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Title:

Links between static and dynamic in vitro digestion of solid protein-based foods

Authors & affiliations:

Alisha Kar, Gail Bornhorst *University of California-Davis, Department of Food Science and Technology, USA*

Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text into it.)

Preparation of Your Abstract

1. The title should be as brief as possible but long enough to indicate clearly the nature of the study. Capitalise the first letter of the first word ONLY (place names excluded). No full stop at the end.
2. Abstracts should state briefly and clearly the purpose, methods, results and conclusions of the work.

Introduction: Clearly state the purpose of the abstract
Methods: Describe your selection of observations or experimental subjects clearly
Results: Present your results in a logical sequence
Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them

Introduction: Increasing demand for high-protein diets has increased dietary protein availability from plant and animal sources. While protein digestibility varies, the influence of food structure on protein digestion kinetics in complex matrices remains unclear. Static in vitro digestion models elucidate drivers for breakdown via gastric fluid diffusion and softening kinetics, whereas dynamic models provide control of physiological factors to mimic in vivo conditions. This study aimed to compare static and dynamic in vitro gastric digestion models to determine the interplay between food structure and physiological conditions on digestion kinetics.

Methods: Ham, paneer, and mozzarella were cut into 10 mm cubes for static digestion or ground (3–4 mm) to mimic oral processing for dynamic digestion. For static digestion, 40 g sample was mixed with 240 mL gastric fluid (pH 1.8, 37 °C) for 30–180 min. Moisture and acid uptake, softening kinetics, and dry matter loss were measured. Dynamic digestion used a human gastric simulator (3 contractions/min, 4.86 mL/min secretion, 6.73 mL/min emptying) for 30–180 min followed by small intestinal digestion (30-180 min). Gastric emptying, pH, rheology, particle size, and protein hydrolysis were measured.

Results: Effective moisture diffusivity during static digestion was ham > paneer ~ mozzarella ($p<0.0001$), while the effective acid diffusivity was paneer > ham ~ mozzarella. For ham, paneer and mozzarella, the softening half-times (static digestion) were 9.6, 4.3, and 1.67 h, while the gastric emptying half-time (dynamic digestion) were 56, 68, and 88 min, respectively. Free amino group release differed significantly ($p<0.0001$) between foods, with mozzarella having a significantly ($p = 0.0164$) higher release after 180 min dynamic gastric digestion compared to ham.

Conclusion: Differences in softening and gastric emptying kinetics and protein hydrolysis suggest that food structure influences gastric breakdown. Using a combination of static and dynamic digestion models provides complementary information to understand protein digestion kinetics in solid foods of varying structures.