

Public Abstract

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Title:Improved functional properties and health benefits of whey protein by interaction with polysaccharides

The dramatic increase in whey protein utilization in the food industry is due to its excellent functional properties and nutritional values. This study aimed to improve functionality and health benefits of whey protein by interaction with polysaccharides. In the first section, whey protein/pectin heated soluble complex was made by heating the two biopolymers together at near neutral pH. Conformational changes of protein during complex formation were investigated by Raman, which showed that heat stability of whey protein was enhanced by forming a soluble complex, mainly because pectin was able to stabilize the secondary structures and further altered the heat aggregation of protein. Acid-induced gelation properties of heated whey protein/pectin soluble complex were then investigated. Gel properties were greatly influenced by the charge density of pectin, initial pH of the complex and biopolymer ratio. The results demonstrated the benefits of heated whey protein-pectin soluble complex in improving acid-induced gelation properties of whey protein. Complex gels showed smoother gel network with lower phase separation, enhanced gel strength and water holding capacity. In the second section, in vitro gastric behavior of whey protein/polysaccharide mixed system was investigated, and its potential in promoting satiety and control blood glucose was discussed. Various polysaccharides were chosen to form heated complexes with whey protein at different biopolymer ratio and at neutral pH. Upon mixing with simulated gastric fluid (SGF), intragastric gelation was observed for polysaccharides with negative charges, while no gelation occurred for neutral polysaccharides. The mechanism behind self-assembled intragastric gelation is believed to be the cross-linking between oppositely charged protein and polysaccharides when pH was reduced below the pI of the protein. Intragastric gelation was influenced by biopolymer ratio, biopolymer concentration, charge density of the polysaccharide, initial pH of the sample, and pH of the SGF. Higher biopolymer ratio and concentration, lower initial pH of the sample and SGF, and higher charge density of the polysaccharides resulted in stronger gel with slower degradation rate, which could potentially be used to delay gastric emptying and promote satiety. Slow release of sugar from the matrix was also observed upon intragastric gelation, which could lead to formulation of whey protein beverage with promoted satiety and lowered postprandial glycemic response. The knowledge gained from this study indicates a great potential of using whey protein/polysaccharide interaction to improve functional properties and health benefits of whey protein.