

Diets of highly active people can raise risk of exertional heat stroke if not moderated

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Military servicemen, athletes and outdoor workers should watch what they eat – not only to stay healthy but also to prevent heat stroke caused by exertion.

The common nutrition, health supplements and diets of these highly active individuals can put them more at risk of exertional heat stroke, if taken inappropriately, said researchers from the National University of Singapore's Yong Loo Lin School of Medicine (NUS Medicine) in a recently published review paper.

Those food choices, if over-consumed, mainly result in gastrointestinal complications, leading to fluid loss and a higher risk of exertional heat stroke.

One example is carbohydrates, which is a staple for many, including sportsmen, who may take them in the form of energy bars and gels and energising drinks in between training and workouts.

But if taken in large amounts – more than 90g of the carbohydrates per hour – they can cause vomiting and diarrhoea.

“One possible reason is that large doses of carbohydrates may

not be adequately absorbed – the carbohydrates left sitting in the gut can subsequently lead to gastrointestinal symptoms,” said Dr Beverly Tan from NUS Medicine's Human Potential Translational Research Programme and one of the two co-leads of the paper.

Scientists from Britain and the United States were also part of the team.

Exertional heat stroke happens with a spike in the core body temperature to above 40 deg C at times – due to strenuous exercise – often in hot and humid environments. Key symptoms are disturbances to the central nervous system, such as delirium, and unconsciousness. Organ and tissue damage is also common, which can lead to multiple-organ failure.

In Singapore, exertional heat injuries are more common compared with the classic heat injuries during heatwaves in temperate regions.

These exertional heat injuries are more common among people who do intensive physical activities for long hours under the sun, including marathoners, construction workers and those in the military.

A doctor from Khoo Teck Puat Hospital previously told *The Straits Times* that it sees up to

three times more patients with heat-related injuries during the hotter months around the middle of the year than in the cooler months.

And with temperatures and humidity expected to rise due to climate change, the risk of exertional heat stroke will be even greater, said Associate Professor Jason Lee, deputy director of the Human Potential Translational Research Programme and the other co-lead of the paper.

Beyond carbohydrate bars and gels, performance-enhancing supplements containing caffeine and sodium bicarbonate do their job by helping consumers reduce their perception of effort and fatigue.

But this effect can increase the risk of exertional heat stroke when consumers end up overestimating their abilities while doing strenuous work in the heat.

The paper also highlighted a number of food substances that can both contribute to and prevent heat stroke. One of them is glutamine, an essential amino acid found in whey protein, for example. When consumed either over seven days or as a single dose two hours before exertional heat stress sets in, the amino acid enhances the ability of cells to withstand

heat stress. But for some people, that same amount of glutamine can lead to gastrointestinal distress, noted Dr Tan.

The review paper, published in the scientific journal *Experimental Physiology* in April, aims to shed light on the role of supplements and food choices in influencing exertional heat stroke.

The more commonly known factors that influence heat stroke and injuries include clothing, environmental conditions, the fitness and health status of individuals, and how acclimatised they are to the heat. Tweaking those factors can reduce the risk of heat injuries.

Prof Lee said: “It is likely that nutrition needs to go hand in hand with other more proven strategies such as work-rest cycles, aerobic (fitness), heat acclimatisation, cooling and appropriate hydration to truly heat-proof humans.”

In furthering the heat-nutrition understanding, Dr Tan said: “It is important for more research to be performed in women, youth, middle-aged individuals and multi-ethnic populations, as the participants in the majority of research studies are young men, mostly Caucasians.”

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Factors that influence risk of heat stress

ENVIRONMENT

- Workers in indoor places such as commercial kitchens are not shielded from heat stress. These places may have insufficient ventilation and some work processes may emit radiant heat.
- High humidity: When the surrounding air is humid with more moisture, that will impede the process of sweat evaporation, which is the body's main mechanism for losing heat.

HEALTH STATUS

- Sleep deprivation: Tiredness impairs decision-making and reduces a person's ability to regulate body heat.
- Low nutrition: The high energy demands of occupational work may lower a person's immunity and make him more susceptible to infections. Such illnesses can blunt one's tolerance to heat stress.
- Poor physical fitness: A fitter person has a more efficient sweating mechanism, and his body experiences less strain when working in the heat.

CLOTHING

- Personal protective equipment covers the body and face, and limits air movement and the cooling effect of sweating. The additional outfit puts an

increased heat load on the body. Rest breaks should be longer or more frequent for these workers.

- Workers should go for loose-fitting and light-coloured clothing.

HEAT ACCLIMATISATION

- New workers, especially those who come from colder climates, should slowly raise their heat tolerance by starting small and increasing their work hours and workload in the hot setting.
- Workers new to Singapore will need one to two weeks to adjust to the local weather conditions and workload.
- Workers returning from long quarantine indoors – common during the Covid-19 pandemic – or long sick leave will need to get themselves accustomed again to the hot environment.

AEROBIC EXERCISES

- One way workers can “heat-proof” themselves is to do more aerobic fitness exercises, to train the heart to pump blood more efficiently and raise their thermal tolerance.

SOURCES: SINGAPORE WORKPLACE HEALTH AND SAFETY GUIDELINES – MANAGING HEAT STRESS IN THE WORKPLACE (2020), ASSOCIATE PROFESSOR JASON LEE, DR BEVERLY TAN