Taurine may be a key to longer and healthier life

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Taurine supplementation increases healthy life span. In the picture bull depicts
A deficiency of taurine—a nutrient produced in the body and found in many foods—is a driver of aging in animals, according to a new study led by Columbia researchers and involving dozens of aging researchers around the world.

The same study also found that taurine supplements can slow down the aging process in worms, mice, and monkeys and can even extend the healthy lifespans of middle-aged mice by up to 12%. The study was published June 8 in *Science*.

"For the last 25 years, scientists have been trying to find factors that not only let us live longer, but also increase health span, the time we remain healthy in our old age," says the study's leader, Vijay Yadav, Ph.D., assistant professor of genetics & development at Columbia University Vagelos College of Physicians and Surgeons.

"This study suggests that taurine could be an elixir of life within us that helps us live longer and healthier lives."

**Anti-aging molecules within us**

Over the past two decades, efforts to identify interventions that improve health in old age have intensified as people are living longer and scientists have learned that the aging process can be manipulated.

Many studies have found that various molecules carried through the bloodstream are associated with aging. Less certain is whether these
molecules actively direct the aging process or are just passengers going along for the ride. If a molecule is a driver of aging, then restoring its youthful levels would delay aging and increase healthspan, the years we spend in good health.

Taurine supplementation makes animals healthier and live longer. Credit: Columbia University Irving Medical Center

Taurine first came into Yadav's view during his previous research into osteoporosis that uncovered taurine's role in building bone. Around the same time, other researchers were finding that taurine levels correlated with immune function, obesity, and nervous system functions.

"We realized that if taurine is regulating all these processes that decline
with age, maybe taurine levels in the bloodstream affect overall health and lifespan," Yadav says.

**Taurine declines with age, supplementation increases lifespan in mice**

First, Yadav's team looked at levels of taurine in the bloodstream of mice, monkeys, and people and found that the taurine abundance decreases substantially with age. In people, taurine levels in 60-year-old individuals were only about one-third of those found in five-year-olds.

"That's when we started to ask if taurine deficiency is a driver of the aging process, and we set up a large experiment with mice," Yadav says.

The researchers started with close to 250 14-month-old female and male mice (about 45 years old in people terms). Every day, the researcher fed half of them a bolus of taurine or a control solution. At the end of the experiment, Yadav and his team found that taurine increased average lifespan by 12% in female mice and 10% in males. For the mice, that meant three to four extra months, equivalent to about seven or eight human years.
Taurine abundance declines with age. Credit: Columbia University Irving Medical Center

Taurine supplements in middle age improves health in old age

To learn how taurine impacted health, Yadav brought in other aging researchers who investigated the effect of taurine supplementation on the health and lifespan in several species.

These experts measured various health parameters in mice and found that at age two (60 in human years), animals supplemented with taurine for one year were healthier in almost every way than their untreated counterparts.

The researchers found that taurine suppressed age-associated weight gain
in female mice (even in "menopausal" mice), increased energy expenditure, increased bone mass, improved muscle endurance and strength, reduced depression-like and anxious behaviors, reduced insulin resistance, and promoted a younger-looking immune system, among other benefits.

"Not only did we find that the animals lived longer, we also found that they're living healthier lives," Yadav says.

A bout of exercise increases taurine levels.

A bout of exercise increases taurine levels. Credit: Columbia University Irving Medical Center

At a cellular level, taurine improved many functions that usually decline with age: The supplement decreased the number of "zombie cells" (old cells that should die but instead linger and release harmful substances), increased survival after telomerase deficiency, increased the number of
stem cells present in some tissues (which can help tissues heal after injury), improved the performance of mitochondria, reduced DNA damage, and improved the cells' ability to sense nutrients.

Similar health effects of taurine supplements were seen in middle-aged rhesus monkeys, which were given daily taurine supplements for six months. Taurine prevented weight gain, reduced fasting blood glucose and markers of liver damage, increased bone density in the spine and legs, and improved the health of their immune systems.

**Randomized clinical trial needed**

The researchers do not know yet if taurine supplements will improve health or increase longevity in humans, but two experiments they conducted suggest taurine has potential.

In the first, Yadav and his team looked at the relationship between taurine levels and approximately 50 health parameters in 12,000 European adults aged 60 and over. Overall, people with higher taurine levels were healthier, with fewer cases of type 2 diabetes, lower obesity levels, reduced hypertension, and lower levels of inflammation. "These are associations, which do not establish causation," Yadav says, "but the results are consistent with the possibility that taurine deficiency contributes to human aging."
The second study tested if taurine levels would respond to an intervention known to improve health: exercise. The researchers measured taurine levels before and after a variety of male athletes and sedentary individuals finished a strenuous cycling workout and found a significant increase in taurine among all groups of athletes (sprinters, endurance runners, and natural bodybuilders) and sedentary individuals.

"No matter the individual, all had increased taurine levels after exercise, which suggests that some of the health benefits of exercise may come from an increase in taurine," Yadav says.

Only a randomized clinical trial in people will determine if taurine truly has health benefits, Yadav adds. Taurine trials are currently underway.
for obesity, but none are designed to measure a wide range of health parameters.

Other potential anti-aging drugs—including metformin, rapamycin, and NAD analogs—are being considered for testing in clinical trials.

"I think taurine should also be considered," Yadav says. "And it has some advantages: Taurine is naturally produced in our bodies, it can be obtained naturally in the diet, it has no known toxic effects (although it's rarely used in concentrations used ), and it can be boosted by exercise.

Taurine supplementation increases healthy life span. In the illustration an old man is seen walking through a taurine shower and coming out as rejuvenated healthy man. Taurine structure is depicted as a ball and stick model in the taurine shower. Credit: Columbia University Irving Medical Center
"Taurine abundance goes down with age, so restoring taurine to a youthful level in old age may be a promising anti-aging strategy."

The study, titled "Taurine deficiency as a driver of aging," is published in Science.


Provided by Columbia University Irving Medical Center

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