

Link between coffee and kidney disease may depend on genetic variant, study finds

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Researchers at the University of Toronto and University of Padova have found that the association between heavy coffee consumption and kidney dysfunction hinges on a common genetic variation.

In a study, the researchers showed that markers of [kidney](#) dysfunction were nearly three times higher in heavy coffee drinkers with a variant of the CYP1A2 gene that makes them slow metabolizers of caffeine than for other heavy coffee drinkers who had a different version of the gene that enables faster caffeine metabolism.

"We think fast metabolizers can eliminate caffeine from their systems more efficiently and avoid harmful build-ups of caffeine," said Ahmed El-Sohemy, a professor of nutritional sciences in U of T's Temerty Faculty of Medicine. "These [individual differences](#) in caffeine metabolism help explain why previous studies on coffee and kidney disease have been inconsistent."

The study, published in the journal *JAMA Network Open*, was observational in design and included data from more than a thousand participants in Italy, collected over a decade by Professor Paolo Palatini and colleagues at the University of Padova.

Some previous studies have found that caffeine is associated with impaired [kidney function](#) and [kidney failure](#), while others have found that coffee may protect against kidney disease. Few have looked at whether individual genetic differences account for these positive or negative associations.

The amount of caffeine a person consumes also appears to be important. For the current study, risk of kidney dysfunction was only significant in people who drank three or more cups of coffee a day, which is about 300 mg of Italian espresso. Current guidelines in Canada and the U.S. recommend no more than 400 mg per day for healthy adults.

The researchers also found that prevalence of the CYP1A2 gene variant that makes people slow metabolizers of caffeine was similar in both the [study group](#) and the general population: roughly 50%.

Many companies and clinics now include CYP1A2 in personalized genetic tests, as different versions of the gene can affect risk for several conditions associated with caffeine consumption.

"Heart disease, prediabetes and hypertension are all affected by variations in CYP1A2, which can also alter athletic performance," said Sara Mahdavi, lead author on the study and a former post-doctoral fellow in El-Sohemy's lab. "We can now be confident that whether or not coffee is deleterious to kidney health depends, in part, on CYP1A2."

The researchers studied three markers of kidney dysfunction: albuminuria (too much of the protein albumin in urine); hyperfiltration (high glomerular filtration rate in the kidney); and hypertension.

Estimates put the prevalence of [kidney disease](#) in Canada at about 13%, with most cases going undiagnosed. Kidney disease is a leading cause of death globally.

"Hopefully, this study will raise awareness about the importance of personalized nutrition recommendations based on individual genetic make-up," said Mahdavi. "This is an exciting area of research and clinical practice with a very bright future."

El-Sohemy is the founder and Chief Science Officer of Nutrigenomix Inc., which provides [genetic testing](#) for personalized nutrition, including the CYP1A2 gene and caffeine metabolism.

More information: Sara Mahdavi et al, CYP1A2 Genetic Variation, Coffee Intake, and Kidney Dysfunction, *JAMA Network Open* (2023). [DOI: 10.1001/jamanetworkopen.2022.47868](https://doi.org/10.1001/jamanetworkopen.2022.47868)

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