Chocolate Constituent Bests Fluoride

"Chocolate Toothpaste? Extract of Tasty Treat Could Fight Tooth Decay."

By Janet Raloff

That's how Tulane University's news office provocatively titled a press release it issued last week. Sound sweet? Unfortunately, it's anything but.

The extract, theobromine, is a bitter constituent of a number of plants, including the beans used to make chocolate. A chemical cousin to caffeine, this compound is also a stimulant—and doesn't taste the least bit chocolate.

That said, theobromine does show promise in fighting cavities. In preliminary tests, Tulane scientists have shown that this chemical—which chocolate-lovers regularly consume—strengthens teeth better than fluoride.

Theobromine's affect on the crystalline structure of teeth offers an additional benefit. For protecting our choppers from erosion by acids, it outperforms an equal concentration of the sodium fluoride found in most toothpastes. That suggests the new extract could limit the ravages of the acid-producing bacteria responsible for most tooth decay.

Since tooth decay is "the most preventable disease still plaguing humankind," the findings are potentially quite important, maintains engineer Arman Sadeghpour, who led the research. Moreover, he notes, the last half-century has witnessed "little to no innovation" in cavity-fighting additives for toothpastes.

So why not just eat chocolate? Because its sugars feed the bacteria that foster tooth decay. The fats in chocolate, which impart the food's delicious creaminess, also risk swelling the waistlines of a population that already collectively weighs far more than is healthy.

Caffeine's kin

For his doctoral research, Sadeghpour evaluated the tooth-protecting prowess of theobromine, also known as 3,7-dimethylinthine. Caffeine is 1,3,7-trimethylinthine; that means it's basically the same compound, except that it has one additional methyl group—a carbon atom bound to three hydrogens—dangling from its double-ring-shaped structure.

But the subtle structural distinctions between these two xanthines account for their profound physiological differences, Sadeghpour notes. Whereas caffeine may harm bones and teeth, theobromine appears to bolster both structural materials.

Teeth and bones are continually dissolving, on a microscopic scale, and then reforming, or remineralizing. Six years ago, researchers in the lab where Sadeghpour works obtained a patent to use theobromine to foster the remineralization of our pearly whites.

In his new work, Sadeghpour evaluated how theobromine treatment affects the integrity of teeth. In one set of experiments, he took leftover human molars from 13 individuals and cut each into pieces. Then he treated some pieces with fluoride at varying doses and exposed other pieces to varying doses of theobromine.

He then put all molar slices into a machine fitted with a diamond bit. For 5 seconds, the bit pressed into each piece of tooth, creating an indentation. The depth of that depression offers a gauge of the tooth enamel's hardness. In these tests, theobromine outperformed fluoride.

In another set of tests, Sadeghpour covered all but a tiny portion of each piece of tooth and subjected the exposed area overnight to solutions containing either fluoride or theobromine. The next day, he exposed the treated tooth surface for 10 minutes to strong acid. When he later analyzed the acid to measure how much calcium had leached into it, he found that theobromine-treated teeth had lost 8 percent less calcium than fluoride-treated teeth.

• PHOTO: These microscopic close-ups show tooth enamel that has been exposed to acid after no pre-treatment (left), after pre-treatment with fluoride (center), and with theobromine (right). A new sheet of tooth enamel has already started to cover the relatively mild pitting on the theobromine-treated tooth.

Of course, these are fairly unnatural tests. Sadeghpour's group now wants to evaluate whether theobromine treatment helps teeth survive a real-world acid test—exposure to the cavity-producing bacteria found in our mouths. His group is also looking to team up with a manufacturer to evaluate whether a toothpaste fortified with theobromine can yield cavity-fighting benefits.

In the mean time, Sadeghpour has whipped up a prototype toothpaste in the lab. He stores it in bottles, not squeezable tubes. And to mask theobromine's bitterness, he's flavored the concoction with—you guessed it—mint.