FUNCTION CHARACTERIZATION OF THE INTERACTION BETWEEN MILK PROTEINS WITH SOME BIOACTIVE COMPONENTS

By

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ABSTRACT

This study was investigated to improve the functional properties of milk proteins by complexed or conjugated with some bioactive components including the psyllium husk mucilage (PHM), napeq mucilage (NapM) and caffeic acid (CA). Firstly, the recovery of milk proteins by non-covalent interaction with PHM and NapM were studied. Furthermore, syntheses the of β-Lactoglobulin-CA (βLg-CA) conjugated at different pH (pH 2.5, 6.0, and 8.5) and its polymerization. The resulting bioconjugates were characterized by MALDI-TOF MS, differential scanning calorimetry (DSC), fluorescence-quenching, infrared, circular dichroism spectroscopies and SDS gels electrophoresis. Furthermore, applying some milk proteins-bioactive ingredients as the emulsifier and antioxidant in omega 3 oil in water emulsion, hepatoprotective rats fed high-fat diet and cytotoxicity agent against liver and breast cancer cells. Results showed: 1) Recovered the buffalo milk proteins using PHM and NapM by two phases (TPS) and pH hydrostatic system. 2) The % of milk protein recovery by TPS and pH system increased, which the BTMP/PHM complex (pH system) was 94.47 % compared to the traditional acid buffalo casein (BCas) and buffalo total milk proteins (BTMP prepared by pH system) as a control 77.10 and 85.52 %, respectively. 3) the pH system recovered the BTMP in native state in contrast with the TPS with heating caused denaturation for milk proteins. 4) The ash, ether extract, fiber and phytochemicals including total phenolic and flavonoid were enhanced after complexation with soluble polysaccharide mucilages. 5) The recovery by pH system with PHM and NapM improved the antioxidants capacity, protein digestibility, thermal stability and amino acid profile (essential and non-essential) of milk proteins. 6) There were significantly ($p \leq 0.05$) differences in the secondary structure, color attributes and rheological behavior. 7) The SDS gel electrophoresis and transmission electron microscope analyses showed that there was a modification in the overall structure of milk proteins/mucilage complexes. 8) The hypatoprotective and anti-carcinogenic activities of complexation had been improved. 9) An optimal molar ratio (8:1) of caffeic acid to βLg was obtained at pH 6 and increased this ratio to be 28:1 with polymerization technic; 10) The βLg-polyCA presented the highest antioxidant and free radical-scavenging activity based on DPPH, ABTS and HS scavenging assays (92.4, 87.92 and 67.35 respectively), which increased as the number of CA units coupled increase 11) Moreover, DSC results showed that coupling of CA with βLg significantly increased the thermal stability of βLg. 12) The βLg-CA and βLg-polyCA conjugates can act as effective antioxidant emulsifiers and stabilizers, which reduce of oxidation to 16.92 %, stronger negative zeta potentials (-69.9 mv) and more homogeneous size distribution (PDI: 0.22). In summary, the milk proteins-bioactive ingredients as multi-functionalities may find application in food technology, cosmetic, pharmaceutical industries and as protective agent against some contemporary diseases.

Keywords: Milk proteins; Bioactive components; Caffeic acid; Antioxidant activity; Anticancer

DEDICATION

I would like to dedicate this work to my dear beloved parents, may Allah protect and blessing them. Their endless love and high expectations on me have constantly empowered me to overcome difficulties and frustrations in my career. Whenever I needed them, they were always there to patiently listen to me and give me encouragement. I also want to thank my brothers (Mohamed and Omer) and sisters (Qamar and Mona), who have always encouraged and supported me.

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