Study finds common panic response can desensitize body to temperature changes

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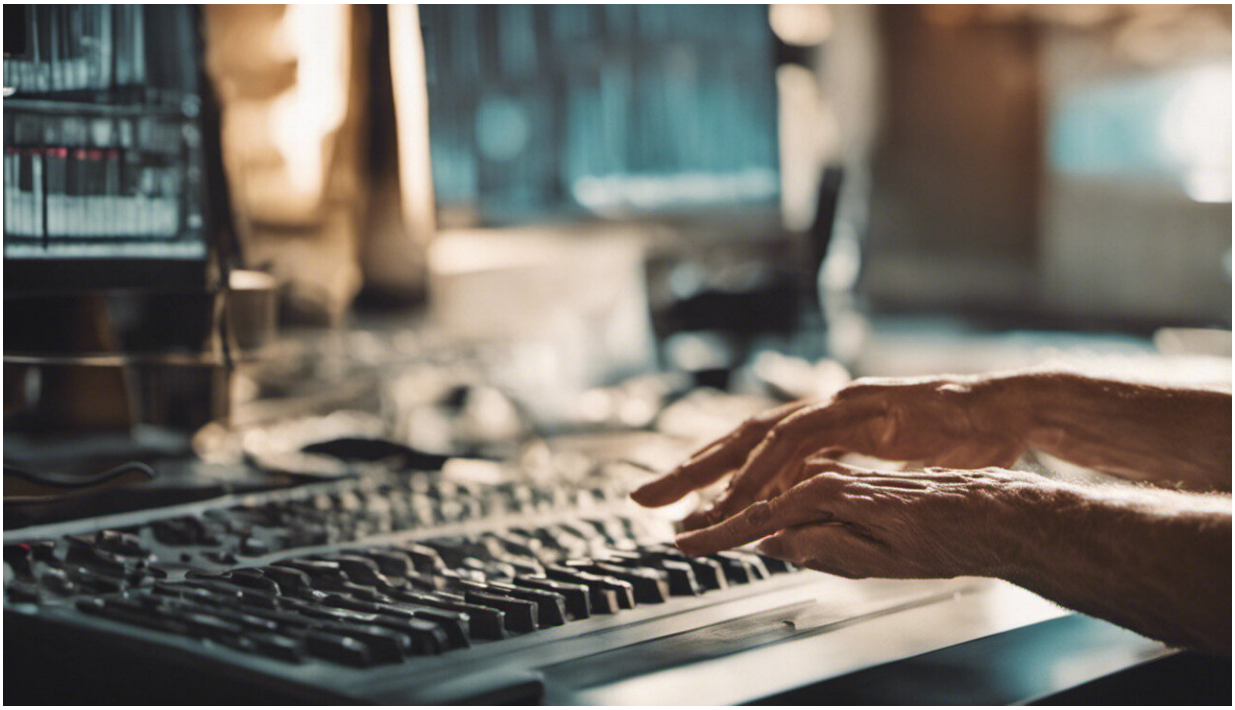

Credit: AI-generated image (disclaimer)

The fight-or-flight response evolved to keep us safe from predators, but it can sometimes cause us to overreact in modern life when we don't face the same dangers we once did. Now, researchers from Japan have found that a common panic response may actually reduce our ability to deal with environmental threats.

In a study published this month in the *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology*, researchers from the University of Tsukuba and Niigata University of Health and Welfare have revealed that a change in blood gas caused by intense breathing can desensitize the body to temperature changes.

When we encounter unexpected stressors in daily life, such as acute pain or fear, a common response is to begin breathing rapidly. This response, called hyperventilation, often involves breathing more quickly than the body really needs in order to deal with the perceived threat or danger.

"The purpose of hyperventilation during stress is not well understood, although it is thought to reduce sensitivity to the stressful stimulus," says lead author of the study, Dr. Tomomi Fujimoto. "However, whether and how hyperventilation reduces sensitivity to temperature changes is still unclear."

To explore this, the researchers first tested sensitivity to temperature changes in young adults while breathing normally. Then, they were asked to breathe rapidly (hyperventilate), with or without the addition of carbon dioxide to their inspired air, to simulate hypocapnia, which is the normal decrease in carbon dioxide that occurs with hyperventilation, or normocapnia, which is a normal carbon dioxide level.

"The results were striking," explains Professor Takeshi Nishiyasu, corresponding author. "Local detection of warm and cool stimuli was blunted when subjects hyperventilated with hypocapnia, but did not differ when they hyperventilated with normocapnia."

In addition, less blood flow to the brain was observed during hyperventilation with hypocapnia than during hyperventilation with normocapnia. Although the reduced sensitivity to warm and cold stimuli was comparable on the forehead, the detection of warm stimuli was

unchanged on the forearm.

"These findings suggest that hyperventilation-induced hypocapnia, not hyperventilation per se, attenuates local skin thermal perception, though changes in responses to warm stimuli may not be clearly perceived at some skin areas," says Dr. Fujimoto.

Given that hyperventilation with hypnocapnia reduces blood flow to the part of the brain that receives signals about thermal stimulation, it is plausible that this is the reason for blunted thermal perception. The findings from this study suggest that hypocapnia may be a mechanism by which hyperventilation reduces sensitivity to stress, while paradoxically dampening thermoregulatory behavior in severe hot and cold environments, which may contribute to heat stroke and accidental hypothermia.

More information: Tomomi Fujimoto et al, Hypocapnia attenuates local skin thermal perception to innocuous warm and cool stimuli in normothermic resting humans, *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology* (2022). DOI: 10.1152/ajpregu.00126.2022

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