

Sugar-reduced chocolate with oat flour just as tasty as original, study finds

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In a blind taste test recently published in the *Journal of Food Science*, 25% reduced-sugar chocolates made with oat flour were rated equally, and in some cases preferred, to regular chocolate. Credit: Kai Kai Ma/Penn State

The secret to making delicious chocolate with less added sugar is oat flour, according to a new study by Penn State researchers. In a blind taste test recently published in the [Journal of Food Science](#), 25% reduced-sugar chocolates made with oat flour were rated equally, and in some cases preferred, to regular chocolate. The findings provide a new option for decreasing chocolate's sugar content while maintaining its texture and flavor.

"We were able to show that there is a range in which you can manage a sizable reduction in added sugar, and people won't notice and don't care, in terms of liking," said John Hayes, professor of food science at Penn State and corresponding author on the study. "We're never going to make [chocolate](#) healthy because it's an indulgence, but we can successfully take out some of the sugar for [consumers](#) who are trying to reduce their intake of added sugars."

Hayes explained that chocolate is about half sugar by weight, with the rest being fat and cocoa solids, so reducing the amount of sugar by any amount can drastically alter the texture and flavor profile of the chocolate.

"The function of sugar in chocolate is both sweetness and bulking, so if we take that sugar out, we have to put something else in that will do the job just as well, or consumers will notice," said Gregory Ziegler, distinguished professor of food science at Penn State and co-author on the study.

Ziegler had the idea of testing two different grains, rice and oats, which contain fine granular starches as replacements for sugar in chocolate. The end result would still contain carbs, which eventually break down into sugar, but the speed of absorption may be slower.

"Starch is still a carbohydrate, so it's not lower calories, but there is an

overall reduction in the added sugar content, which has potential health benefits," Ziegler said.

The team conducted two different blind taste tests using dark chocolate made with varying levels of sugars and grain flour.

The first test, conducted with 66 participants, was designed to evaluate whether consumers would notice a difference between six varieties of chocolates: a control with a normal 54% level of sugar, four sugar-reduced versions with reductions of 25% or 50% sugar and additions of oat or rice flour, and one 54% sugar chocolate with reduced refining time to test if the grinding time would affect the texture.

Consumers rated the 25% sugar-reduced chocolates and the reduced refining time chocolate similar to the blind control, but the 50% sugar reduction was rated significantly different in both texture and flavor. The team concluded this was mainly due to texture, as participants reported the rice flour chocolate contained "a chalkier texture," while oat-flour-containing chocolates were described as "smoother, softer and creamier."

The second blind taste test involved 90 participants and gauged consumer acceptability for 25% reduced sugar chocolates made with oat and rice flour compared to regular chocolate, the control, made with 54% sugar.

Each participant was served one square of each chocolate for a total of three samples and was asked to rate overall liking, flavor liking, texture liking and sweetness liking. The rice flour chocolates were liked significantly less than the normal chocolate control, but the oat flour sample did not differ from the control—and, in some cases, was rated slightly better.

"Our results suggest we can cut back 25% of added sugar to chocolate, effectively reducing the total sugar by 13.5%, if we substitute oat flour," said Kai Kai Ma, a doctoral candidate in food science at Penn State and co-author on the paper. "That addition of oat flour is unlikely to meaningfully impact consumer acceptability, which is great news."

Hayes, who also directs Penn State's Sensory Evaluation Center, said he plans to reach out to some of his former students who are now working in the chocolate industry to share the findings and hopefully spur new varieties of sugar-reduced chocolates by providing a proof-of-concept that oat flour can effectively do the job of added sugars.

"I'm a big believer in meeting consumers where they are," Hayes said. "We've tried for 40 years to tell people to eat less sugar, and it doesn't work because people want to eat what they want to eat. So instead of making people feel guilty, we need to meet people where they are and figure out how to make food better while still preserving the pleasure from food."

More information: Kai Kai Ma et al, Sugar reduction in chocolate compound by replacement with flours containing small insoluble starch granules, *Journal of Food Science* (2024). [DOI: 10.1111/1750-3841.16923](https://doi.org/10.1111/1750-3841.16923)

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