

Comparative Study of the Foaming and Emulsification Properties of Blue and White Lupin Protein Fractions

Stanley Chukwuejim¹ and Rotimi E. Aluko^{1,2,*}

¹ Department of Food and Human Nutritional Science, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2

² The Richardson Centre for Food Technology and Research, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2

* Correspondence: rotimi.aluko@umanitoba.ca

Abstract

Introduction

As the demand for dietary proteins increases in the food and nutraceutical industries, legumes such as lupin are being explored as alternatives to soy and animal proteins owing to their high protein and fiber content. In this study, we investigated the foaming and emulsion properties of protein fractions from white lupin (*Lupinus albus*) and blue lupin (*Lupinus angustifolius*) seeds to assess their potential as functional food ingredients.

Methods

Vicilin and legumin protein fractions were isolated from defatted white and blue lupin flour. Their foaming and emulsification properties were evaluated at different pH levels (3, 5, 7, and 9) and protein concentrations (10, 15, and 20 mg/mL) by measuring the oil droplet size, emulsion stability, foam capacity, and foam stability.

Results

The pH had a significant effect on the mean oil droplet size, with the lowest value observed at pH 9 (BLLEG, $4.32 \pm 0.00 \mu\text{m}$ and WLLEG, $4.13 \pm 0.01 \mu\text{m}$) and the highest at pH 5 (BLLEG, $14.30 \pm 0.14 \mu\text{m}$ and WLLEG, $13.60 \pm 0.20 \mu\text{m}$). The emulsions were generally stable except at pH 5. The blue lupin vicilin exhibited excellent foaming capacity across all the pH values except pH 9 (33%). The foaming capacity of BLVL at pH 3, 5, and 7 was significantly higher at all the different protein concentrations (10 mg/ml, 15 mg/ml, and 20 mg/ml) when compared to WLVL. The foaming stability of BLLEG and WLLEG at pH 3 was not significantly different, with the lowest value for both fractions at 10 mg/ml (BLLEG, 39%, and WLLEG, 45%) and the highest (61%) at 15 mg/ml for WLLEG. Protein concentration had a minimal effect on oil droplet size but influenced foaming properties.

Conclusions

The isolated lupin protein fractions demonstrated excellent functional properties, particularly for foaming and emulsification. These findings advance food quality by identifying novel plant-based ingredients with potential applications in various food formulations, such as non-dairy desserts and baked goods, thus contributing to developing innovative nutritious food products.