

Vitamin E loss through smoking increases health risks

New studies in the Linus Pauling Institute at Oregon State University have shown that vitamin E disappears more quickly in smokers than in non-smokers - findings that may help explain how smoking can cause cancer.

The research, published in the American Journal of Clinical Nutrition, was done in a controlled study of a group of smokers and non-smokers, with diet and most other factors largely the same. By monitoring "labeled" vitamin E, it was found that the blood plasma levels of this essential nutrient dropped 13 percent faster among smokers than among the non-smokers, depleting it much more quickly. The study also demonstrated in humans an important interactive relationship between vitamins C and E, showing for the first time how inadequate levels of vitamin C can cause further and faster depletion of vitamin E.

Together, these scientists say, the research is providing significant insight into how smoking might cause cancer, and how the loss of protective antioxidant vitamins can play a role in this process.

"Cigarette smoke is an oxidant, creating free radicals that are associated with increased oxidative stress, cell mutations, and can lead to such diseases as cancer, heart disease and [diabetes](#)," said Maret Traber, a professor in OSU's Linus Pauling Institute and a national expert on vitamin E. "In lung tissue, vitamin E is one of the first lines of defense against the free radicals generated by cigarette smoke."

It has been known for some time that cigarette smoking reduced blood levels of vitamin C, Traber said, but the data were less clear on vitamin E - it did not appear that there were significant differences in the blood plasma levels of vitamin E between smokers and non-smokers.

But researchers now believe what is happening is that vitamin E is being depleted from tissue concentrations in order to keep up its levels in the blood, leaving the tissues - including those of the lungs - particularly vulnerable to attack by toxins and free radicals. The new studies support that thesis, say Traber and Richard Bruno, also an LPI researcher.

"The liver has a protein that helps to regulate blood concentrations of vitamin E, and while the blood plasma levels may be the same, it appears the tissues are being depleted," Bruno said. "Our research makes it clear that smokers must receive more vitamin E than non-smokers in order to achieve the same overall levels in the body. If the blood levels are the same, and vitamin E is leaving the blood faster, then the tissues must be depleted."

In simple terms, this may mean that with smokers, their diet may be normal but they will have increased usage of vitamin E, and they are at risk of losing its protective effects.

The interaction of vitamin C and E is another part of the puzzle, the scientists said.

"Both vitamins C and E are antioxidants with related roles, but vitamin C is water

soluble and vitamin E is fat soluble," Traber said. "Vitamin C is found outside cell membranes while E is inside the membranes."

In practice, the scientists believe that vitamin E often plays the first role in intervening against free radicals and preventing membranes from becoming oxidized - but in the process, vitamin E itself can be made into a radical. If adequate vitamin C is present, it can help the vitamin E return to non-radical form. But without adequate levels of vitamin C in the body, vitamin E in tissues can quickly decline, Traber said.

"We've now shown this interaction among these two antioxidants in the human body for the first time, an important step forward," Traber said. "Smokers with the lowest vitamin C levels have the fastest disappearance of vitamin E. This is complex biochemistry, but it's part of our body's natural defense mechanism against toxins."

Plants, Traber said, will produce more vitamin E to protect themselves when they are under stress. Humans do not have the ability to do that, and must obtain the nutrient from their diet. When certain agents, such as cigarette smoke, place the body in a condition of constant oxidative stress, the stage can be set for disease, the researchers believe.

Nearly 50 million Americans smoke cigarettes. And some of the most common sources of vitamin E in the diet - oils, fats, desserts - have been steadily reduced in recent years in the move towards low-fat diets. At least partly as a result, studies show that only 8 percent of men and 2.4 percent of women in the U.S., regardless of smoking status, have adequate dietary intake of vitamin E.

For protection, vitamin E must be present before free radical damage occurs, the OSU researchers say. It cannot be ingested later and expected to repair all the damage.

"There has been practically a war going on in the science community for some time now about the value of vitamin E, but much of what gets lost in the debate is the distinction between preventing a serious disease and being able to cure it," Traber said. Some recent studies, often done with sick or elderly people, were unable to demonstrate a health benefit from vitamin E supplementation, Traber said. One recent analysis even concluded that vitamin E might be dangerous.

"Some people have the inaccurate notion that moderate supplementation with vitamin E will hurt you, and that simply is not true," Traber said. "What's increasingly clear is that many people have health habits, such as smoking or poor diet, which can leave them with inadequate levels of vitamin E. And vitamin E has clear value in helping to prevent serious degenerative disease."

Contact: Maret Traber
maret.traber@oregonstate.edu
541-737-7977
Oregon State University
<http://www.orst.edu>