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Iron-binding optimization of bioactive casein phosphopeptides using response surface methodology; effect of pH, mass ratio and time

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Statement of the Problem: Casein phosphopeptides (CPPs) are mineral-binding bioactive peptides derived from enzymatic digestion of casein. They have been shown to increase iron bioavailability due to increasing iron solubility at the alkaline pH of the intestine. Thus, they are potentially applicable as an advantageous preparation for iron fortification of food. This study aimed to characterize a commercially available CPP and determine optimum experimental conditions for binding it with ferrous iron.

Methodology & Theoretical Orientation: The effect of three variables – pH (5-7.5), mass ratio of iron to CPP (MR) (0.04-0.16) and holding time (40-80 min) – on the CPP's iron content was investigated using the central composite design (CCD) in response surface methodology (RSM), and a quadratic model was developed. The optimization in this survey was based on the maximum response.

Findings: Among all the regression's terms, the main and quadratic effects of pH represented the most significant influences on the iron content (P-value<0.05). The obtained optimum conditions were: pH 6.5, MR 0.14 and holding time 72 min, resulting in binding 68.66 mg iron per gram of the CPP.

Conclusion & Significance: The quantity of iron bound to the CPP depended considerably on the experimental conditions and proved the importance of optimization.



Pipers 1: 30 performs in, a well at anti-anterar plane (b, d and 0 of the CVP's true potent at hole d by the (E_1) mass ratio of some r CPP(E) and holding time (E_2)

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Recent publications

- 1. Abd El Salam M and El Shibiny S (2017) Preparation, properties and uses of enzymatic milk protein hydrolysates. Critical Reviews in Food Science and Nutrition, 57:1119-1132.
- 2. Aït-oukhatar N, Peres J M, Bouhallab S, et al. (2002) Bioavailability of caseinophosphopeptide-bound iron. Journal of Laboratory and Clinical Medicine, 140:290-294.
- 3. Bouhallab S and Bouglé D (2004) Biopeptides of milk: caseinophosphopeptides and mineral bioavailability. Reproduction Nutrition Development, 44:493-498.
- 4. Kibangou I B, Bouhallab S, Henry G, et al. (2005) Milk proteins and iron absorption: contrasting effects of different caseinophosphopeptides. Pediatric Research, 58:731-734.
- 5. Phelan M, Aherne A, FitzGerald R J, et al. (2009) Casein-derived bioactive peptides: biological effects, industrial uses, safety aspects and regulatory status. International Dairy Journal, 19:643-654.

Biography

Zohre Delshadian has her expertise in working on a kind of bioactive peptides derived from bovine milk casein, throughout her PhD dissertation. Casein Phosphopeptides (CPPs) are biologically active peptides that have the ability to bind with bivalent minerals, such as Fe⁺² and increase their bioavailability while keeping them soluble in the intestinal tract. The low bioavailability of the most commonly used iron preparation for fortification, ferrous sulfate, is known for its poor solubility at the alkaline pH of the intestine. Therefore, by using casein phosphopeptides bound to iron instead of ferrous sulfate in fortified foods, the defect of the low bioavailability of iron could be principally solved. She has discovered the optimized experimental conditions (pH, mass ratio of iron to CPP (MR) and holding time) for the better binding of ferrous iron to casein phosphopeptides, using response surface methodology.

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