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Gel structure and particle size effects in *in vitro* intestinal lipid digestion

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Abstract

Food structure not only plays an important role as nutrient protector but also has an effect in the digestion process. In the case of lipids digestion, this could be controlled, limiting the lipase access by forming a matrix around the oil droplet. Further, in the case of solid structures, particles size distribution also affects the digestion process.

Methodology and Theoretical Orientation:

The aim of this research was to evaluate the effect of particle size distribution on intestinal in vitro digestion of emulsion-filed alginate gel cubes using the pH-stat method and modeled with Weibull function. For this, oil/water emulsion-filled calcium alginate cubes of 12.5x12.5x12.5mm were prepared and three different particle size distributions were generated. The particles were intestinal in vitro digested (pH-stat method), calculating the percentage of free fatty acid released (%FFA) and analyzing with Weibull function (k and β).

Findings:

Results showed that the %FFA released shows a sigmoidal behavior for the three particle size distributions, and the k and β-values for each stage were obtained through the Weibull function. For the first stage, k increases as particle size decrease, from $2.17x10^{-8}min^{-1}$ to $1.05x10^{-6}min^{-1}$. While β-values were larger than 1 indicating that is the matrix that controls the FFA release. For the second stage, k and β-values were similar for all particles size distribution, since all calcium-alginate was complete dissolved by this time. In this case, β-values<1 indicating that digestion was initially rapid but levels off at a lower FFA release rate.

Conclusion and Significance:

This study showed that the particle size of an emulsion-filled alginate gel affects FFA release during in vitro digestion, especially during the first 30 minutes of digestion.

Recent Publications

1. Guo, Q., Bellissimo, N., & Rousseau, D. (2017). Role of gel structure in controlling in vitro intestinal lipid

digestion in whey protein emulsions gels. Food Hydrocolloids, 264-272
2. Mat, D. J., Le Feunteun, S., Michon, C., & Souchon, I. (2016). In vitro digestion of foods using pH-stat and the INFOGEST protocol: Impact of matrix structure on digestion kinetics of macronutrients, proteins and lipids. Food Research International, 226-233.
3. Ranawana, V., Leow, M.-S., & Henry, C. (2013). Mastication effects on the gycaemic index: impact on variability and practical implications. European Journal of clinical Nutrition, Volumen 68, 137-139.
4. Silva, A. E., Barratt, G., Chéron, M., & Egito, E. S. (2013). Development of oil-in-water microemulsions for the oral delivery of amphotericin B. International Journal of Pharmaceutics.
5. Papadopoulou, V., Kosmidis, K., Vlachou, M., & Macheras, P. (2006). On the use of the Weibull function for the discernment of drug release mechanisms. International journal of pharmaceutics, 44-50



Biography (150-word limit)

Dr. Cristian Ramírez is a Food Engineer of Universidad de La Frontera de Temuco, magister in Engineering Sciences and Doctor in Engineering Sciences of Pontificia Universidad Católica de Chile. Since 2011 he is an Associated Researcher at Universidad Técnica Federico Santa María (UTFSM) in Chile. His main research lines are Food Processing, Food Microstructure and In vitro Food Digestion. In these areas he has published more than 15 articles, including collaborations with the Food Structure Research Group of University of Auckland in New Zealand and multidisciplinary projects with the Physics Department of UTFSM and with Universidad de Antioquia de Colombia. Regarding results dissemination, during the last years he has presented on more than eight international conferences, standing out IFT, IUFoST, EFFoST and CIBIA XI. He has also participated as specialist consultant for the design and validation of thermal processes at industrial level, working with Nestle, Daff and Aramark among others.

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