Caffeine prevents multiple sclerosis-like disease in mice

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Mice given caffeine equivalent to a human drinking six to eight cups of coffee a day were protected from developing experimental autoimmune encephalomyelitis (EAE), the animal model for the human disease Multiple Sclerosis (MS), according to researchers at Cornell University.

Caffeine is a well-known adenosine receptor blocker, and the researchers believe results show the importance of this molecule in permitting the infiltration of immune cells into the central nervous system of patients with MS.

Dr. Jeffrey H. Mills, a postdoctoral associate in the laboratory of Dr. Margaret S. Bynoe, presented the findings at Experimental Biology 2008 on April 7. The presentation was part of the scientific programs of the American Society of Immunologists.

Multiple sclerosis is an autoimmune disease of the central nervous system (CNS) that occurs when the body's immune system attacks and damages nerves in the brain and spinal cord. The infiltration of immune cells into brain and other CNS tissue is rarely seen in healthy individuals without MS. What allows the immune cells to infiltrate the CNS tissue of patients with MS is unknown. In earlier work, the Bynoe laboratory became convinced that the molecule adenosine is responsible for this infiltration.

Adenosine is widely present in the body and plays an important role in many biochemical processes, such as energy transfer and the promotion of sleep and suppression of arousal. The researchers' first studies found that mice that lacked CD73, the enzyme necessary for synthesizing extracellular adenosine, were protected from developing the mouse form of MS (experimental autoimmune encephalomyelitis or EAE).

Additional studies involving immune cells from mice that lack CD73 further convinced them that normal CD73's ability to synthesize extracellular adenosine was what was important for development and progression of the MS-like disease. That helped explain the presence of adenosine near the cells, but how did the compound get into the CNS cells? Since adenosine must bind to its receptor in order to affect a cell, the researchers reasoned that perhaps adenosine receptor activation was what allowed for entry of immune cells into the brain and spinal cord. To test that idea in the study presented at Experimental Biology 2008, they turned to caffeine.

Caffeine's stimulatory effects on the CNS are in large part due to its ability to bind to the same receptors as adenosine, thus blocking adenosine's ability to affect CNS cells. Mice that consumed caffeine in their drinking water were protected from development of EAE, the MS model. Dr. Bynoe concludes that these experiments show that CD73 and adenosine receptor signaling are required for the efficient entry of immune cells into the CNS during the initiation and progression of EAE in mice and, quite possibly, during the development of MS in humans.

Dr. Bynoe adds, "These results might mark the first in a series of discoveries from our lab that could spawn the impetus for the development of adenosine-based therapies for the treatment of MS."

Source: Federation of American Societies for Experimental Biology