

Should you take fish oil? Depends on your genotype

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Fish oil supplements are a billion-dollar industry built on a foundation of purported, but not proven, health benefits. Now, new research from a team led by a University of Georgia scientist indicates that taking fish oil only provides health benefits if you have the right genetic makeup.

The study, led by Kaixiong Ye and published in *PLoS Genetics*, focused on [fish oil](#) (and the omega-3 fatty acids it contains) and its effect on triglycerides, a type of fat in the blood and a biomarker for cardiovascular disease.

"We've known for a few decades that a higher level of omega-3 fatty acids in the blood is associated with a lower risk of heart disease," said Ye, assistant professor of genetics in the Franklin College of Arts and Sciences. "What we found is that [fish oil supplementation](#) is not good for everyone; it depends on your genotype. If you have a specific genetic background, then [fish](#) oil supplementation will help lower your triglycerides. But if you do not have that right genotype, taking a fish oil supplement actually increases your triglycerides."

Ye's team, including first author and graduate student Michael Francis, examined four blood lipids (fats)—[high-density lipoprotein](#), low-density lipoprotein, total cholesterol and triglycerides—that are biomarkers for cardiovascular disease. The data for their sample of 70,000 individuals was taken from UK Biobank, a large-scale cohort study collecting genetic and health information from half a million participants.

The team divided the sample into two groups, those taking [fish oil supplements](#) (about 11,000) and those not taking fish oil supplements. Then they performed a genome-wide scan for each group, testing for 8 million genetic variants to compare. After running over 64 million tests, their results revealed a significant genetic variant at gene GJB2. Individuals with the AG genotype who took fish oil decreased their triglycerides. Individuals with the AA genotype who took fish oil slightly increased their triglycerides. (A third possible genotype, GG, was not evident in enough study volunteers to draw conclusions.)

Determining your genotype is not as far-fetched as it sounds, thanks to direct-to-consumer genetic testing companies. Companies may not report that specific genetic variant yet, but a tech-savvy consumer should be able to download the raw data and look at the specific position to discover the [genotype](#), according to Ye. The ID for the variant is rs112803755 (A>G).

Looking at earlier fish oil studies

The study's findings may also shed light on previous trials, most of which found that fish oil provides no benefit in preventing cardiovascular disease.

"One possible explanation is that those clinical trials didn't consider the genotypes of the participants," Ye said. "Some participants may benefit, and some may not, so if you mix them together and do the

analysis, you do not see the impact."

Now that Ye has identified a specific gene that can modify an individual's response to fish oil supplementation, his next step will be directly testing the effects of fish oil on cardiovascular disease.

"Personalizing and optimizing fish oil supplementation recommendations based on a person's unique genetic composition can improve our understanding of nutrition," he said, "and lead to significant improvements in human health and well-being."

More information: Michael Francis et al, Genome-wide association study of fish oil supplementation on lipid traits in 81,246 individuals reveals new gene-diet interaction loci, *PLOS Genetics* (2021).
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