

Is a popular painkiller hampering our ability to notice errors?

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New U of T research shows acetaminophen could be hindering error-detection in the brain. Credit: University of Toronto Scarborough

It's been known for more than a century that acetaminophen is an effective painkiller, but according to a new U of T study it could also be impeding error-detection in the brain.

The research, authored by a team including postdoctoral fellow Dan Randles and researchers from the University of British Columbia, is the first neurological study to look at how [acetaminophen](#) could be inhibiting the brain response associated with making errors.

"Past research tells us physical pain and social rejection share a neural process that we experience as distress, and both have been traced to same part of the brain," says Randles.

Recent research has begun to show how exactly acetaminophen inhibits pain, while behavioural studies suggest it may also inhibit evaluative responses more generally. Randles own past research has found that people are less reactive to uncertain situations when under the effect of acetaminophen.

"The core idea of our study is that we don't fully understand how acetaminophen affects the brain," says Randles. "While there's been recent behavioural research on the effects of acetaminophen, we wanted to have a sense of what's happening neurologically."

To test the idea two groups of 30 were given a target-detection task called the Go or No Go. Participants were asked to hit a Go button every time the letter F flashed on a screen but refrain from hitting the button if an E flashed on the screen. "The trick is you're supposed to move very quickly capturing all the GOs, but hold back when you see a No Go," says Randles.

Each participant was hooked up to an electroencephalogram (EEG), which measures electrical activity in the brain. The researchers were looking for a particular wave called Error Related Negativity (ERN) and Error Related Positivity (Pe). Essentially what happens is that when people are hooked up to an EEG and make an error in the task there is a robust increase in ERN and Pe.

One group, which was given 1,000 mg of acetaminophen - the equivalent of a normal maximum dose - showed a smaller Pe when making mistakes than those who didn't receive a dose, suggesting that acetaminophen inhibits our conscious awareness of the error.

"It looks like acetaminophen makes it harder to recognize an error, which may have implications for [cognitive control](#) in daily life," says Randles.

Cognitive control is an important neurological function because people are constantly doing cognitive tasks that flow automatically like reading, walking or talking. These tasks require very little cognitive control because they are well mapped out neurological processes, notes Randles.

"Sometimes you need to interrupt your normal processes or they'll lead to a mistake, like when you're talking to a friend while crossing the street, you should still be ready to react to an erratic driver," explains Randles.

"The task we designed is meant to capture that since most of the stimuli were Go, so you end up getting into a routine of automatically hitting the Go button. When you see a No Go, that requires cognitive control because you need to interrupt the process."

The study was double blind, so neither the researcher running the study nor the participant knew whether they had been given a placebo or acetaminophen.

An unexpected and surprise finding that Randles plans to explore more closely is that those who received an acetaminophen dose appeared to miss more of the Go stimuli than they should have. He plans on expanding on the error detection aspect of the research to see whether acetaminophen is possibly causing people to "mind wander" and become distracted.

"An obvious question is if people aren't detecting these errors, are they also making errors more often when taking acetaminophen? This is the first study to address this question, so we need more work and ideally

with tasks more closely related to normal daily behaviour."

The research is published in the current edition of the journal *Social Cognitive and Affective Neuroscience*.

Provided by University of Toronto

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