controversial. Many attempts to reduce egg cholesterol content have met little practical application (*Harigis, 1988*). An alternative way to reduce the cholesterolaemic effects of eggs is by altering the yolk fatty acid composition. The cholesterol-lowering effects of (n-6) and (n-3) polyunsaturated fatty acids (PUFA)[3] have been recognized for some years (*Demeter and Doreau, 1999*) and feeding layers diets rich in PUFA results in a large increase in the relative and absolute concentrations of PUFA in yolk total lipid (*Hargis et al., 1991; Huyghebeat et al., 1991 and Huyghebeart, 1994*).

So, the aim of this work was to study the quality of different types of bird's eggs as a source of good quality lipid, effect of breed of bird on cholesterol contents as well as measuring fatty acids pattern specially (EPA and DHA) n-3 polyunsaturated fatty acids

MATERIALS AND METHODS

A total of 72 eggs of different types of bird's eggs which are native breed's (balady), farm bird (white shell, brown shell, double yolk), quill and duck were collected from different supermarket in Cairo Governorate (12 samples for each type). Each 3 eggs of each type were pooled and examined as one sample. The collected eggs were examined for:-

1- Cholesterol contents:-

Yolk samples were separated from broken eggs then fat extracted in order to determine cholesterol according to the method described by *Falch et al., (1957).*

2- Fatty acids composition:-

The methyl esters of extracted yolk lipids were prepared according to *Radwan, (1978)* by using Gas Liquid Chromatography (GLC), GC Modle Shimadzu-4 CM (PFE) equipped with PID detector and glass column 2.5 m X 3mm i.d under the following conditions: column 5% DEGS on 80/100 Chromo Q., detector temp: 27C°, H_2 flow rate: 75 ml/min, sensitivity: 16X 10^2, column temp.: 180 C° isothermal, N2 flow rate: 20 ml/min, Air flow rate: 0.5ml/min, chart speed: 2.5 mm/min.

3- Statistical analysis:-

Data obtained were simultaneously analyzed and statistically operated according to *Petrie and Watson (1999).*

RESULTS AND DISCUSSION

The nutritional manipulation of the diets of laying hens to include sources of n-3 fatty acids promotes the deposition of these nutrients into egg yolk where n-3 Fatty acid-rich eggs may provide an exciting alternative food source for enhancing consumer intake of these proposed healthful fatty acids. Care must be taken when designing n-3 fatty acid-rich poultry rations, however, to assure that the resulting egg fatty acid profile is useful for promoting consumer health yet maintaining egg sensory quality *(Van, 2002).*

The cholesterol and fatty acids composition of eggs can be changed by dietary means and by different spices of birds *(Leskanish &Noble,1990 and Scheidler et al., 1999)*

The results obtained in table (1) showed the cholesterol ratio of different types of the examined eggs. It revealed that the quill eggs has the lowest cholesterol ratio followed by native breed's (balady) eggs then the duck eggs. On the other hand, the highest cholesterol ratio was recorded in double-yolk egg followed by white-shell egg and finally the brown-shell egg.

No available literature were recorded about native breed, quill and duck's eggs.

The results of white and brown-shell eggs were agreed to some extent with those recorded by *Szymezyk & Pisulewski (1998) and Shafer et al., (2001)* who attributed that, the high ratio of cholesterol may be reflect the high fat diet of laying hens. Also, *Garcia and Albala, (1999)* reported that laying hens that fed on diet contained fish meal or oils produce eggs with significant high cholesterol than that fed on vegetable ingredients. *Scheideler et al., (1999)* approved that the spices and age of bird has an affect on the lipid profile of eggs

So, the cholesterol esters content was significantly high in farm table eggs than in other native breed, duck and quill eggs which are naturally nested uncaged and unmedicated at houses by individuals. This is may be due to the farm laying hen fed on diet contain high percent of fat in the form of meals, perimex and some types of oil, while the individual housed hens and ducks fed on vegetable diet or corn with low fat content without any additives.

The fatty acids composition of different types of tested eggs was tabulated in table (2). It showed that the concentration levels of the different fatty acids in quill and balady's egg revealed three trends namely, constant (insignificant changes), higher and lower. The percentage of $C_{14:0}$; $C_{16:0}$; $C_{18:3}$; $C_{20:0}$; $C_{20:1}$ and $C_{22:1}$ showed insignificant changes. The percent share of acids $C_{18:0}$, $C_{18:1}$ and $C_{18:2}$ underwent highly significant increases. On the other hand, $C_{16:1}$; $C_{20:5}$ n-3;$C_{22:5}$ n-3 and $C_{22:6}$ n-3 were highly significantly decreased.

Moreover, monioneic fatty acids significantly higher in quill and balady' egg than white and brown-shell, double yolk and duck's eggs. Polyioneic and total n-3 series polyunsaturated fatty acids were significantly lower in quill and balady' egg that may be due to oxidation or enzymatic hydrolysis of highly unsaturated fatty acids where lipid hydroperoxides well be the primary products *(Refsgaard, et al., 1998).*

From the obtained results, it is obvious that the highest fatty acids profile was recorded in double-yolk eggs followed by duck's egg then white shell egg and finally the brown-shell egg. The lowest profile was recorded in quill's eggs followed by native breed's eggs.

literatures recorded by *Huyghebaert et al., (1991); Vahl et al., (1991) and Katleen et al., (2001)* proved that the egg yolk fatty acids pattern clearly reflected the dietary fatty acid composition. This may explain that the farm laying hen fed on diet contain high percent of fat lay eggs rich in fatty acids, while the individual housed hens and ducks fed on low fat diet lay eggs with low fat contents.

On the other hand, *Posati et al., (1997)* revealed that large sized egg contain more lipids and fatty acids on a per-egg basis than do small eggs. Lipid class compositional studies indicate that 83 percent of total egg lipids are fatty acids. This percentage figure provides the basis for converting fatty acid data expressed as weight per cent methyl esters to the gram-per-100-gm,-food basis used in nutrient tables. Reliable, up-to-date tabulations of total lipids and fatty acids in eggs of different species and egg products are presented.

Finally, it can be concluded that the native breed eggs followed by quill eggs are the most suitable eggs for consumption by the individual as it contain lower ratio of lipid profile (cholesterol and saturated and unsaturated fatty acids)

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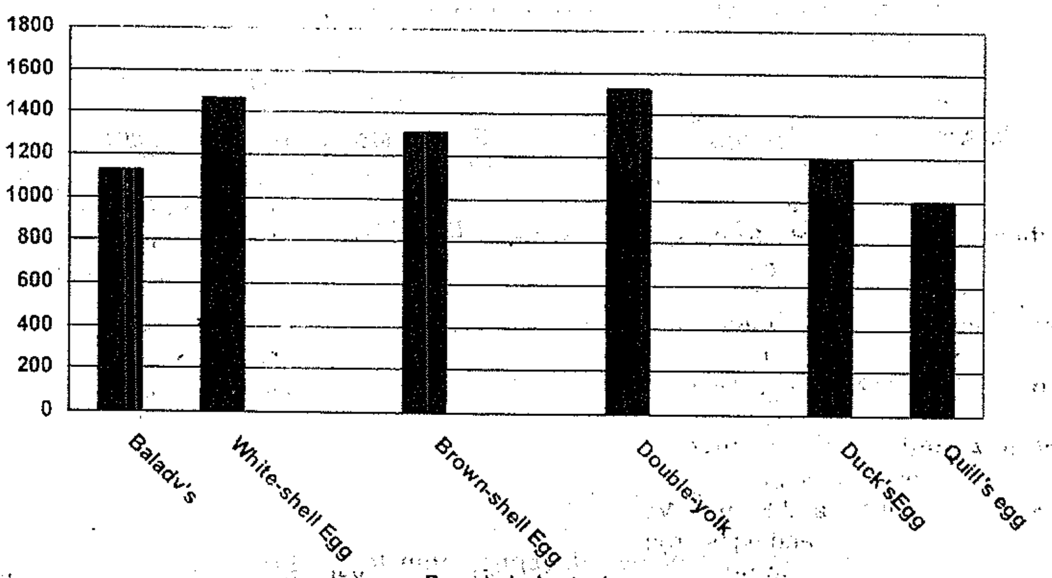

Yolk cholesterol (mg/100 yolk) of different types of examined eggs

Table (1): Egg yolk cholesterol (mg/100g yolk) of laying hens fed different additives to diet.

Breed of Bird	Balady Egg	White-shell Egg	Brown-shell Egg	Double-yolk Egg	Duck Egg	Quill Egg
Cholesterol Ratio	1130 ± 11.18	1470±8.63	1310±14.87	1527± 12.94	1187± 11.41	995± 8.45

Table (2): Fatty acids pattern of different types of examined eggs.

	Balady Egg	White-shell Egg	Brown-shell Egg	Quill Eggs	Duck Egg	Double-yolk Eggs	T.
Louric ($C_{12:0}$)	-	0.33±0.04	-	-	1.58±0.03	0.362±0.058	0.01 NS
Myristic ($C_{14:0}$)	504±089	6.14±0.89	8.18±0.99	7.225±0.534	8.41±1.79	6.518±0.577	0.899 NS
Palmitic ($C_{16:0}$)	20.38±0.81	19.31±0.51	18.99±3.08	18.457±1.419	19.48±2.08	19.77±0.693	0.831 NS
Palmitoleic ($C_{16:1}$)	7.28+ 0.27	7.17±0.91	12.14±2.18	10.33±0.596	9.53±1.61	8.473±0.313	2.759**
Stearic ($C_{18:0}$)	2.18 ± 0.11	3.76±0.64	3.17±0.73	1.686±0.181	1.04±0.08	2.661±0.260	3.078**
Oleic ($C_{18:1}$)	32.54 ± 8.1	28.09±0.13	18.39±1.81	20.132±1.115	23.17±2.54	31.085±0.517	8.912***
Lenoliec ($C_{18:2}$)	5.18 ± 0.53	8.17±1.98	4.67±0.14	3.372±0.363	6.08±1.01	7.532±0.642	5.641***
Lenoliec ($C_{18:3}$)	2.62 ± 0.059	2.54±0.16	2.03±0.09	1.6±0.577	-	1.521±0.121	0.134 NS
Arachidic ($C_{20:0}$)	8.41±0.85	6.07±7.47	6.19±0.89	5.78±0.45	4.23±0.76	7.016±0.58	1.684 NS
Eicosenoic ($C_{20:1}$)	2.55±0.09	4.18±1.08	3.99±0.49	3.597±0.521	3.01±0.14	2.444±0.251	1.994 NS
EPA ($C_{20:5}$) n-3	1.18±0.01	2.47±0.38	7.01±0.94	6.0±0.577	7.28±0.93	1.132±0.076	8.364***
Erucic ($C_{22:1}$)	9.04±1.71	3.38±0.29	6.40±0.57	6.203±1.099	5.39±0.48	4.526±0.512	1.383
($C_{22:5}$) n-3	2.18±0.18	1.15±0.69	3.18±0.19	2.3±0.192	3.99±0.87	1.131±0.12	5.163***
DHA ($C_{22:6}$) n-3	2.19 ±0.14	4.19±0.23	10.54±0.95	9.835±0.095	10.48±1.91	5.829±0.636	6.230***
Lignoceric ($C_{24:0}$)	-	1.05±0.01	0.59±0.28	3.483±1.028	2.83±0.04	-	1.14 NS
Saturated fatty acids	36.48 ± 3.17	36.17 ± 1.78	36.98±3.11	36.631±3.077	36.24±7.18	36.327±1.954	0.083 NS
Unsaturated fatty acids	63.52 ± 3.08	63.83±3.49	93.02±3.77	63.369±3.077	63.76±3.18	63.673±2.033	0.082 NS
Monioneic fatty acids	43.28±4.18	48.17±3.92	50.11±0.87	40.262±2.287	25.15±4.12	46.528±1.592	2.249*
di-and polyioneic fatty acids	17.38 ± 1018	19.41±1.53	23.14±0.51	23.107±1.151	14.89±0.66	17.145±0.262	5.05**
Total n-3 unsaturated fatty acids	10.17±0.18	9.01±0.23	13.03±0.15	18.135±0.211	14.89±0.66	8.092±0.143	39.400***

* Significant at P≤ 0.05
** Highly significant P≤0.01
*** Highly significant at P≤ 0.001
NS Not significant at P≤ 0.05