

Development of lactoferrin-glycomacropetide nanohydrogels: a vehicle to encapsulate bioactive compounds

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Protein-based nanohydrogels have attracted great attention due their non-toxicity, small dimension, and large interior network for multivalent bioconjugation, which offers several possibilities for the encapsulation of functional bioactive components. The aim of the current work was to develop nanohydrogels composed of lactoferrin and glycomacropetide (GMP), and to evaluate their sensitivity to environmental stimuli and their ability to incorporate a bioactive compound. Lactoferrin and glycomacropetide are two natural proteins with isoelectric points of 8.5 and 4.8, respectively. Lactoferrin and GMP solutions were mixed at pH 5.5, and then subsequently stirred and heated at 80 °C during 20 min. Curcumin, a polyphenol with numerous biological and pharmacological activities, was used as bioactive compound and incorporated in the nanohydrogels. The resulting nanohydrogels were then characterized in terms of morphology (Transmission Electron Microscopy (TEM), Dynamic Scattering Light (DLS), and Atomic Force Microscopy (AFM)), stability, and curcumin binding capacity. The thermal, pH, and ionic strength stability of the nanohydrogels were evaluated during 24 wk. The results showed that nanohydrogels have a spherical shape with a hydrodynamic diameter around 170 nm and a polydispersity index of 0.1 during 24 wk. The increase in temperature (from 20 to 90 °C) resulted in nanohydrogels with higher values of hydrodynamic diameter (from 170 to 200 nm) that returned to their initial size when the temperature returned to 20 °C. Also, it was observed that the size and polydispersity of the nanohydrogels are influenced by pH and ionic strength. Finally, it has been shown that the nanohydrogel presents a curcumin binding capacity of 90% (mass of curcumin bound per 100 g of total curcumin). Lactoferrin-glycomacropetide nanohydrogels showed to be a good alternative to encapsulate bioactive compounds to apply in the food industry.