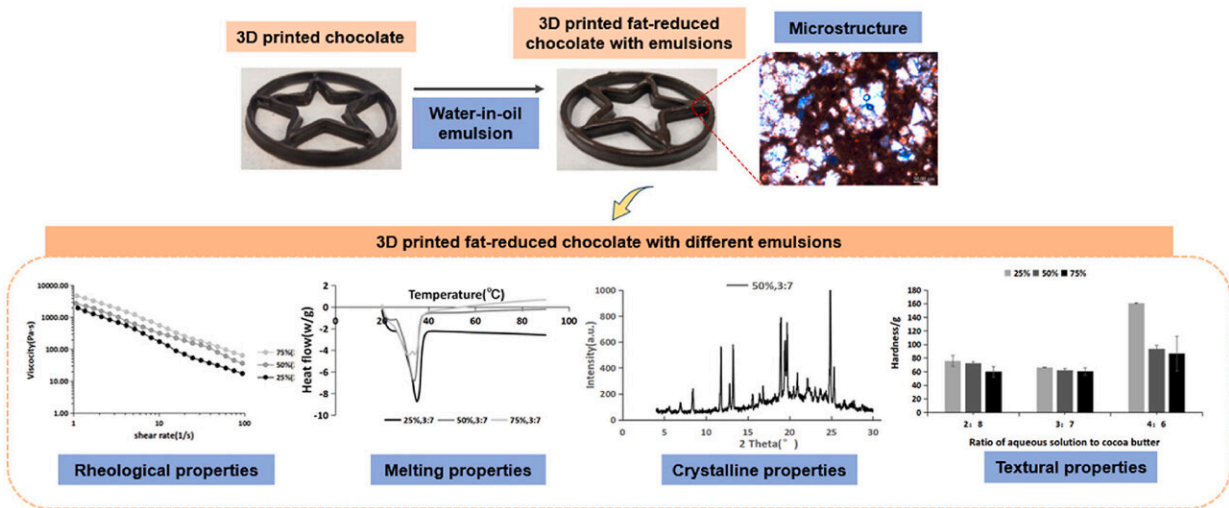


# Want healthy Valentine's day chocolates? We can print them

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Graphical abstract. Credit: *Food Hydrocolloids* (2022). DOI: 10.1016/j.foodhyd.2022.108114

A Rutgers scientist has developed a formulation of low-fat chocolate that can be printed on a 3D printer in pretty much any shape a person can conceive, including a heart.

The work heralds what the researcher hopes will be a new line of "functional foods"—edibles specially designed with [health benefits](#). The aim is to develop healthier kinds of [chocolate](#) easily accessible to consumers.

Reporting in the journal, *Food Hydrocolloids*, a Rutgers-led team of scientists described the successful creation and printing of a mixture producing low-fat chocolate—substituting fatty [cocoa butter](#) with a lower-fat, water-in-oil emulsion.

"Everybody likes to eat chocolate, but we are also concerned with our health," said Qingrong Huang, a professor in the Department of Food Science at the Rutgers School of Environmental and Biological Sciences. "To address this, we have created a chocolate that is not only low-fat, but that can also be printed with a 3D printer. It's our first 'functional' chocolate."

Huang, an author of the study, said he already is working on manipulating [sugar content](#) in the new chocolate formulation for low-sugar and sugar-free varieties.

Researchers create emulsions by breaking down two immiscible liquids into minute droplets. In emulsions, the two liquids will usually quickly separate—as is the case with oil and vinegar—unless they are held together by a third, stabilizing ingredient known as an emulsifier. (An egg is the emulsifier in a vinaigrette.)

Chocolate candy is generally made with cocoa butter, cocoa powder and powdered sugar and combined with any one of a variety of different emulsifiers.

For the study, the scientific team experimented with different ratios of the ingredients for a standard chocolate recipe to find the best balance between liquid and solid for 3D printing. Seeking to lower the level of fat in the mixture, researchers created a water-in-cocoa butter emulsion held together by gum arabic, an extract from the acacia tree that is commonly used in the [food industry](#), to replace the cocoa butter. The researchers mixed the emulsion with golden syrup to enhance the flavor

and added that combination to the other ingredients.

As delightful as it is to eat, Huang said, chocolate is a material rich with aspects for food scientists to explore.

Employing advanced techniques examining the [molecular structure](#) and physical properties of chocolate, researchers investigated the printed chocolate's physical characteristics. They were seeking the proper level of viscosity for printing and looking for the optimal texture and smoothness "for a good mouthfeel," Huang said. Experimenting with many different water-oil ratios, they varied the percentages of all the main ingredients before settling on one mixture.

In 3D printing, a printer is used to create a physical object from a digital model by laying down layers of material in quick succession. The 3D printer, and the shapes it produces, can be programmed by an app on a cellphone, Huang said.

Ultimately, Huang said he plans to design functional foods containing healthy added ingredients—substances he has spent more than two decades studying, such as extracts from orange peel, tea, red pepper, onion, Rosemary, turmeric, blueberry and ginger—that consumers can print and eat.

"3D [food](#) printing technology enables the development of customized edible products with tailored taste, shape and texture as well as optimal nutrition based on consumer needs," Huang said.

**More information:** Siqi You et al, Development of fat-reduced 3D printed chocolate by substituting cocoa butter with water-in-oil emulsions, *Food Hydrocolloids* (2022). [DOI: 10.1016/j.foodhyd.2022.108114](#)

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