

Unveiling the nasty action of trans-fatty acids in blood

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Consumption of trans fatty acids, often found in processed foods, increases the risk of heart disease and stroke. Credit: Creative Commons Zero (CC0) license

Tohoku University researchers have found that trans-fatty acids promote cell death in a more direct manner than previously thought, leading to the development of atherosclerosis, a major cause of heart attacks and strokes.

Trans-fatty acids are [unsaturated fatty acids](#) produced as byproducts during food manufacturing. Trans-fatty [acid](#) consumption is strongly linked to atherosclerosis, an inflammatory disease in which plaque clogs arteries. Atherosclerosis is a major cause of cardiovascular diseases such as heart attacks and strokes.

During the development of atherosclerosis, white blood cells turn into macrophages, immune cells that destroy harmful substances in the body. Those macrophages eventually become foam cells that form plaques and cause inflammation. When macrophages die, they release pro-inflammatory molecules, including extracellular ATP, that enhance inflammation and advance the disease.

Although previous studies have reported the link between the consumption of trans-fatty acids and the development of atherosclerosis, the mechanism remained unknown. A previous study reported extracellular ATP activates a molecule that generates reactive oxygen species, triggering an ASK1 kinase involved in the cell death process. This led the researchers to assume that trans-fatty acids accelerate the cell death process by generating more reactive oxygen species.

The Tohoku University team found this process actually happens in a much more direct way. Trans-fatty acids promote cell death by enhancing extracellular ATP, which directly activates the ASK1 kinase, and another kinase called CaMKII, without increasing [reactive oxygen species](#). The finding was published in the *Journal of Biological Chemistry*.

The researchers, led by Associate Professor Takuya Noguchi and Professor Atsushi Matsuzawa, also found that several trans-fatty acid types—elaidic acid, linoelaidic acid and trans-vaccenic acid—stimulate [cell death](#), but not their corresponding cis-fatty acids, which are naturally occurring unsaturated fatty acids with health benefits. The harmful trans-fatty acids are made from these cis-fatty acids through a hydrogenation process commonly used by the food industry. The finding provides insight into the mechanism of disorders caused by trans-fatty acid consumption and suggests potential targets for treatment.

The researchers note that future studies should investigate how trans-fatty acids lead to the development of [atherosclerosis](#) and cardiovascular diseases at a molecular level.

More information: Trans-fatty acids promote proinflammatory signaling and cell death by stimulating the apoptosis signal-regulating kinase 1 (ASK1)-p38 pathway, Yusuke Hirata, Miki Takahashi, Yuki Kudoh, Kuniyuki Kano, Hiroki Kawana, Kumiko Makide, Yasuharu Shinoda, Yasushi Yabuki, Kohji Fukunaga, Junken Aoki, Takuya Noguchi, and Atsushi Matsuzawa, *Journal of Biological Chemistry*, [DOI: 10.1074/jbc.M116.771519](#)

Provided by Tohoku University

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