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Broccoli byproducts protein concentrate: High intensity ultrasound (HIUS) effect on *in-vitro* digestibility, structural, physiochemical, techno-functional and thermal properties

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Abstract

Inspired by the exploration of underutilized byproducts to address food security concerns, broccoli byproduct protein concentrate (BBPPC) was subjected to high intensity ultrasound treatment (HIUS) to enhance its properties for broader food applications. The study examined HIUS effects at varying power levels (240, 360 and 480 W) and a fixed processing time of 10 minute on the *in-vitro* digestibility, conformation, physicochemical, functional and thermal properties (DSC) of BBPPC. Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM) revealed that HIUS treatment modifies the spatial structure of BBPPC. Secondary structure (Circular dichroism) analysis showed an initial decrease then increase in α-helix and β-sheet content, while random coil and β-turn content initially increase then decreases, reflecting initial protein unfolding followed by refolding. SDS-PAGE showed the presence of RuBisCO, prolamin and glutelin, whereas amino acid profiling indicated transient exposure of buried residues. Notably, the average particle size reduced from 647.7 nm to 296.3 nm, enhanced zeta potential and sulfhydryl group compare to control at a power of 360 W. The functional properties improved significantly ($p<0.05$), with a maximum water absorption capacity of 4.05 g/mL, oil absorption capacity of 4.35 g/mL, foaming capacity of 89.74%, foam stability reaching 58.69%, and emulsification activity index and stability index at 8.99 m^2/g and 65.39 minutes, respectively. Additionally, high pressure treated BBPPC had higher solubility and *in-vitro* digestibility. This study could provide a theoretical basis for the application of HIUS technology for modification of BBPPC to expand its potential use as an alternative protein source.

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