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Composition and Functional Properties of *Lupinus campestris* Protein Isolates[1]

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Abstract. Protein isolates from *L. campestris* and soybean seeds were prepared using isoelectric precipitation (PI) and micellization (MI) procedures. The amount of protein recovered was considerably higher with the isoelectric precipitation than with the micellization procedure (60% and 30%, respectively). Protein contents were higher than 90% in protein isolates. Antinutritional factors content (alkaloids, lectins, and tannins) were reduced to innocuous levels after protein isolate preparation. Minimum protein solubility for the precipitated lupin protein isolate (LPI) was at pH 4.0, and between pH 4 and 6 for the micellized lupin protein isolate (LMI), increasing at both extremes of the pH scale. Water absorption for the LMI was 1.3 ml/g of protein and its oil absorption 2.2 ml/g of protein. The LPI had 1.7 ml/g of protein in both water and oil absorption. Foaming capacity and stability was pH-dependent. Foaming capacity was higher at pH 2 and lower near the protein isoelectric points. Minimum protein concentration for gelation in LMI was 8% w/v at pH 4, while for LPI was 6% at pH 4 and 6. Amino acid composition in *L. campestris* flour and protein isolates was high in lysine and low in methionine. Most of the essential amino acids in lupin protein isolates were at acceptable levels compared to a reference pattern for infants and adults. The electrophoretic pattern of both protein isolates showed three bands with different mobilities, suggesting that the protein fractions belong to α-conglutin (11S-like protein), β-conglutin (7S-like protein) and γ-conglutin. It is proven that some of the functional properties of *L. campestris* protein isolates are similar to those soybean protein isolates recovered under equal conditions.

Key words: Functional properties, *L. campestris*, Protein isolates, Soybean, Vegetable proteins

Introduction

Proteins are commonly used as food ingredients as they are of fundamental importance in the human diet. They also contribute to foods sensory properties and provide suitable functionality [1]. The nutritional quality and functionality of protein ingredients depend on their molecular composition and structure, the isolation method used and their interactions with other ingredients in the food product [2].

Due to the high cost of animal proteins, there is an active search for other protein sources to satisfy human nutrition requirements. Excellent alternative sources are legume protein isolates. Soybeans currently constitute the most significant vegetable protein source in food formulations. However, lupins, and particularly *L. albus* from the Mediterranean and *L. mutabilis* from South America, are very promising legumes that can be grown in poor soils [3]. Other species include *L. campestris* which, along with approximately 110 other wild lipin species, has been reported growing throughout México [4].

Lupin seeds have 40% protein content and 20% fat content, which is similar to soybeans but higher than other legumes. Globulins (α-conglutin or 11S-like protein, β-conglutin or 7S-like protein and γ-conglutin) are the main storage proteins (80–90%), in lupins, and have values similar to those reported in most legume seeds [3]. The alkaloid content of lupin seed appears to be the only significant antinutritional component, as hemagglutinin, phytate, α-galactoside, tannin, and trypsin inhibitor levels are lower than those found in other legumes and comparable to those of cereals [5].

Lupins utilize quinolizidine alkaloids as a defense against predators, but this is a limiting factor for human consumption. Elevated concentrations produce a bitter taste, and they do have some reported pharmacological effects [6]. However, alkaloids have been proven non-toxic at low concentrations [7]. Any potential effect from the alkaloids in lupins is eliminated during preparation of protein isolates since the alkaloids are water-soluble and are removed during processing [3].

Protein isolates have become increasingly important in the food industry because of their high protein contents, up to 90% in some legume protein isolates. They represent an alternative protein source for preparation of traditional foods and in development of new foods [2]. Successful use of plant protein isolates depends on the versatility of their functional properties, which are influenced by intrinsic factors (protein composition and conformation), environmental factors (food or model system composition), and isolation methods and conditions [8].

The most widely used procedure to prepare seed protein isolates is isoelectric precipitation. After alkaline solubilization of the proteins (pH 8–10) and removal of the insoluble material by centrifuging, proteins are precipitated by adding acid (pH 4–6) until reaching the isoelectric point [2, 8, 9]. Another process for isolating seed proteins is micellization, which involves precipitation from a neutral salt

[1]The authors dedicate this paper to honor the memory of our dear professors: Dr. Luz María del Castillo and Dr. Manuel Castañeda Agulló.