

Chemicals found in everyday fruits could minimise organ damage after heart attack and stroke

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Strawberry Heart., Credit: sax

(Medical Xpress)—Scientists have identified chemicals found in some everyday fruit that could protect vital organs from long-term damage

following a heart attack or stroke, according to new research carried out in mice. The researchers now hope the chemicals will provide a starting point for developing new injectable drugs that could be used to prevent some of the long-term damage caused by heart attack and stroke.

During a heart attack or stroke, a clot can starve the heart or brain of blood and oxygen, causing irreversible damage. Further damage is caused when the clot is dislodged and blood rushes back into the heart or brain. Until now, it was unclear how the return of [blood flow](#) starts this damage.

In research published today in *Nature*, scientists led by teams at the Medical Research Council (MRC) Mitochondrial Biology Unit, MRC Cancer Unit and the University of Cambridge, are the first to find that this damage is caused by a build-up of a chemical called succinate. Succinate occurs naturally in the body when sugar and fat are broken down to release the energy stored in food.

The research shows that succinate builds up to abnormally high levels inside an organ when blood flow is limited. When the blood flow returns, the excessive build-up of succinate interacts with oxygen as the blood rushes into the oxygen-starved tissues. This causes the release of destructive molecules which react with muscle cells in the organ, damaging them.

In the months and years after a heart attack, this damage can ultimately lead to heart failure, a debilitating condition that leaves people unable to carry out everyday tasks like washing themselves or climbing stairs.

Working with mice, the researchers identified the increase in succinate by measuring a range of different chemicals in the [vital organs](#) before and after heart attack and stroke, in a technique called metabolomics. Crucially, the researchers have discovered that they can reduce [organ](#)

[damage](#) in mice and rats by administering simple chemicals, called malonate esters, when blood flow is restored. Malonate esters stop the build-up of succinate and the resulting release of destructive molecules.

Malonate esters are cheap, readily available and are found naturally in fruits such as strawberries, apples and grapes, although not in high enough volumes to be beneficial.

The findings could also have implications in surgery where transplanted organs such as the kidney, liver and the heart all suffer damage after they are connected to the transplant patient's blood flow.

Dr Michael Murphy from the MRC Mitochondrial Biology Unit, a co-author on the research paper, said: "This research explains how organ damage occurs during the first few minutes of restoring blood supply after a heart attack or stroke and, importantly, how to stop this damage.

"We have used simple chemicals found in everyday fruits like apples and grapes, which had never been suspected as being therapeutically useful before. Amazingly, these chemicals worked very well."

Dr Thomas Krieg from the Clinical Pharmacology Unit at the University of Cambridge, another co-author of the study said: "Now that we know the specific cause of organ damage after heart attacks and strokes, we can start developing effective drugs to treat the serious after-effects of these conditions.

"There are currently no drugs routinely used that block this cause of damage. But our research shows that simple, cheap chemicals could significantly improve the outcome of patients suffering a [heart attack](#) or stroke. We now hope to develop this research further, leading to an effective treatment for people within five to 10 years."

More information: "Ischaemic accumulation of succinate controls reperfusion injury through mitochondrial ROS." *Nature* (2014) [DOI: 10.1038/nature13909](https://doi.org/10.1038/nature13909)

Provided by University of Cambridge

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