Compounds that give coffee its distinctive 'mouthfeel'

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Coffee drinkers intuitively recognize the pleasure of swallowing a smooth, rich brew versus a watery one. Aside from added cream or sugar, the coffee itself contributes to this sensation—referred to as body

or mouthfeel—but the specific compounds are not well defined. Now, researchers report several coffee compounds that contribute to the feeling of the beverage coating the inside of the mouth, as well as astringency and chalkiness sensations. The results could be used to tune processing and roasting conditions for specialty coffees.

The researchers will present their results today at the fall meeting of the American Chemical Society (ACS).

"We've known that coffee itself can impact textural sensations, and it was traditionally thought to be because of sugars and lipids," says Christopher Simons, Ph.D., one of the project's co-principal investigators. "But our team finds that this feeling may actually be driven by small molecules, which is kind of unique." He says that this knowledge could help producers and growers make the best coffee. It also could help aficionados attribute certain features of a cup of java to specific compounds, just as wine enthusiasts do.

Brianne Linne, a graduate student who is presenting the work at the meeting, had previously studied tactile perception on the tongue when the opportunity to study coffee body arose. "From our background reading, we found definitions of coffee body to be very vague, and at times, contradictory, so we thought that this would be an intriguing topic for us to study," she says. Linne is working with Simons and co-principal investigator Devin Peterson, Ph.D., on the project at The Ohio State University (OSU).

The team set out to isolate the compounds responsible for coffee's mouthfeel by first establishing a descriptive analysis panel. They started with four different coffees that evaluators licensed by the Specialty Coffee Association had given varying ratings in terms of body. A separate panel of eight experienced tasters, skilled in tactile awareness, then agreed on a set of references that illustrated the sensations

differentiating each cup.

"To better define the term 'body,' we broke it down into components that would allow us to look for the compounds driving those particular sensations," says Simons. Four tactile sub-attributes, namely chalkiness, mouthcoating, astringency and thickness were used to differentiate the coffees. They separated the fullest-body coffee into 12 fractions using liquid chromatography and a panel of five tasters screened each fraction. If a majority ranked a sub-attribute strongly in a fraction, it was further purified to pinpoint the exact compound responsible.

The researchers found that a cluster of small molecules contribute to coffee's mouthfeel. Peterson says they isolated melanoidin compounds, formed by the Maillard reaction during roasting, and for the first time associated them with astringency. Two compounds, 3- and 4-caffeoylquinic acid, correspond with mouthcoating. Unexpectedly, the sensation subsided with increased concentrations. Peterson says that although biological responses are multifaceted, it is uncommon for an attribute to be perceived at low levels, but not at high levels. Finally, they isolated a novel compound related to chalkiness that contains an amino acid.

The team is now interested in whether there are mechanoreceptors in the mouth that detect these small molecules. According to Peterson, such receptors could be responsible for the decreased mouthcoating sensation that occurs with increasing caffeoylquinic acid. They also want to know more about how coffee bean growing conditions and roasting temperatures affect the compounds. With this knowledge, growers and producers could manipulate their processes to downplay or highlight the small molecules in a cup of coffee according to consumers' preferences.

More information: Identification and characterization of chemical compounds contributing to coffee body, ACS Fall 2021.

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