

# High Doses of Antioxidants May help Prevent Hearing Loss

Colleen Le Prell, Ph.D., and Josef Miller, Ph.D., of the U-M Kresge Hearing Research Institute. Credit: U-M Photo Services

Colleen Le Prell, Ph.D., of the University of Michigan's Kresge Hearing Research Institute, has found that high doses of certain antioxidants reduces noise-induced hearing loss in animals when taken both before and after loud noise.

Dr. Le Prell was supported by a grant from the American Hearing Research Foundation in 2005, when she was studying the auditory nerve. Her work using this grant has led to her new research.

Dr. Le Prell's new research, which was conducted in collaboration with Joseph Miller, Ph.D., revealed that a combination of high doses of vitamins A, C, and E and magnesium, taken one hour before noise exposure and continued as a once-daily treatment for five days, was very effective at preventing permanent [noise-induced hearing loss](#) in guinea pigs. The animals had prolonged exposure to sounds as loud as a jet engine at take-off at close range. Her study was recently published online in the journal [Free Radical Biology and Medicine](#).

Previously, it was believed that loud sounds or noise damaged hearing by directly destroying the inner ear's sensory hair cells by intense vibration. More recent studies indicate that noise exposure damages sensory cells by the formation of free radicals, damaging molecules known to cause cell death. Le Prell's research shows that damage to the sensory cells can be prevented by antioxidants that prevent free radical damage by binding to free radical molecules and rendering them harmless.

The formulation the researchers used built on earlier animal studies showing that single antioxidant vitamins were somewhat effective in preventing hearing loss, and on studies of Israeli soldiers given magnesium many days prior to exposure, who gained relatively small protective effects.

The researchers measured noise-induced hearing loss in four groups of guinea pigs treated with the antioxidant vitamins A, C and E, magnesium alone, an ACE-magnesium combination, or a placebo. The treatments began one hour before a five-hour exposure to 120 decibel (dB) sound pressure level noise, and continued once daily for five days.

The group given the combined treatments of vitamins A, C and E and magnesium showed significantly less noise-induced hearing loss than all of the other groups. Noise-induced sensory cell death was also reduced in the group given the combined treatment.

"Vitamins A, C and E and magnesium worked in synergy to prevent cell damage," explains Dr. Le Prell. According to the researchers, pre-treatment presumably reduced reactive elements called free radicals that form during and after noise exposure and noise-induced constriction of blood flow to the inner ear, and may have also reduced neural excitotoxicity, or the damage to auditory neurons that can occur due to over-stimulation. The post-noise nutrient doses apparently "scavenged" free radicals that continue to form long-after after this noise exposure ends.

In the past 10 years, scientists have learned that noise-induced hearing loss occurs in part because cell mitochondria in the ear churn out damaging free radicals in response to loud sounds. “Free radical formation bursts initially, then peaks again during the days after exposure,” explains Le Prell.

The antioxidant vitamins and magnesium used in the study are widely used dietary supplements, not new drugs, and therefore they don’t require the extensive safety tests required for new drug entities prior to use in clinical trials. Human trials are expected to begin within two to three months with soldiers in urban combat training exercises, and doses of the micronutrients will be within the ranges considered safe according to the Institute of Medicine and federal nutrition guidelines.

“Other people would likely benefit by consuming a pill or nutritional bar before going to work in noisy environments, or attending noisy events like NASCAR races or rock concerts, or even using an iPod or other music player,” says Le Prell. “Based on an earlier study with other antioxidant agents, we think this micronutrient combination will work even post-noise.”

That study suggested a “morning after” treatment that might minimize hearing damage for soldiers, musicians, pilots, construction workers and others — even if they don’t take it until after they experience dangerous noise levels.

If effective, such pre- and post-noise treatments could have far-reaching effects. About 30 million Americans regularly experience hazardous noise levels at work and at home, according to the National Institute on Deafness and Communications Disorders. Hunting, snowmobiling, using machines such as leaf blowers, lawnmowers and power tools, and attending or playing in loud music concerts commonly expose people to dangerous noise levels. Noise levels above 85 decibels damage hearing. About 28 million Americans have some degree of hearing loss. For about a third of them, noise accounts at least in part for their loss.

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Note: the antioxidant formula offered by Sound Therapy International is three times more powerful than the combination used in this study since it contains not only first generation but also second and third generation anti-oxidants.