

Study offers insight on how hot weather impairs the immune system

March 20 2024, by Michael Merschel



Credit: Mary Taylor from Pexels

A study that looked at how the immune system reacts to hot weather offers new insight into what's happening when the mercury rises.

Researchers found a link between hot weather and measures of the body's [immune response](#), including levels of certain blood cells and indicators of inflammation. It's a step toward eventually finding treatments that could help protect people from dangerously high temperatures, which have been linked to increased rates of heart attack, stroke and other cardiovascular issues.

The [research](#), presented Tuesday, March 19, at the American Heart Association's [Epidemiology, Prevention, Lifestyle and Cardiometabolic Health conference](#) in Chicago, is considered preliminary until full results are published in a peer-reviewed journal.

Previous studies had linked temperature and inflammation, said lead researcher Dr. Daniel W. Riggs, an epidemiologist and an assistant professor in the division of environmental medicine at the University of Louisville School of Medicine in Kentucky.

Inflammation, which is associated with heart disease risk, is part of the body's response to infection or injury. Different types of white blood cells also are part of that immune response. Some of those cells release proteins called cytokines, which regulate inflammation. Other immune cells attack invaders such as bacteria and viruses directly.

Cytokines and immune cells can be measured as markers of how much the body has ramped up its defenses in response to a perceived threat.

Earlier studies of heat and inflammation had looked at just a few signals of how the body was responding, Riggs said. He and his colleagues "wanted to get a fuller picture of what the relationship with higher temperatures and these markers could be."

The team looked at blood samples taken from 624 people who were part of the [Green Heart Project](#), which is studying how planting greenery in a

Louisville neighborhood might improve air quality and reduce heart disease.

Study participants ranged in age from 20 to 70 years, with an average age of 50. About 77% were white, 18% were Black, and 59% were women. Each person gave one blood sample during the summers of 2018 and 2019.

Researchers measured 11 types of cytokines and nine types of immune cells in each sample. The weather on the day of each blood draw was assessed using the Universal Thermal Climate Index, a measure of how temperature, humidity and wind speed affect the human body's comfort level. The average 24-hour UTCI during the measurements was 78°F.

The blood measurement was then matched with the weather readings, and the results were adjusted for differences in demographic factors such as sex, age, race and education. The results also were adjusted for body mass index (a measure of obesity), air pollution and whether the person smoked or was taking anti-inflammatory medication.

The results showed a link between hot weather and increased levels of several cytokines. One of them, TNF-alpha, is "one of the major inflammatory markers and plays an important role in cardiovascular disease," Riggs said.

At the same time, hot weather was associated with higher levels of some classes of white blood cells known as monocytes, which could be a sign that heat is causing inflammation or prompting an immune response, Riggs said.

Heat also was associated with reduced levels of another class of monocyte, known as nonclassical, that lowers inflammation. And heat also was linked to lower levels of infection-fighting and blood-cleansing

white blood cell known as B cells. Lower levels of those cells could mean someone is more susceptible to infection, Riggs said.

He was surprised to see so many types of cells change with the short-term exposure to [hot weather](#). The study did not look at what could be causing that, but Riggs said heat acclimation could lead to an increase of heat shock proteins, which are known to be involved in immune and inflammatory responses.

"I think this is an important study," said Dr. Judith Lichtman, chair of the department of chronic disease epidemiology at Yale School of Public Health in New Haven, Connecticut. She has done research on how temperature affects stroke rates but was not involved in the new work.

A lot of the prior research has looked at whether heat waves lead to more hospitalizations or deaths, she said. "What's so valuable about this study is they're really trying to understand, at the body level, the mechanisms that may be contributing to this increased risk."

The study looks only at one neighborhood, she said, so the findings need to be replicated more broadly. And in such studies, it's not clear how much people are actually being exposed to the outdoor heat; people could be staying inside in air conditioning.

But overall, Lichtman said, this study is "opening up a new area of research." Understanding heat's effects on the body will gain importance as the climate changes, and if researchers can start to understand how aspects of the environment affect health, "maybe we can also come up with novel ways to reduce our cardiovascular risk."

Climate change is expected to increase the number of extreme heat events, Riggs said. "Our future research will focus on the long-term effects of exposure to extreme heat events on immune responses and

inflammation, and how this relates to the progression of cardiovascular disease."

As part of the Green Heart Project in Louisville, Riggs said, "we're going to look into whether actually tree-planting could mitigate the effects on your immune system and inflammation." Other ongoing research involves collecting additional [blood samples](#). "The major limitation of this study is that it's only one time point," he said, and additional samples will show whether the findings persist.

"The more you understand the mechanism, the more you can clearly work on prevention and treatment," he said.

More information: P297 - Associations Between Short-Term Outdoor Heat Measures and Markers of Immune Response and Inflammation.
[www.abstractsonline.com/pp8/#!/... 343/presentation/484](http://www.abstractsonline.com/pp8/#!/...343/presentation/484)

Provided by American Heart Association

Citation: Study offers insight on how hot weather impairs the immune system (2024, March 20)
retrieved 27 April 2024 from
<https://medicalxpress.com/news/2024-03-insight-hot-weather-impairs-immune.html>

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