The Antioxidant Stability of Microencapsulated Bovine Colostrum Protein Hydrolysates

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ABSTRACT

The bovine colostrums collected on the second day postpartum were used to prepare skimmed milk, caseins and whey in this study, and the antioxidant properties of these samples were analyzed. In addition, an enzyme preparation from porcine small intestine was used to hydrolyze these samples under different enzyme/substrate (E/S) ratios (10-60 %), and the antioxidant properties of the colostrum protein samples after hydrolysis by the enzyme preparation were also investigated. Moreover, five different encapsulating materials, including Acryl-EZE, Surelease, chitosan, gum arabic and β - cyclodextrin, were used in this study to encapsulate the colostrum protein samples and their hydrolysates with different encapsulating material/protein (or hydrolysate) ratios (9:1, 8:2, and 7:3) and the microencapsulated samples were digested by the enzymes simulated in gastrointestinal tracts in order to investigate the effects of the encapsulating materials and the protein (or hydrolysate)/encapsulating material ratios on the antioxidant properties of the colostrum protein and their hydrolysates. The results were as follows: 1. (a) The ferrous ion chelating abilities of colostrum skimmed milk, caseins and whey (10 mg/mL) were in order of caseins > whey > skimmed milk. The ferrous ion chelating abilities of these samples were all higher than 60 %. (b) The Trolox equivalent antioxidant capacities (TEAC) of these samples were in order of whey > casein > skimmed milk. The TEAC values of these samples were all higher than 10 m mol Trolox. (c) The superoxide anion scavenging activities of these samples at a concentration of 1 mg/mL were in order of skimmed > casein > whey. 2. In the enzyme/substrate (E/S) ratios (10-60 %) test for the hydrolysis of protein samples, the degree of hydrolysis of caseins and whey proteins were 29.16 and 23.55 %, respectively, when the proteins were hydrolyzed under a 60 % E/S ratio for 12 and 18 hours. 3. As for the results of antioxidant properties of the protein samples (at a concentration of 10 mg/mL) hydrolyzed under a 30 % E/S ratio, (a) the ferrous ion chelating abilities were in order of caseins hydrolysate > whey hydrolysate > skimmed milk hydrolysate. The ferrous ion chelating ability of the hydrolysates of caseins and whey proteins were 85.17 and 71.99 %, respectively when the proteins were hydrolyzed for 24 hours. The ferrous ion chelating abilities of caseins and whey were significantly increased when they were hydrolyzed, and the ferrous ion chelating abilities of the enzymatic hydrolysates were increased with the increasing concentration. (b) The TEAC values of the hydrolysates were in order of whey hydrolysate > casein hydrolysates > skimmed milk hydrolysates. The TEAC values of the hydrolysates of caseins and whey were 13.39 and 13.46 m mol Trolox/g, respectively, when the proteins were hydrolyzed under a 60 % E/S ratio for 24 hours. The TEAC values of the hydrolysates were also increased with increasing concentration. (c) The superoxide anion scavenging activities of the skimmed milk, caseins and whey were all decreased significantly after hydrolysis. 4. As for the antioxidant properties of the microencapsulated colostrum proteins and their hydrolysates after digestion by the enzymes simulated in gastrointestinal tracts, the result showed: (a) The best encapsulating material for keeping antioxidant activity was gum Arabic, and the worst was β - cyclodextrin. (b) The best encapsulating material/protein (or hydrolysate) ratio was 7:3.

Keywords : bovine colostrums ; casein ; whey ; enzymatic hydrolysis ; antioxidant properties ; microencapsulated

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