ESTIMATION OF QUAIL EGG YOLK PLASMA PHOSPHOLIPIDS AFTER FRAGMENTATION BY THIN LAYER CHROMATOGRAPHY METHOD

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Summary

The purpose of this study was the separation and dosage of quail egg yolk plasma phospholipids. The phospholipids have been fragmented using the thin layer chromatography method, while their dosage has been made by estimating phosphorus, after the perchloric acid digestion. The obtained results have demonstrated the presence of phosphatidylcholine in large quantity (74.8%), as well as the presence of the other phospholipids: phosphatidylethanolamine (11.3%), phosphatidylserine (4.3%), sphingomyelin (6.5%) and lysophosphatidylcholine (3.1%). Due to the high level of phosphatidylcholine, as well as the presence of sphingomyelin, the use of quail eggs in diets is highly recommended, as these phospholipids contribute to the decrease of lymphatic absorption of cholesterol.

Key words: quail, egg, phosphatidylcholine, sphingomyelin

Eggs have represented human food since ancient times because they have high quality nutrients. Eggs are readily digested and can provide a significant portion of the nutrients required daily for the growth and maintenance of body tissue.

Quail eggs are small and fine (about 1/5 the weight of chicken egg) and very delicious. The nutritional content is similar to that of chicken eggs, with flavor that is similar or perhaps more delicate. Some people who are allergic to chicken eggs find that can tolerate quail eggs.

Yolk is a fat-in-water emulsion with about 50% dry matter content, and consisting of proteins and lipids, ratio of about 1:2. The major components of yolk lipid are triacylglycerol (TG), phospholipids (PH) and cholesterol (3, 10). These lipids are closely related to the proteins which are found in yolk. Diluted yolk solution by centrifugation is fragmentised in the granules and the plasma. Yolk plasma contains low-density lipoprotein (LDL) and livetin (globular protein). Granules contain lipovitellin, phosvitin, high-density lipoprotein (HDL) and low-density lipoprotein-g (LDLg) (2).

The objective of this work is the investigation of quail egg yolk plasma phospholipids.
Materials and methods

Materials. The fresh quail eggs were obtained from a farm and stored at 4°C.

The fragmentation of egg yolk plasma. The eggs of quail were broken; the albumen was separated and the chalaza removed from the egg yolk. 0.1 ml egg yolk was diluted with 10 ml distilled water. The mixture was then mixed with a magnetic stirrer and centrifuged at 16000 x g for 10 min at 10°C. The plasma fraction was decanted and stored at 4°C.

Phospholipids extraction. The environment provided for the extraction of phospholipids was the mix of methanol – chloroform (2/1, v/v), ratio of 5 ml extractor to 0.1 ml of serum.

Thin layer chromatography (TLC). TLC plates (silica gel) were pre-washed by migration in a clean tank containing chloroform/methanol (1/1, v/v). Plates were air dried and lipid samples (10 µl) were rapidly applied on plates. Plates were rapidly placed in the chromatography tank containing chloroform/methanol/water (65/24/4, v/v/v) (1). Staining was made with iodine.

Quantitative determination of phospholipids. Iodine was removed by evaporation in hot air flow and phospholipids were extracted from the silica gel using two elutions with 5 ml of chloroform/methanol/water (5/5/1, v/v/v). After adding 5 ml of water, the lower phase was collected and evaporated. Lipids were dissolved in chloroform/methanol (2/1, v/v). Phospholipids were estimated by phosphorus determination after perchloric acid digestion. After the ammonium molybdate reaction, absorbance at 800 nm was read (12).

Results and discussions

The obtained results using the thin layer chromatography method have demonstrated the existence of phosphatidylethanolamine (PE), phosphatidylserine (PS), phosphatidylcholine (PC), sphyngomielin (SM) and lysophosphatidylcholine (LPC) in quail egg yolk (fig.1). The spot obtained for the phosphatidylcholine indicated the fact that this phospholipid represents a majority in the content of the quail egg yolk plasma. The other phospholipids, with the exception of the phosphatidylserine, have shown low intensity spots, which indicate very low concentrations.

The results which have been obtained using the chromatography method in thin layer have been confirmed by those obtained in the quantitative analysis of the phospholipids. Phosphatidylcholine represents 74.8% out of the total of phospholipids, phosphatidylethanolamine represents 11.3%, phosphatidylserine – 4.3 %, sphyngomielin -6.5%, and lysophosphatidylcholine – 3.1% (table 1).
Table 1

<table>
<thead>
<tr>
<th>Phospholipids fraction</th>
<th>%</th>
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<tbody>
<tr>
<td>Phosphatidylethanolamine</td>
<td>11.3 ± 0.73</td>
</tr>
<tr>
<td>Phosphatidylserine</td>
<td>4.3 ± 1.07</td>
</tr>
<tr>
<td>Phosphatidylcholine</td>
<td>74.8 ± 1.1</td>
</tr>
<tr>
<td>Sphyngomielin</td>
<td>6.5 ± 0.63</td>
</tr>
<tr>
<td>Lysophosphatidylcholine</td>
<td>3.1 ± 0.88</td>
</tr>
</tbody>
</table>

Figure 1. The chromatographic distribution of phospholipids from the quail egg yolk plasma (PE – Phosphatidylethanolamine, PS – Phosphatidylserine, PC – Phosphatidylcholine, SM – Sphyngomielin, LPC – Lysophosphatidylcholine)

The composition of phospholipids in the egg yolk plasma, separated using the thin layer chromatography method, shows that the proteins in the plasma, under the form of lipoproteids, are mostly associated with phosphatidylcholine (lecithin).

The presence of a large quantity of phosphatidylcholine in quail egg yolk points to the recommendation to use quail eggs in diets, without the risk of increasing the normal level of cholesterol. These statements have been supported by recent studies conducted on chicken eggs, studies which have demonstrated
that an adequate supply of phosphatidylcholine in diet is necessary to support the normal rate of fat absorption. In vitro studies have shown that PC inhibits cholesterol uptake by Caco-2-cells, isolated brush border membranes, everted intestinal sacs, and perfused small intestine (4, 5, 11, 14). Research conducted by Yongzhi and col. has suggested that the intestinal absorption of egg cholesterol may be reduced by the presence of PC in egg yolk (13). Numerous human studies show that despite the high content of cholesterol in egg yolk, consumption of one or two eggs per day has little effect on blood cholesterol levels and coronary heart disease risk (6, 7, 8).

The presence of sphingomyelin in quail egg yolk is an additional factor to the decrease of cholesterol absorption, as the sphingomyelin contributes to the decrease of lymphatic absorption of cholesterol (9).

Conclusions

1. In the quail egg yolk plasma there have been identified the following phospholipids: phosphatidylethanolamine, phosphatidylserine, phosphatidylcholine, sphingomyelin and lysophosphatidylcholine.
2. The quail egg yolk plasma contains a large quantity of phosphatidylcholine.
3. The high level of content of phosphatidylcholine, as well as of sphingomyelin, point to the recommendation to use quail eggs in diets, as these phospholipids contribute to the decrease of lymphatic absorption of cholesterol.

References