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Structuring food for improving amino acid bioavailability

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The food matrix structure is one of the key drivers to control the fate of food in the digestive tract and, consequently, the kinetics of nutrient release. Milk and egg are excellent raw material to build a wide variety of structures and can be really seen as a “Lego boxes” from which all the constituents can be separated (cracking) and re-assembled into different structures.

The behavior in the gastrointestinal tract of milk protein matrices of identical composition but different micro and macrostructures was investigated in the present study. Six multi-cannulated and catheterized mini-pigs were fed 6 different dairy matrices (raw and heat-treated milks, acid and rennet gels). Effluents from the duodenum and mid-jejunum as well as plasma from the abdominal aorta were collected over 7h. Structure was shown to drive the time of residence of food in the stomach. The liquid-gel transition led to a significant increase in the gastric emptying time. Liquid matrices generated a fast and intense peak of proteins in the intestine and amino acids in the bloodstream. Peptidomic analysis showed different patterns between intestinal samples. Finally, rennet gels had a different behavior than the acid ones forming a compact coagulum in the stomach that slowed down the gastric emptying and delayed the release of amino acids.

Therefore, controlling the time of residence of food in the stomach by playing on its structure should allow to design products with a fast release of nutrients particularly adapted for elderlies, athletes etc... whereas foods persisting in the stomach should induce satiety and be dedicated to overweight people. Ongoing experiments using biophysical methods will help us to understand the mechanisms of gel particle breakdown in the stomach in order to design dairy products of new generation perfectly adapted to the nutritional needs of specific populations.