Nanohydrogels from bovine lactoferrin: a vector for iron in food applications

Miss Susana F. Santos[1], Miss Ana I. Bourbon[2], Mr. Miguel A. Cerqueira, PhD.[3], Professor António A. Vicente, PhD.[4]

[1]University of Minho, [2]University of Minho, [3]University of Minho, [4]University of Minho

Food properties can be improved with the addition of nanohydrogels (e.g. solubility, binding and surface properties) as they may be a vehicle to enrich foods with essential nutrients. Milk proteins such as lactoferrin are edible, have nutritional value and, by heat treatment and with the addition of a salt, may be able to form nanohydrogels. Iron deficiency is one of the most significant nutritional problems in the world and one of the strategies to solve it is its inclusion in a large variety of iron-rich foods in order to increase iron absorption. Ferric chloride (III) is a salt that, in addition to its gelling action, consists of iron that binds to lactoferrin. Therefore, the association of lactoferrin to iron can be very effective in the production of nanohydrogels. The aim of this work was the development of lactoferrin nanohydrogels with the addition of ferric chloride (FeCl3). Nanohydrogels were formed by dissolving 0.2 % (w/v) of lactoferrin in deionized water and heating the solution at 75 °C for 20 minutes. After the heat treatment 35 mM (w/v) of FeCl3 was added. The resulting nanohydrogels were characterized for morphology (Transmission Electron Microscopy - TEM), stability and iron binding capacity (evaluated through Atomic Absorption Spectroscopy - AAS). The structure#s stability over time, the thermal and pH stability and resistance to lyophilization were evaluated by dynamic light scattering (DLS), through the determination of the size distribuition and polydispersity index (PDI) of nanohydrogels. Results showed that nanohydrogels are stable (maintaining their characteristics - size and PDI) during 12 weeks, and for variations of pH from 2 to 11 and temperatures ranging between 4 and 70 °C. Finally, it has been shown that the nanohydrogel presents an iron binding capacity of 20 % (mass of bound iron per 100 g of total iron). This work shows that nanohydrogels can be produced from lactoferrin and FeCl3 and suggests that these systems can be used in the food industry as vectors to facilitate the release of essential nutrients in the human body.