Changes in brain's blood flow could cause 'brain freeze'

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'Brain freeze' is a nearly universal experience—almost everyone has felt the near-instantaneous headache brought on by a bite of ice cream or slurp of ice-cold soda on the upper palate. However, scientists are still at a loss to explain this phenomenon. Since migraine sufferers are more likely to experience brain freeze than people who don't have this often-debilitating condition, brain freeze may share a common mechanism with other types of headaches, including those brought on by the trauma of blast-related combat injuries in soldiers. One possible link between brain freeze and other headache types is local changes in brain blood flow.

In a new study, Melissa Mary Blatt, Michael Falvo, and Jessica Jasien of the Department of Veterans Affairs New Jersey Health Care System, Brian Deegan and Gearold O Laighin of the National University of Ireland Galway, and Jorge Serrador of Harvard Medical School and the War Related Illness and Injury Study Center of the Veterans Affairs New Jersey Health Care System use brain freeze as a proxy for other types of headaches. By bringing on brain freeze in the lab in volunteers and studying blood flow in their brains, the researchers show that the sudden headache seems to be triggered by an abrupt increase in blood flow in the anterior cerebral artery and disappears when this artery constricts. The findings could eventually lead to new treatments for a variety of different headache types.

An abstract of their study entitled, "Cerebral Vascular Blood Flow Changes During 'Brain Freeze,'" will be discussed at the meeting

Experimental Biology 2012 being held April 21-25 at the San Diego Convention Center. The abstract is sponsored by the American Physiological Society (APS), one of six scientific societies sponsoring the conference, which last year attracted some 14,000 attendees.

Bringing on Brain Freeze

According to study leader Serrador, previous studies meant to assess what physiological changes might prompt headaches have mainly relied on various drugs, or brought in patients already in the throes of a migraine to the lab. However, both methods have their limitations. Pharmacological agents can induce other effects that can make research results misleading, he says, and since researchers can't wait for migraine sufferers to experience a migraine in the lab, those studies miss the crucial period of headache formation that occurs sometimes hours before scientists were able to study these patients.

To induce headache inside the lab and study it from start to finish, Serrador explains, brain freeze is a perfect fit. It's easy to bring on and resolves quickly without expensive or complicated equipment or drugs.

In this study, Serrador and his colleague recruited 13 healthy adults. The researchers monitored the volunteers' blood flow in several brain arteries using transcranial Doppler while they first sipped ice water with the straw pressed against their upper palate—ideal conditions for bringing on brain freeze—and then while sipping the same amount of water at room temperature. The volunteers raised their hand once they felt the pain of a brain freeze, then raised it again once the pain dissipated. Findings showed that one particular artery, called the anterior cerebral artery, dilated rapidly and flooded the brain with blood in conjunction to when the volunteers felt pain. Soon after this dilation occurred, the same vessel constricted as the volunteers' pain receded.

Changing the Course of Headaches

Serrador and his colleagues speculate that the dilation, then quick constriction, may be a type of self-defense for the brain. "The brain is one of the relatively important organs in the body, and it needs to be working all the time," he explains. "It's fairly sensitive to temperature, so vasodilation might be moving warm blood inside tissue to make sure the brain stays warm." But because the skull is a closed structure, Serrador adds, the sudden influx of blood could raise pressure and induce pain. The following vasoconstriction may be a way to bring pressure down in the brain before it reaches dangerous levels.

He notes that similar alterations in blood flow could be at work in migraines, posttraumatic headaches, and other headache types. If further research confirms these suspicions, then finding ways to control blood flow could offer new treatments for these conditions. Drugs that block sudden vasodilation or target channels involved specifically in the vasodilation of headaches could be one way of changing headaches' course.

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