Small milk fat globules promote growth of good bacteria, study reveals

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A new study has unveiled fascinating insights into the complex relationship between milk fat globules and bacteria. The research, published in *Food Chemistry*, explores how the structural properties of

these microscopic fat droplets influence their interactions with both beneficial and harmful bacteria, shedding light on milk's natural mechanisms for promoting health and protecting against pathogens.

The study was led by Professor Nurit Argov-Argaman from the Robert H. Smith Faculty of Agriculture, Food and Environment at the Hebrew University of Jerusalem, in collaboration with researchers from the Agriculture Research Organization.

Milk fat globules, secreted by mammary gland epithelial cells, have long been recognized for their role in delivering essential nutrients. This new study takes a closer look at how their structure, rather than just their chemical composition, shapes interactions with bacteria.

The research tested milk fat globules obtained from mammary gland epithelial cells and raw milk, examining their impact on bacterial growth and biofilm formation. Remarkably, the size of the globules emerged as a decisive factor. Small milk fat globules promoted the growth of Bacillus subtilis, a commensal bacterium, while large milk fat globules triggered biofilm formation, a behavior often linked to bacterial resilience and adaptation.

These findings were supported by metabolomic profiling of the bacteria secretions, supporting the different metabolic response of the bacteria to the various sizes of the milk fat globules from both sources (raw milk and secretions of mammary gland cells).

Interestingly, the size variations of milk fat globules did not influence the behavior of Escherichia coli, a common pathogenic bacterium, highlighting the specificity of the interactions. Furthermore, a synthetic lipid mixture mimicking the chemical composition of small milk fat globules failed to stimulate bacterial growth, underscoring the critical role of structural properties over mere chemical makeup.

The study concluded that the unique structure of milk fat globules plays a central role in regulating the interaction with bacteria. The results will be used to further explore if the structure can be utilized to provide a competitive advantage to beneficial bacteria, potentially enhancing the safety and health properties of dairy and other food products.

Moreover, the findings also confirmed that milk components secreted by mammary gland epithelial cells share functional similarities with raw milk fat globules, reinforcing the idea that nature's design plays a pivotal role in shaping the microbial ecosystem.

Professor Argov-Argaman stated, "Our research highlights the intricate ways in which the physical characteristics of milk fat globules can influence microbial dynamics, offering potential pathways to enhance health through natural dietary components."

This research opens the door to a deeper understanding of how milk's natural properties influence microbial communities, with implications for dairy science, infant nutrition, and food safety. Professor Argov-Argaman's work exemplifies how delving into the microscopic details of nature can reveal profound insights into the mechanisms that sustain health.

More information: C. Raz et al, The role of structure in the interaction between bacteria, mammary epithelial cells and milk fat globules from raw or "cultured" milk, *Food Chemistry* (2024). DOI: 10.1016/j.foodchem.2024.142244

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