A common, cat-borne parasite already associated with risk-taking behavior and mental illness in humans may also contribute to exhaustion, loss of muscle mass, and other signs of "frailty" in older adults, suggests
a study published Nov. 6 in the Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences.

The research, by an international team of scientists including University of Colorado Boulder, University of Maryland School of Medicine and the University of A Coruña in Spain, is the latest to explore how the tiny, single-celled organism Toxoplasma gondii (T. gondii) could have big impacts on human health.

"We often think of T. gondii infection as relatively asymptomatic, but this study highlights that for some people it may have significant health consequences later on," said co-author Christopher Lowry, a professor in the Department of Integrative Physiology at CU Boulder.

Approximately 11% to 15% of people in the U.S. have been infected with T. gondii at some point and rates tend to be far higher in older individuals. In some countries, more than 65% have been infected. Once infected, people can unknowingly harbor the parasite for life.

For the study, the team examined the blood of 601 Spanish and Portuguese adults over age 65, along with measures of a common geriatric syndrome known as "frailty"—which includes unintentional weight loss, tiredness, loss of cognitive sharpness and other indications of declining health.

A whopping 67% of study subjects were "seropositive" showing markers in their blood of a latent infection.

The researchers did not, as they originally hypothesized, find an association between any infection to T. gondii and frailty. But they did find that, among those infected, those with higher "serointensity" or a higher concentration of antibodies to the parasite, were significantly more likely to be frail.
Higher serointensity could reflect a more virulent or widespread infection, multiple infections or recent reactivation of a latent infection, the authors said.

"This paper is important because it provides, for the first time, evidence of the existence of a link between frailty in older adults and intensity of the response to T. gondii infection," said co-author Blanca Laffon, a professor of psychobiology at the Interdisciplinary Center of Chemistry and Biology at University of A Coruña.

**How cats spread T. gondii**

Wild and domestic felines are considered the definitive host of the parasite, while warm-blooded animals like birds and rodents serve as secondary hosts: When cats eat infected animals, T. gondii takes up residence and multiplies in their intestines, shedding eggs in their feces.

People are typically infected via exposure to those eggs (via litter boxes, contaminated water or dirty vegetables) or by eating undercooked pork, lamb or other meat that's infested. Most people never know they've been infected, with only about 10% initially having brief flu-like symptoms. But T. gondii tends to linger dormant for decades, cloaked in cysts in muscle and brain tissue (specifically the emotion-processing region known as the amygdala) with some insidious impacts, mounting research suggests.

In a creepy evolutionary trick seemingly designed to benefit the parasite's favorite host, rodents infected with T. gondii tend to lose their fear of felines, making it easier for cats to catch rats and mice. In the wild, infected chimpanzees have been shown to actually grow attracted to the smell of the urine of their feline predator, the leopard.

People who have been infected also tend to engage in risky behavior,
with research showing they tend to be more impulsive, more entrepreneurial and more likely to get in a car accident. They also have higher rates of schizophrenia, certain mood disorders, cognitive problems and are more likely to attempt suicide, according to research by Lowry and Dr. Teodor Postolache, a professor in the Department of Psychiatry at University of Maryland School of Medicine and senior author on the new study.

A declining immune response?

The authors caution that the new study does not prove that exposure to T. gondii causes frailty, but rather identifies a compelling association that warrants further study. They found that frail people with high T. gondii seropositivity also had higher levels of certain inflammatory markers, suggesting that infection with the parasite could exacerbate inflammation that already occurs with aging—a.k.a. "inflammaging."

Because latent T. gondii tends to hide out in muscle tissue, Postolache suspects it could also play a role in hastening sarcopenia, or age-related muscle wasting.

Lowry's research centers around the impact microorganisms have on the immune system and, thus, mental health. He notes that many microbes that humans have evolved with impact health in a positive way—a theory known as the Old Friends hypothesis.

Even T. gondii may have health benefits we aren't yet aware of, he said.

But in some cases, a switch flips, and friends become enemies.

In the case of T. gondii, certain medications or immune compromising diseases like HIV or cancer can enable a latent infection to escape suppression and reactivate, with adverse effects. Even in people with
healthy immune systems, Lowry notes, immune function can decline with age, potentially enabling dormant T. gondii to rear up.

The researchers hope their study will inspire more research into the relationship between T. gondii and frailty, and ultimately lead to new ways of keeping the parasite from doing harm.

For now, they encourage people—especially pregnant, elderly and immune compromised people— to take steps to avoid infection.

**Prevention strategies**

- Change litter box daily, and wash hands afterward.
- Avoid eating undercooked meat.
- Rinse fruits and vegetables.
- If pregnant or immunocompromised:
  - Avoid changing the litter box if possible (T. gondii infection during pregnancy can cause serious problems to a developing fetus).
- Keep cats indoors.
- Avoid stray cats.


Provided by University of Colorado at Boulder

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