

Researchers find elephants cannot handle exercise on hot days

May 8 2013, by Bob Yirka



African Bush Elephant in Mikumi National Park, Tanzania. Taken by Oliver Wright, via Wikipedia.

(Phys.org) —A team of researchers from Indiana State University has found that elephants can overheat when exercised in hot weather. In their paper published in *The Journal of Experimental Biology*, the group describes how they measured the internal temperature of a pair of zoo elephants as they were exercised in various heat related weather conditions. They found that when walking in hot weather, Asian elephants can overheat to the point of dying within just four hours.

Because their natural environment is Africa, a place most equate with [hot weather](#), zoo keepers and others have assumed that elephants can handle the heat. This is not the case the researchers report—their study proves it.

To find out how elephants handle different heat related [weather conditions](#), the researchers conducted a study at the Audubon Zoo in New Orleans. There, along with zoo personnel, two [Asian elephants](#) were taken on walks (on a half-mile track) during different times of the year. Temperatures on those days ranged from 46 to 94 degrees Fahrenheit. As the animals were walking, the researchers read monitors that revealed both their internal and skin temperatures.

The researchers found that despite an extraordinary ability to maintain body temperature due to their large size—known as gigantothermy—the elephants were extremely sensitive to overheating when exercising on hot days. This they found is because of the small amount of skin coverage relative to their body size. As the animals were being walked on hot days, they found that their skin became as hot as the ambient air around them. This meant that internally generated heat had no way to escape. The result was a steady increase in [internal body temperature](#).

Elephants, unlike humans, don't sweat. Instead they rely on heat dissipating through their skin to help cool them—wallowing in pools of water helps too, of course. The researchers suggest that in the wild, elephants likely do most of their walking at night and cool down along the way by taking dips in water holes.

The researchers also suggest their findings are likely applicable to dinosaurs as well. *Edmontosaurus*, they note, was roughly the same size as an elephant, and therefore likely was prone to overheating when exercising on hot days too. This means, they add, that studies of dinosaurs should include taking body size and a tendency to overheat into account when trying to pin down how a particular animal may have behaved.

More information: Heat storage in Asian elephants during submaximal exercise: behavioral regulation of thermoregulatory

constraints on activity in endothermic gigantotherms, *J Exp Biol* 216, 1774-1785. May 15, 2013. [doi: 10.1242/jeb.076521](https://doi.org/10.1242/jeb.076521)

Abstract

Gigantic size presents both opportunities and challenges in thermoregulation. Allometric scaling relationships suggest that gigantic animals have difficulty dissipating metabolic heat. Large body size permits the maintenance of fairly constant core body temperatures in ectothermic animals by means of gigantothermy. Conversely, gigantothermy combined with endothermic metabolic rate and activity likely results in heat production rates that exceed heat loss rates. In tropical environments, it has been suggested that a substantial rate of heat storage might result in a potentially lethal rise in core body temperature in both elephants and endothermic dinosaurs. However, the behavioral choice of nocturnal activity might reduce heat storage. We sought to test the hypothesis that there is a functionally significant relationship between heat storage and locomotion in Asian elephants (*Elephas maximus*), and model the thermoregulatory constraints on activity in elephants and a similarly sized migratory dinosaur, *Edmontosaurus*. Pre- and post-exercise (N=37 trials) measurements of core body temperature and skin temperature, using thermography were made in two adult female Asian elephants at the Audubon Zoo in New Orleans, LA, USA. Over ambient air temperatures ranging from 8 to 34.5°C, when elephants exercised in full sun, ~56 to 100% of active metabolic heat production was stored in core body tissues. We estimate that during nocturnal activity, in the absence of solar radiation, between 5 and 64% of metabolic heat production would be stored in core tissues. Potentially lethal rates of heat storage in active elephants and *Edmontosaurus* could be behaviorally regulated by nocturnal activity.

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