J Food Sci Technol
https://doi.org/10.1007/s13197-021-05225-y

ORIGINAL ARTICLE

Hydrolysis of peanut (*Arachis hypogea* L) protein concentrate by fungal crude protease extract: effect on structural, functional and in-vitro protein digestibility

Deep Narayan Yadav[1] · Nisar Ahmad Mir[1] · Ritika Wadhwa[1] · Surya Tushir[2] · Swati Sethi[1] · Rahul Kumar Anurag[2] · Harinder Singh Oberoi[3]

Revised: 18 July 2021 / Accepted: 28 July 2021

Abstract Peanut protein concentrates (PPCs) were subjected to hydrolysis by crude protease extract (CPE) obtained from three fungi viz; *Rhizopus oligosporus, Trichoderma reesei,* and *Aspergillus oryzae* and the effect on structural, functional and in-vitro protein digestibility (IVPD) properties were studied. Particle size was found significantly ($p \leq 0.05$) lower in hydrolyzed samples than un-treated samples. Fourier transform infrared spectroscopy (FTIR) spectrum of hydrolyzed samples displayed intense absorbance peaks in the wavelength ranging from 1500 to 2600 cm^{-1}. Peanut protein concentrates hydrolyzed by CPE from *R. oligosporus* showed higher surface hydrophobicity (564.18). Total sulfhydryl content was found lower in all the hydrolyzed samples whereas, reverse trend was observed for exposed sulfhydryl content. The structural changes simultaneously affected the functional and IVPD attributes of hydrolyzed PPCs. In comparison to the PPCs hydrolysed using crude extracts from *T. reesei* and *R. oligosporus,* PPCs hydrolysed by *A, oryzae* showed higher solubility, water and oil binding capacity, foaming capacity and foam stability. Higher IVPD values of 86.70% was also found in PPCs hydrolyzed with CPE of *A. oryzae*. The study established that CPE hydrolysis of PPCs has potential for scale-up studies and may serve as a cost effective alternative to protein hydrolysis with pure enzymes.

Keywords Peanut protein concentrate · Hydrolysis · Crude protease extract · Conformational changes · Solubility

Introduction

Peanut (*Arachis hypogea* L.), a major source of edible oil and protein is considered valuable for animal and human nutrition. Defatted peanut meal containing about 30–35% protein with higher bioavailability and lower anti-nutritional factors is underutilized product of the peanut industry (Yadav et al 2012). Extraction of protein from defatted peanut meal and their applications in formulation of protein beverages can be of great significance (Malik et al 2016). Plant based protein drinks could also serve as an alternative to animal protein drinks due to some dietary restrictions and religious concerns (Jain et al 2019). Peanut protein has promising nutritional profile, however, its uses in food formulations are limited owing to lower solubility and poor emulsifying properties.

Different approaches like high-intensity ultrasound (HIUS) (Mir et al 2019); heat treatment (Mir et al 2020) and irradiation (Malik and Saini 2017) have been studied for modification of native protein structure in order to enhance the functional properties. Enzymatic hydrolysis with pure enzymes is also used for enhancing functional properties of the protein and usually preferred from the food safety point of view. Yu et al (2007) and Quist et al (2009) reported that enzymatic hydrolysis can generate lower molecular weight polypeptides and free amino acids. The lower molecular weight polypeptides are easily

✉ Deep Narayan Yadav
deep.yadav@icar.gov.in

[1] Food Grains and Oilseed Processing Division, ICAR-Central Institute of Post-Harvest Engineering & Technology, Ludhiana 141004, Punjab, India

[2] Agricultural Structures and Environmental Control Division, ICAR-Central Institute of Post-Harvest Engineering & Technology, Ludhiana 141004, Punjab, India

[3] Division of Post-Harvest Technology and Agricultural Engineering, ICAR-Indian Institute of Horticultural Research, Hesaraghatta, Bengaluru 560089, India

Published online: 03 August 2021