



Phosvitin Phosphopeptides (PPPs) – A Functional Food Ingredient Derived from Leftover Egg Yolk

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Summary

This project was conducted (1) to develop an industrial method of phosvitin extraction from leftover egg yolk, (2) to develop optimum conditions for phosvitin phosphopeptides (PPPs) preparation from phosvitin hydrolysates, (3) to study the bioactivities of phosvitin and phosvitin phosphopeptides (PPPs).

Problem

Phosvitin, extracted from leftover egg yolk, is particularly resistant to proteolytic action and strongly chelates with metal ions, resulting in low bioavailability of Ca and Fe. However, Phosvitin phosphopeptides (PPPs), which are derived from phosvitin hydrolysates, have been demonstrated to enhance Fe and Ca intake and exhibit novel antioxidant activity.

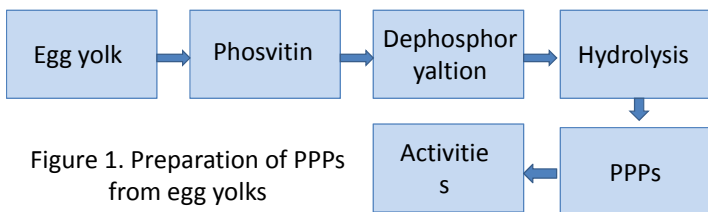


Figure 1. Preparation of PPPs from egg yolks

In comparison, casein phosphopeptides (CPPs) derived from bovine milk have already been commercialized as a valuable component for functional food uses. However, commercialization of PPPs is hampered by (1) industrial extraction protocol of phosvitin, prohibiting organic solvent and chemicals from being used in food industry, and (2) preparation of PPPs with optimum activity.



Figure 2. Casein phosphopeptides Products

Methodology

- Develop protocol for industry production of phosvitin, by using simple process like centrifugation and precipitation
- Prepare PPPs with optimum activity using FPLC, HPLC
- Develop protocol for phosphorus determination
- Bioactivities study of PPPs using animal experiments

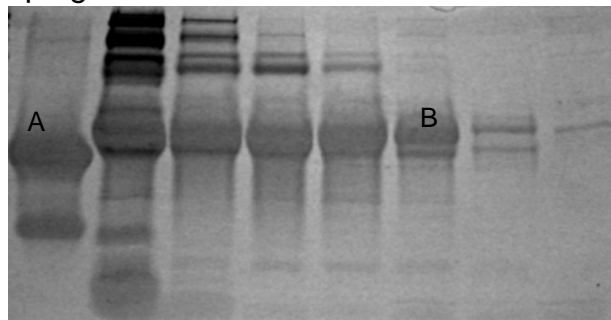


Figure 3. SDS-PAGE profile of crude phosvitin sample A, Phosvitin standard from sigma; B, Crude phosvitin from this study

	N/P (purity)	Recovery over dry yolk matter %
Yamamoto (1990)	3.70	0.2
Nakai (1992)	3.60	0.4
Castellani (2003)	3.5	3.3
This study	2.79	0.67

Table 1. Phosvitin prepared by different protocols

Our Observations

- Centrifugation could reduce large amount of lipids from egg yolk granules to plasma;
- High concentration salt could disrupt the complex of HDL and phosvitin;
- The differences in solubility of phosvitin and HDL could be employed to separate phosvitin or HDL from each other.

What does this mean?

- There is the possibility to build an industrial protocol for phosvitin extraction without non-food grade chemicals.
- There is the possibility of industrial scale of PPPs production from enzymatic hydrolysates of phosvitin.
- PPPs, which could be a million dollars' industry, is near at hand.

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