CAFFEINE AND GENETICS

Brew Too Bitter? You Might Drink More, Not Less

Dreamtime /TNS

Recent research found that people who are genetically predisposed to be sensitive to the bitter taste of caffeine, drink more coffee than those who are less sensitive.

Research finds people who are sensitive to bitter flavor of coffee are more likely to drink larger quantities of the beverage

By Cindy Dampier
Chicago Tribune

CHICAGO — Marilyn Cornelis has been thinking about coffee for most of her life. As a child, the Northwestern University Feinberg School of Medicine preventive medicine professor watched her father down cup after cup — "a couple of pots a day" and made a game of daring her siblings to lick the spoon he used to stir it. "It was so bitter to us," she says, her voice still registering a little of the face-twisting shock.

That reaction to bitter tastes is universal, and it's coded into our DNA — at a time when human beings needed to constantly seek food to sustain life, an aversion to bitter tastes kept people from jamming poisonous things into their mouths as they sought to stave off hunger. Humans who hated bitter tastes lived to forage another day, which gave them the opportunity to spawn descendants, who are currently standing in line at Starbucks.

Cornelis, whose academic research has centered on genetics and caffeine for her entire career, is sometimes among them, she admits, though it takes some milk and sugar to get her to down the bitter brew.

"I still can't drink it black," she says.

Yet, in research published by Cornelis earlier this month, she and colleagues at the QIMR Berghofer Medical Research Institute in Australia found that people who are genetically predisposed to be sensitive to the bitter taste of caffeine drink more coffee than those who are less sensitive or those who are sensitive to other bitter tastes such as quinine.

Cornelis says the finding was surprising.

"Typically, humans avoid bitter tastes, and caffeine is one of those compounds, but people who were genetically sensitive to the taste of caffeine actually drank more coffee. So it might be that when you taste caffeine, you have learned to link that to the stimulant effects of caffeine."

In other words, the desire for the stimulant effects of caffeine is so strong, we are willing to seek out a bitter taste in order to get it.

That stimulant-seeking behavior is controlled by different genetic variants — those that control the body's ability to metabolize caffeine. If your genes are programmed to metabolize caffeine efficiently, you will burn through its stimulant effect more quickly, which is why you'll spend more time at the office coffee pot than colleagues. "We are all sort of constantly titrating our own caffeine levels," says Cornelis.

She and other researchers have identified about eight genetic variants that act on metabolism of caffeine and, as a result, predict consumption levels. But a genetic test for coffee junkies isn't what researchers are after. Instead, studying caffeine and genetics may one day unlock some of the mysteries of caffeine's protective effects on general health and diseases like diabetes and heart disease.

Large-scale studies have shown a link between lifespan and coffee consumption — people who drink around four cups per day live longer, and as scientists work to understand those effects, they may be able to harness that knowledge to combat disease.

The genetic link to bitter tastes has also been studied carefully. Scientists have shown that supertasters, who have more taste buds and actually taste everything more vividly than the rest of us, tend to avoid strong spices and have a stronger aversion to bitter. On the other hand, there are a few outliers who express a true like for bitter tastes (versus a learned tolerance). Correlations have been shown between this affinity for bitter tastes and "malevolent traits associated with a psychopathic personality, particularly the characteristic known as 'everyday sadism,'" writes Brown University neuroscientist Rachel Herz.

Herz's book 'Why You Eat What You Eat' explores the intersection of science and eating habits, and also points out that enjoyment of bitter tastes has implications for drinking and vulnerability to alcoholism. A study at Indiana University showed that beer drinkers experienced dopamine release that mimics the feeling of being intoxicated simply by tasting a bitter taste like beer. It's a classic Pavlovian response: transferring the response to beer onto a simple taste signal. Study participants with a family history of alcoholism experienced even greater dopamine release from the bitter taste, signaling a genetic predisposition to expect reward from bitter tastes.

Most of us who are lining up for coffee, however, don't have an affinity for bitter tastes. Part of the draw to the coffee shop can be explained by cultural and even meteorological considerations — people in cold-weather climates tend to drink more coffee.

Chicago, poster city for cold winters, has always been a big consumer of coffee (we were home to Starbucks' first expansion store back in 1987), and that's nothing compared with places like Finland, where coffee consumption per capita is about twice that in the U.S.

But Cornelis (who never drank coffee until she moved to Chicago) says her research simply shows that those who are sensitive to the taste of caffeine are naturally attuned to finding it, in an effort to get that little extra burst of energy. They still may like the taste of something sugary better — which brings us back to the coffee shop.

"It might be that when you taste caffeine, you have learned to link that to the stimulant effects of caffeine."

— Marilyn Cornelis, preventive medicine professor

The genius of Starbucks, says Cornelis, isn't that it is perfectly positioned to take advantage of human genetics or eons of learned experience. "Where Starbucks is really keyed in," she says, "is that the bitterness of coffee can be easily masked. So they're always coming out with a new drink, a new flavor." The caffeine is what we're all after, but for most of us, there's only one question that matters, she says: "It's all about 'What else do you want in your drink?'"

Study: HIV drugs could be used for Alzheimer's

By Bradley J. Fikes
The San Diego Union-Tribune

SAN DIEGO — A major new study on Alzheimer's disease provides previously unknown evidence of how the brain-robbing illness may originate.

Moreover, it proposes that certain HIV drugs called reverse transcriptase inhibitors could immediately be repurposed for Alzheimer's patients.

Led by scientists from Sanford Burnham Prebys Medical Discovery Institute in San Diego, the study finds that, as long suspected, Alzheimer's is a genetic disease. But in nearly all cases, it's not inherited. Rather, it arises during a patient's lifetime by genetic rearrangements in neurons. Sequences of DNA are copied, altered and inserted back into the genome.

The genetic rearranging isn't random mutation, but a process that recombines DNA into different patterns. This reshuffling creates a mosaic of slightly differing cells. The immune system uses a similar process to make antibodies, but nothing like it has been seen in the human brain.

Reverse transcriptase inhibitors might also ward off Alzheimer's in those with Down syndrome, who develop Alzheimer's as they age, the study said.

The study was published Wednesday in the journal Nature.

Confirmation of the findings is required, said Dr. Jerold Chun, the lead author. But Chun says testing with the HIV drugs should begin immediately. Even a low degree of effectiveness would be better than what is now available.

The study combines single and multiple-cell analytical methods to examine 13 donated human brains, some normal, some with Alzheimer's. Its findings jibe with epidemiological data from elderly HIV patients. They have been treated with reverse transcriptase inhibitors for decades, and almost never get Alzheimer's.

The first documented case of Alzheimer's in an HIV-positive individual was reported in 2016.

Cautious praise for the study came from Dr. Paul Aisen, a longtime Alzheimer's researcher who specializes in clinical trials. Aisen heads the University of Southern California Alzheimer's Therapeutic Research Institute in San Diego.

"The authors carefully demonstrate that there are extensive modifications to genetic material in the Alzheimer's disease brain," Aisen said by email.

"These are changes that occur with aging, rather than inherited genetic characteristics. While this is an intriguing idea, the actual contribution of this age-related genetic change remains uncertain."

Fred "Rusty" Gage, president of the Salk Institute and a noted brain expert, said the study's results back up the claim that DNA sequences are copied and inserted back into the neuronal genome.

"These results are quite striking and could have implications for Alzheimer's disease diagnosis and progression," Gage said by email.

About 5.7 million Americans today have been diagnosed with Alzheimer's disease, according to the Alzheimer's Association. That number is expected to double by 2060, according to the Centers for Disease Control and Prevention.

In recent years, Alzheimer's researchers have changed their view of the disease. They now say Alzheimer's begins decades before symptoms appear. Eventually, the damage eating away at the brain becomes severe enough to affect cognition and memory.

So increasingly, researchers are looking for the earliest possible signs that Alzheimer's is developing, before mental functions are affected.

The study traces the ultimate cause to the genetic rearrangements, so blocking this reshuffling should block Alzheimer's.

The reshuffling can be likened to a copy-and-paste function in affected neurons. But instead of making an exact copy, the process scrambles DNA segments, then reinserts them back into the neuron's genome.

Normal brains also show genetic variation in individual cells. Research suggests this condition is a normal part of brain development. Instead of having billions of identical neurons, each may vary slightly in a way that helps the brain work, Chun said.

This process goes wrong in producing the Alzheimer's-causing variations, derived from a gene called APP. Certain variants of this gene are strongly linked with Alzheimer's.

Because genes produce proteins, these rearrangements of the APP gene likely produce variations of toxic brain proteins called beta amyloid, known to be involved in Alzheimer's.

Some of these genetic variants are found in a very rare form of Alzheimer's that is directly inherited. Virtually all people with these variations come down with Alzheimer's.

But this "familial" form constitutes only a few percent of all Alzheimer's cases. The vast majority of "sporadic" Alzheimer's cases shows genetic tendencies, but fall far short of a perfect correlation.

The study provides an explanation for sporadic Alzheimer's: Because these genetic changes only occur in the brain, they don't show up when a person's genome is sequenced.

Music Can Benefit Alzheimer's patients

Research suggests that listening to or singing songs can provide emotional and behavioral benefits for people with Alzheimer's disease and other types of dementia. Musical memories are often preserved in Alzheimer's disease because key brain areas linked to musical memory are relatively undamaged by the disease.

For example, music can:

- Relieve stress
- Reduce anxiety and depression
- Reduce agitation

Music can also benefit caregivers by reducing anxiety and distress, lightening the mood, and providing a way to connect with loved ones who have Alzheimer's disease — especially those who have difficulty communicating.

If you'd like to use music to help a loved one who has Alzheimer's disease, consider these tips:

- Think about your loved one's preferences.

What kind of music does your loved one enjoy? What music evokes memories of happy times in his or her life? Involve family and friends by asking them to suggest songs or make playlists.

- Set the mood.

To calm your loved one during mealtime or a morning hygiene routine, play music or sing a song that's soothing. When you'd like to boost your loved one's mood, use more upbeat or faster paced music.

- Avoid overstimulation.

When playing music, eliminate competing noises. Turn off the TV. Shut the door. Set the volume based on your loved one's hearing ability. Opt for music that isn't interrupted by commercials, which can cause confusion.

- Encourage movement.

Help your loved one to clap along or tap his or her feet to the beat. If possible, consider dancing with your loved one.

- Sing along.

Singing along to music together with your loved one can boost the mood and enhance your relationship. Some early studies also suggest musical memory functions differently than other types of memory, and singing can help stimulate unique memories.

- Pay attention to your loved one's response.

If your loved one seems to enjoy particular songs, play them often. If your loved one reacts negatively to a particular song or type of music, choose something else.

Keep in mind that music might not affect your loved one's cognitive status or quality of life. Further research, to better understand the precise effects of music and Alzheimer's disease is needed.

— Mayo Clinic News Network