TOWARDS MECHANISTIC UNDERSTANDING OF GASTRIC DIGESTION OF STRUCTURED PROTEINS

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Digestion of food is a complex process that is essential for our life. On its way in the digestive system the food is systematically broken down into smaller pieces and/or soluble components. The breakdown of food is done via a large number of complex mechanical, enzymatic and chemical processes. We are focussing on *in vitro* gastric digestion of proteins. Numerous *in vitro* studies on protein digestion are based on experiments with dissolved proteins. However, the majority of protein exists in solid food. Therefore, our research is aimed at understanding how the structure of food affects the digestion of protein. Protein gels are used as a model system for a solid food matrix.

We previously studied the *in vitro* digestion of protein and protein gels by analyzing the peptide distribution after hydrolysis[1], and found that the kinetics of protein hydrolysis in solution and in gels is different. We hypothesized that pepsin needs to penetrate the gel microstructure and hydrolyze proteins in gel matrices. Thus the digestion kinetics may be limited by diffusion of pepsin in gel matrices, which can explain the differences in hydrolysis kinetics. Also the pH in the stomach and the pH in the food matrix play a role in the actual activity of pepsin and therewith the degradation of the food matrix.

For a better understanding of the gastric digestion of a food matrix, it is essential to quantify diffusion of gastric juice, i.e. acid and enzyme into the matrix. Diffusion of pepsin in gel matrices was studied with Fluorescence Correlation Spectroscopy (FCS)[2]. Scanning Electron Microscopy (SEM) was used to study the surface of undigested and digested gel. Knowledge on the kinetics of the pepsin hydrolysis and modelling of the system, combined with techniques such as SEM and FCS should give us insight in the underlying mechanisms of structured protein digestion. By quantifying the diffusion of pepsin, we gained more insight on the action of pepsin and effect of gel structure in protein digestion. Moreover, this approach makes it possible to bridge the digestion process with established physical-chemistry theories and models, which may lead to better knowledge on the underlying mechanisms of gastric digestion.

[1]Luo, Q., Boom, R. M., & Janssen, A. E. M. (2015). Digestion of protein and protein gels in simulated gastric environment. *LWT - Food Science and Technology*, *63*(1), 161–168.

[2]Luo, Q., Borst, J.W., Westphal, A., Boom, R. M., & Janssen, A. E. M. (2016). Pepsin diffusivity in whey protein gels and its effect on gastric digestion. Submitted.