Tick-related disease thrives on cholesterol, study suggests

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People who have high cholesterol levels may be much more susceptible to a particular disease transmitted by the bites of ticks, a new study in mice suggests.

Scientists infected mice with Anaplasma phagocytophilum, the bacterium that causes human granulocytic anaplasmosis (HGA), a disease with flu-like symptoms. Bacteria levels were 10 times greater in mice that were genetically predisposed to high cholesterol levels and that were also fed a high-cholesterol diet.

The results confirmed what the researchers had suspected – that A. phagocytophilum depends on its host's cholesterol stores for its survival.

The implication is that the higher a person's cholesterol levels, the more susceptible that person may be to developing a severe case of HGA, said Yasuko Rikihisa, the study's lead author and a professor of veterinary biosciences at Ohio State University.

Yet HGA is difficult to accurately diagnose, as symptoms are similar to those of the flu and include high fever, muscle aches, chills and headaches. But in some cases misdiagnosis can be devastating.

“Young, healthy people probably don't develop very severe symptoms,” Rikihisa said. “But left undetected, the infection could kill an older person or someone with a weakened immune system.”

She added that immune function slowly declines and blood cholesterol levels typically increase as we age.

The researchers report their findings in a recent issue of the Journal of Infectious Diseases. Rikihisa conducted the study with Qingming Xiong and Xueqi Wang, both graduate students in Rikihisa's laboratory.

Experts say that HGA is on the rise in the United States , where anywhere from 400 to more than 1,000 people contract the disease each year. It is transmitted by the bite of Ixodes scapularis, or deer tick. Deer ticks also spread Lyme disease, and are found primarily in the upper Midwest, New England, parts of the mid-Atlantic States and northern California.

The disease attacks immune cells called granulocytes, which the body normally uses to destroy infectious pathogens.

In the current study, Rikihisa and her colleagues studied two groups of mice. Animals in one group lacked a protein important for maintaining normal blood cholesterol levels, while mice in the other group had this protein, called apoliprotein E (apoE).

For about a month several mice from each group ate a diet high in cholesterol, while the rest of the animals ate a diet with normal cholesterol levels. At the end of the month, some of the mice from each feeding group were infected with A. phagocytophilum.

Ten days after infecting the mice, the researchers collected blood samples from each mouse and also harvested each animal's spleen and liver. They determined the extent of the infection based on the amount of bacteria found in each tissue. Since the spleen and liver both filter blood, and the liver makes and stores cholesterol, the researchers thought that they may find higher concentrations of bacteria in these organs.

A. phagocytophilum levels were 10 times higher in mice predisposed to high blood cholesterol levels and that ate the high-cholesterol diet than in any other group of mice, including the animals that were predisposed and ate a normal-cholesterol diet.

Bacterium levels were highest in the blood and the spleen, and were quite low in the liver of any of the

mice.

Cholesterol levels increased four times in the mice that ate the high-cholesterol diet and that were predisposed to high cholesterol. Yet cholesterol levels remained normal in the mice which had the cholesterol predisposition but consumed the normal-cholesterol diet.

Some people have mutations in the apoE gene, which controls apoE production. As a result, they cannot adequately maintain blood cholesterol. In humans, this mutation can cause blood cholesterol levels to significantly increase when they eat a diet high in cholesterol, Rikihisa said.

“A high-cholesterol diet really boosted infection levels in the mice without apoE,” Rikihisa said. “The findings suggest that humans may be more susceptible to HGA if they eat a high-cholesterol diet and if they are otherwise prone to high blood cholesterol levels.”

Studies by other researchers have found a link between older age and the level of A. phagocytophilum infection. In one study, infected patients averaged 51 years old, while 39 was the average age for a person infected with Lyme disease.

“Our blood cholesterol levels generally rise as we age,” Rikihisa said. “Someone who suspects he was bitten by a tick needs to seek prompt antibiotic therapy. Additionally, lowering cholesterol levels through diet or with medication may help decrease the chance of developing HGA, or at least reduce the severity of its symptoms.”

Source: Ohio State University