White-tailed deer blood shown to kill bacteria that causes Lyme disease

March 30 2023

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As tick season kicks in across the country, the executive director of the University of Massachusetts Amherst-based New England Center of Excellence in Vector-Borne Diseases (NEWVEC) and his team have completed research that offers a promising lead in the fight against Lyme disease.

The study, published recently in the journal *Vector-borne and Zoonotic Diseases*, demonstrates that the blood of the white-tailed deer kills the corkscrew-shaped bacterium that causes Lyme disease, a potentially debilitating illness. The Centers for Disease Control and Prevention (CDC) estimates that each year some 476,000 people are diagnosed with and treated for Lyme, the most common vector-borne disease in the U.S.

"Deer are vitally important to the survival of deer ticks, but they are not involved with transmitting the Lyme bacteria, Borrelia burgdorferi," explains senior author Stephen Rich, professor of microbiology. "We've known for some time that ticks taken from white-tailed deer are not infected, and we speculated that something about the deer prevented those ticks from becoming infected. But until publication of our paper, no one had done the experiment to show that deer blood—specifically the serum component of white-tailed deer blood—kills Lyme."

The results of the study may one day lead to new strategies and approaches for Lyme disease prevention and treatment, says lead author Patrick Pearson, a Ph.D. student in NEWVEC, whose upcoming doctoral examination focuses in part on this research.

"In these experiments we determined that white-tailed deer serum kills the Lyme bacterium. The next important question will be to understand exactly how deer blood kills Lyme bacteria," Pearson says.

The Lyme disease bacterium is passed to juvenile blacklegged (Ixodes scapularis) deer ticks from mice the arthropods feed on. The infected ticks then pass the bacterium on to humans when they feed on people.

"We are the accidental host," Rich says. "The ticks that bite us are actually looking for a deer because that's where they breed. Without the deer, you don't have ticks. But if you had only deer, you wouldn't have any Lyme."

To carry out their experiment, the researchers obtained blood serum from a semi-captive white-tailed deer herd at Auburn University in Alabama. The deer were believed to have no exposure to ticks and the bacteria that causes Lyme disease.

The researchers then grew the Lyme disease germ in test tubes and added the deer serum. "And lo and behold, it killed the bacteria," Rich says. "Whatever it is in the deer that's killing the germ is part of the innate immune system, a part of the immune system that precedes antibodies."

Pearson adds, "The Lyme bacterium has proteins on its surface that protect it from the human innate immune system. Deer blood is somehow different such that Lyme bacteria are apparently unable to protect themselves from the innate immune system of white-tailed deer."

The next research step is to determine the precise mechanisms in deer blood that kill the bacteria.

"We'd like to determine if it's something we can induce in humans," Rich says. "Or maybe we could use this somehow to our advantage to reduce the incidence of Lyme disease in the wild."

More information: Patrick Pearson et al, White-Tailed Deer Serum Kills the Lyme Disease Spirochete, Borrelia burgdorferi, *Vector-Borne and Zoonotic Diseases* (2023). DOI: 10.1089/vbz.2022.0095

Provided by University of Massachusetts Amherst