Targeting oxidized cysteine through diet could reduce inflammation and lower disease risk

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A team of scientists at Emory University School of Medicine has identified a direct link between oxidative stress and inflammatory signals in the blood. The finding could lead to improved strategies for preventing several diseases by including antioxidants in the diet and for reducing the impact of inflammation in critically ill patients by adding cysteine to intravenous or tube feeding.

The results are published online this week in the journal PLoS One.

Many normal metabolic functions produce reactive forms of oxygen that can damage cells. Oxidative stress, a disruption of the body's ability to control reactive forms of oxygen, has been connected with heart disease, diabetes and several neurodegenerative diseases.

However, scientists are still learning about the best ways to measure and reduce oxidative stress, says Dean P. Jones, PhD, professor of medicine and director of the Clinical Biomarkers Laboratory at Emory University School of Medicine. For example, large-scale clinical trials have shown little benefit in supplementing the diet with antioxidants such as vitamins C and E.

Jones and his colleagues, including Thomas R. Ziegler, MD of the Emory Department of Medicine, have been concentrating on a measure of oxidative stress in the blood: cysteine, an amino acid found in most

proteins in the body. Cysteine can exist in two forms: oxidized and reduced. The higher the level of oxidative stress outside the cell, the more oxidized cysteine there is. Other indicators such as glutathione are more important inside cells.

Several studies have shown that levels of oxidized cysteine in the blood tend to rise as people age. Smoking and alcohol consumption are also linked with higher levels of oxidized cysteine. In addition, Jones and Ziegler have found that critical illness and malnutrition are associated with oxidative stress and oxidized cysteine in the blood.

Working with Jones, graduate student Smita Iyer and immunologist Mauricio Rojas, MD, found that a high level of oxidized cysteine drives white blood cells to send out inflammatory messages in the form of the protein IL-1 beta.

The researchers used a mouse model of sepsis to test the effects of dietary cysteine on reducing inflammation. They treated the mice with LPS, which mimics the inflammatory effect of bacteria on the human immune system and causes an increase in the level of IL-1 beta. When they supplemented the diet of the mice with cysteine, however, IL-1 beta levels dropped, thus blunting the impact of a sepsis-like inflammation.

In a subsequent study of healthy, but overweight adult volunteers with an average age of 62, IL-1 beta levels also rose and fell in association with the amount of dietary cysteine.

"Our research shows a direct mechanistic link between the oxidative stress biomarker (cysteine redox potential) and pro-inflammatory cytokines, which have been linked to multiple age-related and chronic diseases," says Jones. "Our group and others have already established that cysteine redox potential is oxidized with aging and with a number of health risk factors. This suggests that one could target cysteine redox

potential as a means to decrease chronic proinflammatory signaling as an intervention for age-related diseases and for the acute inflammation of sepsis or lung injury."

The researchers plan to continue studying the relationship between cysteine and markers of inflammation in different age groups, in overweight and normal weight individuals and in critically ill patients requiring intravenous feeding.

More information: "Cysteine Redox Potential Determines Pro-Inflammatory IL-1b Levels." *PLoS One*, published online March 27, 2009.

Source: Emory University (news : web)