How milk proteins interact with caffeine in espresso

June 6 2024

Credit: Pixabay/CC0 Public Domain

The swirl of milk and espresso—a small storm in your mug—doesn't impact the dynamics of the milk proteins, according to research published in *ACS Food Science & Technology*.

Researchers took a molecular view of how milk proteins and caffeine molecules interact in water and in a coffee drink. The results suggest that the structures of milk proteins remain intact, meaning they retain their original mouthfeel and taste in your morning brew.

Pouring milk into coffee causes the proteins to interact (e.g., combine or repel) with compounds extracted from the roasted, ground coffee beans, and that could change the proteins' mouthfeel and the way they are digested. Milk proteins could also potentially affect the absorption, or bioavailability, of caffeine by the human body.

To shed light on these mysteries, Tobias Weidner and Fani Madzharova used 2D infrared spectroscopy to investigate milk proteins' molecular structures and dynamics when in a coffee beverage. They assessed increasingly complex mixtures of a store-bought whole fat (3.5%) milk, water solutions with milk and caffeine, and then a handmade cappuccino.

They found that the folding of milk proteins was unaltered by the presence of caffeine in these beverages, even in the cappuccino, which contained components extracted from the coffee grounds, such as chlorogenic acid. Additionally, while previous studies have reported that caffeine slows the molecular movement of water, this study didn't show substantial effects from caffeine on the mobility or dynamics of milk proteins.

These experimental results provide a useful molecular picture about

some components that affect the texture, flavor and nutritional properties of coffee beverages with milk ingredients, which the researchers say could be applied toward engineering future drinks.

More information: Fani Madzharova et al, Structure and Dynamics of Milk Proteins Interacting with Caffeine and Espresso Determined by Two-Dimensional Infrared Spectroscopy, *ACS Food Science & Technology* (2024). DOI: 10.1021/acsfoodscitech.4c00070