

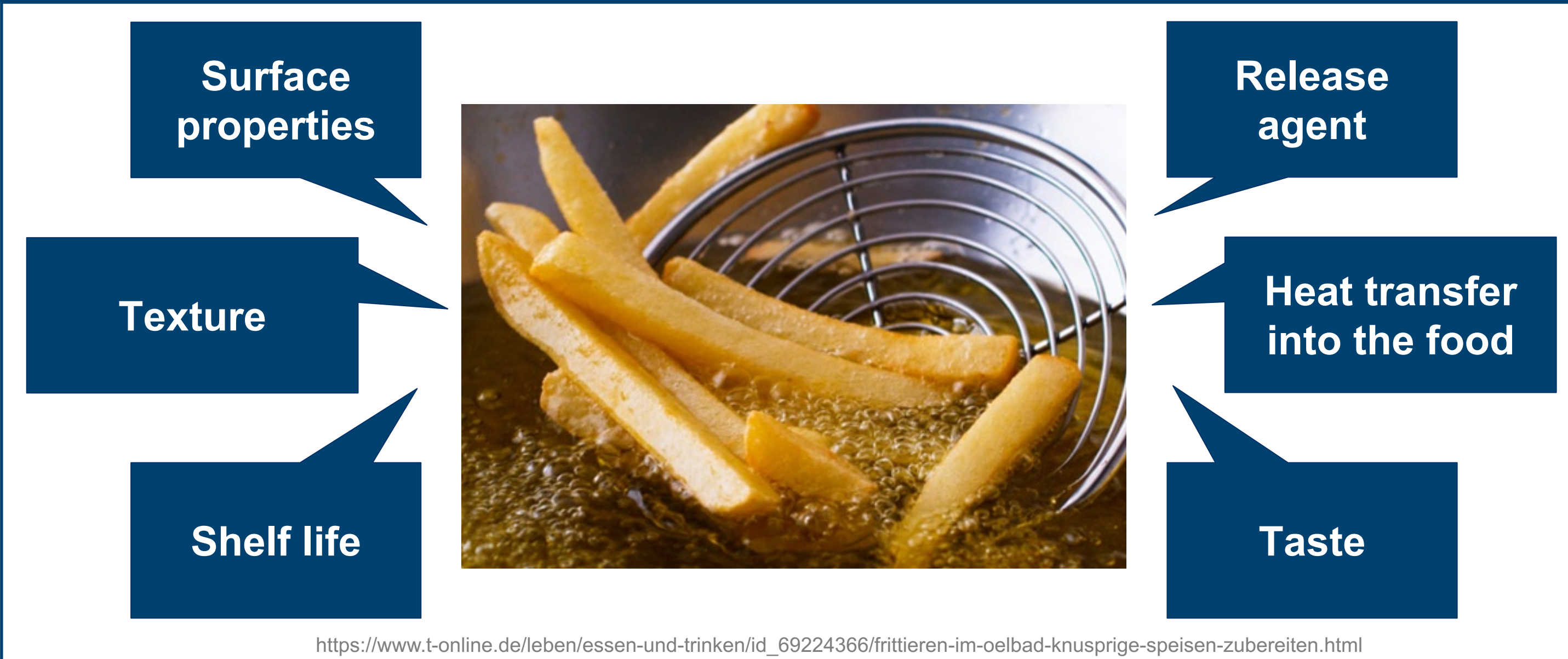
Oleogels as alternative deep-frying media to optimize the surface properties of fried products

Madline Schubert¹, Sharline Nikolay², Lydia Weber¹, Nelli Erlenbusch¹, Inga Smit¹, Bertrand Matthäus¹

¹ Max Rubner-Institut, Federal Research Institute of Nutrition and Food, Department of Safety and Quality of Cereals, Germany

² OWL University of Applied Sciences and Arts, Department of Life Science Technologies, Germany

Influence of deep-frying media on deep-fried food



https://www.t-online.de/leben/essen-und-trinken/id_69224366/frittieren-im-oelbad-knusprige-speisen-zubereiten.html

During deep-frying water present in the food is replaced by the frying medium. Therefore, the texture and rheology of the frying medium correlate with the surface properties of the fried goods and can be modified via variation of the frying medium.

Characteristics of classic deep-frying media

Rapeseed oil	Palm oil	Hydrogenated oil
<ul style="list-style-type: none"> + Low amount of saturated fatty acids + High amount of unsaturated fatty acids - Oil leakage of the deep-fried product - Greasy surface 	<ul style="list-style-type: none"> + No oil leakage of the deep-fried product + Less greasy surface - High amount of saturated fatty acids - Environmental and ethical concerns 	<ul style="list-style-type: none"> + No oil leakage of the deep-fried product + Less greasy surface - High amount of saturated fatty acids - High amount of <i>trans</i>-fatty acids

<https://eatsmarter.de/ernaehrung/ernaehrungsmitteln/rapeseel-gut-fuer-kinder>; <https://alpe-cos.com/alpe-cos/sunflower-oil-high-oleic-helianthus-annuus-hybrid-oil-refined-500ml>; <https://www.gesundheit.de/ernaehrung/lebensmittel/saucen-und-oele/palmoel>; <https://www.euroimmunblog.de/neuer-test-zur-unterscheidung-echter-erdnuss-allergien-und-unbedenklicher-kreuzreaktionen/>

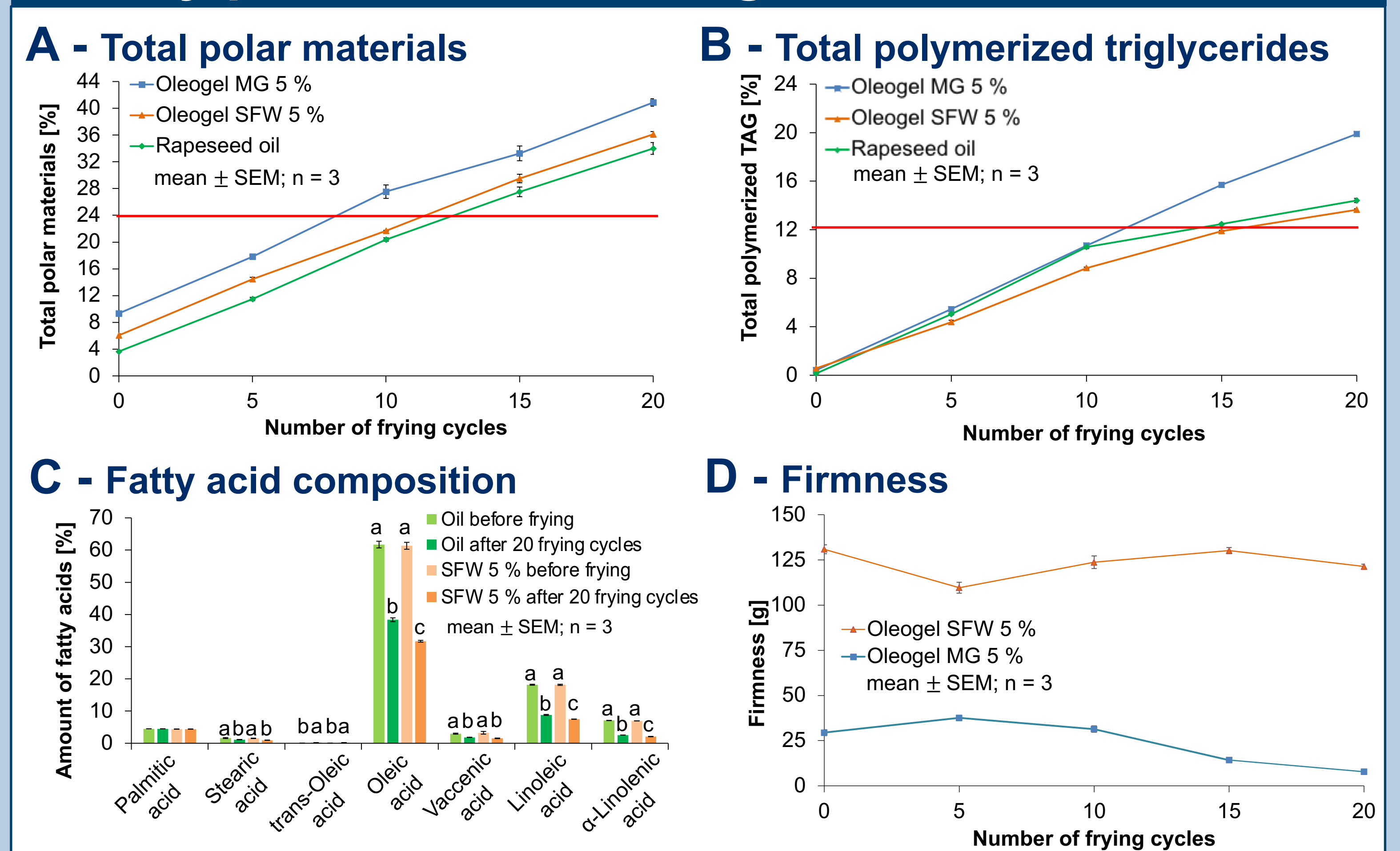
Conventional deep-frying media display a lot of nutritional, environmental and technological disadvantages, resulting in a high demand for solid fats without hydrogenated fats, low amount of saturated fatty acids and palm oil free.

Replacement of solid fats via oleogels

	Structure of triglycerides (TAG)	Schematic structure	Product
Conventional solid fats	Glycerol with saturated fatty acids (SFA)	Compact structure of SFA	
Structured oils - oleogels	Glycerol with mono-/poly unsaturated fatty acids (UFA)	Lipidic continuous phase and 3D-network of building blocks	

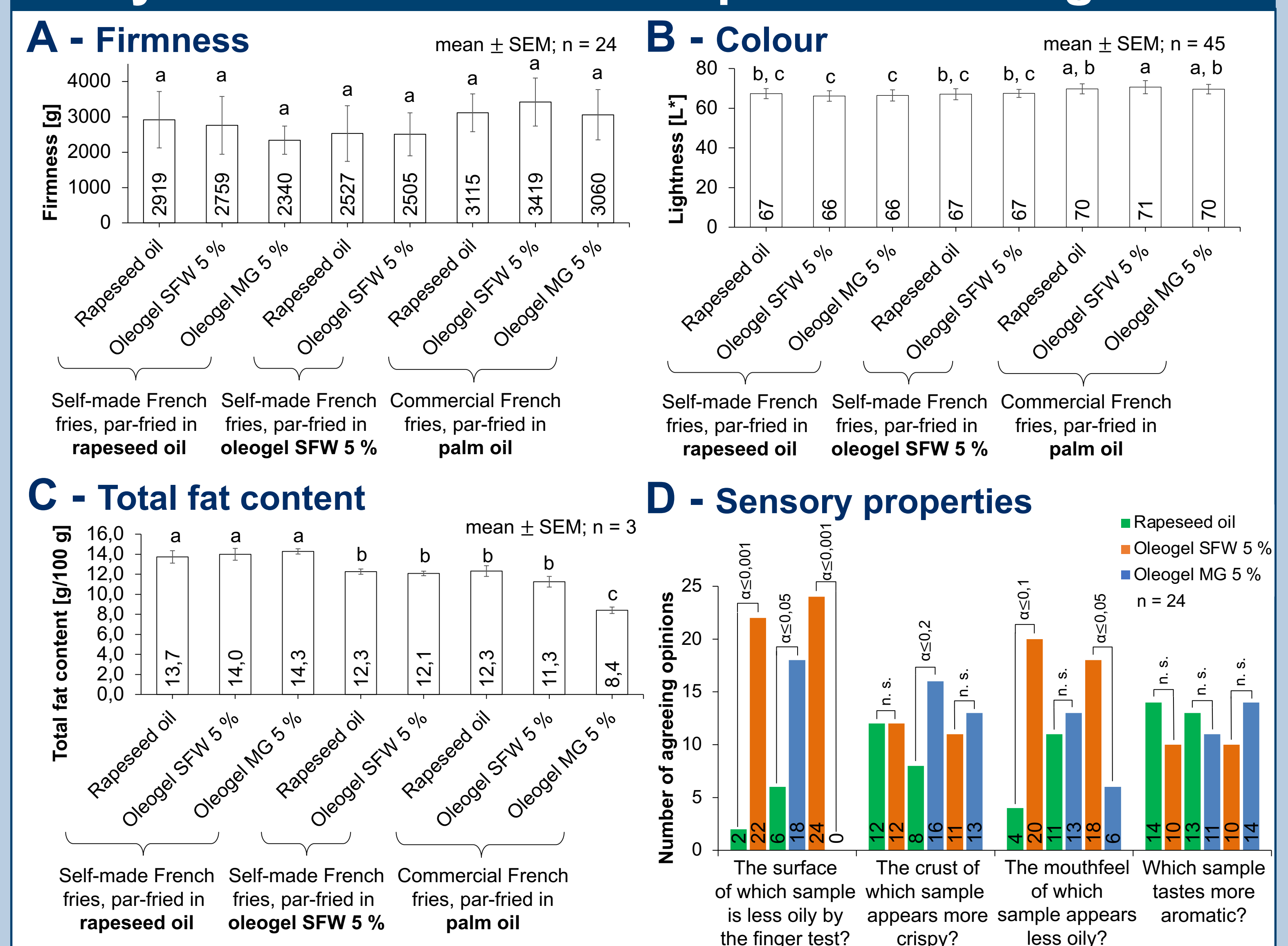
Instead of conventional TAG oil structuring, rapeseed oil is used as lipidic continuous phase because of its nutritionally favourable fatty acid composition. To stabilize the rapeseed oil in a gel-like structure, sunflower wax (SFW) or monoglycerides (MG) can be used as structurants, which form a 3D-network of building blocks.

Quality parameters of oleogels after stress test



Within a stress test performed at 175°C several quality parameters, like total polar materials (A), total polymerized triacylglycerides (B), fatty acid composition (C) and the firmness (D) of oleogels were analyzed. Whereas the quality parameters of oleogels with 5 % SFW were comparable with rapeseed oil, oleogels with 5 % MG reached the limit values of polar compounds and polymerized triglycerides more quickly and were less firm.

Analysis of French fries deep-fried in oleogels



Self-made and commercial par-fried French fries were deep-fried in rapeseed oil, which was set as standard frying medium, and in oleogels based on rapeseed oil with 5 % SFW or 5 % MG. French fries produced in oleogels displayed a similar colour (A) and texture (B) compared to the standard product. In contrast, par-frying in oleogels seems to reduce the total fat uptake (C). Moreover, a two-sided pairwise comparison (D) confirmed, that oleogel based French fries displayed optimized organoleptic properties, since the surface of the fries was less greasy and almost no oil leakage was observed.

Summary

French fries deep-fried in oleogels based on rapeseed oil and 5 % sunflower wax or 5 % monoglycerides displayed the same colour and texture compared to the standard, while the organoleptic properties were significantly improved by the application of oleogels. Moreover, par-frying in oleogels seems to reduce the total fat uptake. Since the amount of polar compounds in monoglyceride based oleogels was very high even before frying, especially the application of 5 % SFW based oleogels represents a promising new alternative for deep-frying.