Imaging gastric structuring of lipid emulsions and its effect on gastrointestinal function: a randomized trial in healthy subjects.

Summary / Zusammenfassung
Background: Efficient fat digestion requires fat processing within the stomach and fat sensing in the intestine. Both are processes that also control gastric emptying and gastrointestinal (GI) secretions.

Objective: This work aimed to visualize the influence of intragastric stability of fat emulsions on their dynamics of gastric processing and structuring and to assess the effect this has on GI motor and secretory function.

Design: 18 healthy subjects of normal BMI were studied on four separate occasions in a double-blind randomized cross-over design. Magnetic Resonance Imaging (MRI) data of the GI tract and blood triglycerides were recorded before and for 240min after consumption of four different fat emulsions; LE1 (acid stable, 0.33µm), LE2 (acid stable, 52µm), LE3 (acid unstable, solid fat, 0.32µm) and LE4 (acid unstable, liquid fat, 0.38µm).

Results: Intragastric emulsion instability was associated with a change in gastric emptying. The acid unstable emulsions exhibited bi-phasic and faster emptying profiles compared to the two acid stable emulsions (p < 0.0001). When combined with solid fat (LE3) different dynamics of postprandial gallbladder volume were induced (p < 0.001). For the acid stable emulsions, a reduction of droplet size by two orders of magnitude (LE1, 0.33µm vs. LE2, 52µm) delayed gastric emptying by 38min. While acid stable (LE1, LE2) and re-dispersible (LE4) emulsions caused a constant increase in blood triglyceride, no increase was detectable for LE3 (p <0.0001). For LE3, MRI confirmed the generation of large fat particles during gastric processing, which emptied into, and progressed through, the small intestine.

Conclusions: MRI allows the detailed characterization of the in vivo fate of lipid emulsions. The acute effects of lipid emulsions on gastric emptying, gallbladder volume and triglyceride absorption are dependent on the microstructural changes they undergo during consumption.

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