

Hello, this is Kevin O'Donovan, and I'd like to welcome you to the National Institute of Environmental Health Sciences Superfund Research Program monthly Research Brief podcast.

This month, we're discussing how nicotine in peppers and other vegetables may reduce Parkinson's disease risk.

The Research Brief, Number 223, was released on July 3, 2013, and was written by SRP contractor Sara Mishamandani in conjunction with SRP-supported researchers Susan Searles Nielsen and Harvey Checkoway.

Eating nicotine-containing vegetables, mainly peppers, may provide a protective effect against Parkinson's disease (or PD), according to new research from the University of Washington Superfund Research Program. Based on studies consistently suggesting that smokers are less likely than non-smokers to develop PD, Susan Searles Nielsen, Ph.D., led a study to explore other sources of nicotine that might have effects similar to active smoking, such as vegetables from the same plant family as tobacco, including peppers, tomatoes, and potatoes.

PD is a progressive and debilitating disorder that impairs movement. Researchers believe PD is caused, in part, by environmental exposures. Although specific causal exposures for human PD remain to be identified, suspects include various pesticides and metals found at many Superfund hazardous waste sites. For decades, researchers have observed a surprising, yet consistent, epidemiologic pattern: those who have smoked cigarettes have a reduced PD risk (about half) compared to those who have never smoked.

Harvey Checkoway, Ph.D., Director of the University of Washington SRP, conducted a population-based case-control study that included 490 newly diagnosed PD cases and 644 unrelated, neurologically normal controls. The study confirmed the predicted strong inverse relationship between active tobacco smoking and PD risk. To determine whether nicotine, among the hundreds of chemicals in tobacco smoke, is the neuroprotective agent as suggested by animal studies, Searles Nielsen began exploring other sources of nicotine that might have similar effects as active smoking.

First, Searles Nielsen examined the relation between PD and environmental tobacco smoke exposure at home and work, based on self-reports by cases and controls. Environmental tobacco smoke, whether occurring at home or at work, appeared to be as strongly inversely associated with PD as active smoking. However, it remained unresolved whether a truly protective effect of tobacco smoke underlies these associations, and cigarette smoke is generally detrimental to health, accounting for an estimated 443,000 deaths each year in the United States.

Searles Nielsen then investigated whether other relatively modest sources of nicotine would demonstrate an inverse association with PD. Drawing on participants' self-reported lifetime dietary data, frequency of consumption of foods from the same plant family as tobacco,

Solanaceae, was inversely associated with PD risk, even though consumption of all other vegetables combined was not.

The potentially protective effect was strongest for peppers. Compared to study participants who ate peppers less than once a week, people who ate peppers 2-4 times per week had a 30% reduced risk of PD, and those who ate them even more frequently had a 50% reduction. The dose-response association was mainly evident in people who had never smoked, consistent with a low-dose nicotine effect being over-shadowed by the substantially higher doses received by smokers.

According to Searles Nielsen, nicotine may be protective because of its interaction with nicotinic acetylcholine receptors on dopaminergic neurons, the type of cells lost in PD. Additionally, other *Solanaceae* phytochemicals structurally similar to nicotine, such as anatabine, exhibit anti-inflammatory properties. Neuroinflammation is widely acknowledged as a potentially important pathogenesis mechanism in PD.

“If it turns out that a small amount of nicotine is indeed somehow beneficial with respect to PD, it is certainly good news that peppers and tomatoes are sources of vitamins A and C, instead of the known cancer-causing chemicals in tobacco,” said Searles Nielsen.

The authors recommend further studies to confirm and extend their findings, which could have important implications for elucidating PD pathogenesis and ultimately for disease prevention.

If you'd like to learn more about this research, visit the Superfund Research Program website at www.niehs.nih.gov/srp. From there, click on “Who We Fund” and follow the links to the University of Washington research summary. If you have any questions or comments about this month's podcast or if you have ideas for future podcasts, contact Maureen Avakian at avakian@niehs.nih.gov.

Join us next month as we discuss more exciting research and technology developments from the Superfund Research Program.