Chocolate, water reduce pain response to heat

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People often eat food to feel better, but researchers have found that eating chocolate or drinking water can blunt pain, reducing a rat's response to a hot stimulus. This natural form of pain relief may help animals in the wild avoid distraction while eating scarce food, but in modern humans with readily available food, the effect may contribute to overeating and obesity.

The study, published Wednesday in the Journal of Neuroscience by authors Peggy Mason, PhD, professor of neurobiology, and Hayley Foo, PhD, research associate professor of neurobiology at the University of Chicago, is the first to demonstrate that this powerful painkilling effect

occurs while the animals are ingesting food or liquid even in the absence of appetite.

"It's a strong, strong effect, but it's not about hunger or appetite," Mason said. "If you have all this food in front of you that's easily available to reach out and get, you're not going to stop eating, for basically almost any reason."

In the experiments, rats were given either a chocolate chip to eat or had sugar water or regular water infused directly into their mouth. As the rat swallowed the chocolate or fluid, a light-bulb beneath the cage was switched on, providing a heat stimulus that normally caused the animal to lift its paw off the floor. Mason and Foo found that rats were much slower to raise their paw while eating or drinking, compared to tests conducted while they were awake, but not eating.

Surprisingly, the researchers found no difference in the delayed paw-lift response between when the rat was eating chocolate and when it was drinking water, despite previous research indicating that only sugary substances were protective against pain.

"This really shows it has nothing to do with calories," Mason said. "Water has no calories, saccharine has no sugar, but both have the same effect as a chocolate chip. It's really shocking."

Mason and Foo then repeated the heat test as the rats were given quinine, a bitter drink that causes rats to make an expression called a gape that's akin to a child's expression of "yuck." During quinine administration, the rats reacted to heat as quickly as when not eating, suggesting that a non-pleasurable food or drink fails to trigger pain relief.

The context of ingesting was also important to whether eating or drinking blunted pain, the researchers found. When rats were made ill by

a drug treatment, eating chocolate no longer delayed their response. However, drinking water still caused a reduced pain response, indicating that drinking water was considered a positive experience while ill.

By selectively inactivating a region in the brainstem called the raphe mangus - an area previously shown to blunt pain during sleep and urination - Mason and Foo were able to remove the effect of drinking water on the rat's pain response. The brainstem controls subconscious responses such as breathing and perspiration during exercise.

"You're essentially at the mercy of your brainstem, and the raphe magnus is part of that," Mason said. "It tells you, 'you're going to finish eating this, whether you like it or not,' just like you sweat while running whether you like it or not."

In the wild, Mason said, rats and other animals would not want to be distracted during the rare but important times that they were able to eat or drink. Therefore, the activation of the raphe magnus during eating or drinking would allow the rat to filter out distractions until their meal was completed. For obvious reasons, this natural pain relief would be activated when an animal is eating or drinking something pleasurable, but not when it tastes something that could be toxic or harmful.

Don Katz, an associate professor of psychology and neuroscience at Brandeis University who studies taste, said that Mason and Foo's paper brings together two systems - taste and pain - that are usually studied separately.

"They're saying the purpose of the taste system is to give the animal a cue that helps it decide what stimulus they should or shouldn't pay attention to," Katz said. "This shows there is a whole region there to enable the animal to keep eating."

Mason believes that this effect is also present in humans (studies by other labs have observed similar pain reduction in infants receiving sugar water during a booster shot), but that it has detrimental effects in modern society given our ready access to large quantities of pleasurable and fattening foods. Opening up a bag of chips could activate the brainstem such that you don't stop eating until the bag is empty, even while realizing that such behavior is bad for you.

"We've gotten a lot more overweight in last 100 to 150 years," Mason said. "We're not more hungry; the fact of the matter is that we eat more because food is readily available and we are biologically destined to eat what's readily available."

But the painkilling effect can be turned to our advantage, Mason said, perhaps as a replacement for the practice of using candy to calm children - or even adults - in the doctor's office.

"Ingestion is a painkiller but we don't need the sugar," Mason said. "So replace the doctor's lollipop with a drink of water."

Source: University of Chicago (news : web)