

Toxicology Final

A. Environmental Toxicants

DEET – (N,N-Diethyl-meta-toluamide) It is the most common active ingredient in insect repellents. It is intended to be applied to the skin or to clothing, and provides protection against mosquitos, ticks, fleas, chiggers, leeches, and many other biting insects.

- Absorption - Studies have found that the dermal absorption of DEET in intact human adult skin is between 5% and 17% of the applied dose.
- Distribution - Studies determined the effects of the insect repellent in male and pregnant mice. After the dose was given via injection, high tissue concentrations of DEET were found in the liver, kidney, lacrimal gland and nasal mucosa.
- Metabolism - One pathway involves oxidative hydroxylation of the aromatic methyl group in the meta position, yielding N,N-diethyl-m-hydroxymethylbenzamide. The second pathway involves dealkylation of an N-ethyl group, producing N-ethyl-m-toluamide. Subsequent oxidation or hydroxylation can then yield additional metabolites.
- Excretion - Excretion studies using radiolabeled DEET in humans showed that 3.8% to 8.33% of the applied dose of DEET is recovered from the urine. The majority of the applied radioactivity was recovered in skin rinses.

Reference:

ATSDR. Agency for Toxic Substances and Disease Registry, 14 Aug. 2008. Web. 14 June 2015. <<http://www.atsdr.cdc.gov/consultations/deet/index.html>>.

B. Food Toxicants

HCAs are chemicals formed when muscle meat, including beef, pork, fish, or poultry, is cooked using high-temperature methods, such as pan frying or grilling directly over an open flame. MeIQx (2-amino-3,8-dimethylimidazo[4,5-f]quinoxaline) is a type of HCA that is oxidized to hydroxyamino derivatives by cytochrome P450s, and further converted to ester forms by acetyltransferase and sulfotransferase. Eventually, they produce DNA adducts through the formation of N-C bonds at guanine bases and can lead to DNA damage and mutations.

High intake of HCAs, particularly red and processed meat cooked at high temperatures, has been associated with an increased risk of a number of common cancers,

such as cancers of the breast, colorectum, pancreatic and prostate. MeIQx has been found to be carcinogenic in both mice and rats. In the mouse, MeIQx induces liver and lung tumors, lymphomas, and leukemias, whereas in the rat it causes tumors in the liver, the skin, the zymal gland, and the clitoral gland.

Reference:

Gooderham, Nigel J., et al. "Food-derived heterocyclic amine mutagens: variable metabolism and significance to humans." *Drug Metabolism and Disposition* 29.4 (2001): 529-534.

C. Drug-Nutrient Interactions

Stomach acid is very important to maintain a balance in the healthy digestion of food and nutrients. The breakdown and absorption of nutrients occurs at an optimum rate only within a narrow range of acidity in the stomach. If there isn't enough acid, the normal chemical reactions required to absorb nutrients is impaired. Over time this can lead to diseases such as anemia, osteoporosis, cardiovascular disease, depression, and more.

When food is eaten, the secretion of stomach acid triggers the production of pepsin. Pepsin is the enzyme required to digest protein. If stomach acid levels are depressed, so are pepsin levels. As a result, proteins don't get broken down into their component amino acids and peptides. This can lead to a deficiency of essential amino acids, which in turn may lead to chronic depression, anxiety and insomnia. As acid declines and the pH of the stomach increases, absorption of nutrients becomes impaired. Having low stomach acid, whether it occurs on its own or as a result of using antacid drugs, reduces absorption of several key nutrients such as iron, B12, folate, calcium and zinc.

An alternative to antacids is to try using apple cider vinegar. The slightly lower pH of the vinegar will slightly reduce the pH of the stomach acid. This will allow the stomach acid to still break down the food, but will have fewer complications since the pH will be lower. Take a tablespoon of apple cider vinegar, and chase it with a glass of water. Stomach churning and pain should subside within minutes, unless the problem is ulcers. Another alternative to antacids would be to exercise more frequently and lose weight. This has been shown to improve symptoms that people normally take antacids for in the first place such as heartburn and indigestion.

Reference:

Antacids. International Foundation for Functional Gastrointestinal Disorders, 12 Sept. 2014. Web. 14 June 2015. <<http://www.iffgd.org/site/manage-your-health/diet-treatments/antacids>>.

D. Personal Care Products

Aluminum chlorohydrate is the active ingredient in many anti-perspirant deodorants. The average concentration is 10-25% and works by having the aluminum ions pass into cells in the top layer of the skin which lines sweat gland ducts and water passes in with them. This causes the cells to swell, squeezing the ducts closed so that the sweat cannot get out.

Because aluminum compounds in antiperspirants create a chemical reaction with your sweat and clumping to clog your sweat glands, it may cause irritation in sensitive underarm areas. This may result in allergic reactions like contact dermatitis, acne or itching. Some research has suggested that these aluminum compounds may be absorbed by the skin and cause changes in estrogen receptors of breast cells. Because estrogen can promote the growth of both cancer and non-cancer breast cells, some scientists have suggested that using the aluminum-based compounds in antiperspirants may be a risk factor for the development of breast cancer. Aluminum toxicity may also lead to nerve damage, kidney damage and osteomalacia, and has been linked to increased instances of Alzheimer's.

Alternatives to using aluminum anti-perspirant deodorants would be to look for deodorants that do not contain any aluminum compounds. Some companies that advertise that they are aluminum free are Nature's Gate and Tom's of Maine products.

Reference:

"Antiperspirants and Breast Cancer Risk." *Antiperspirants and Breast Cancer Risk*. American Cancer Society, 14 Oct. 2014. Web. 14 June 2015.

<<http://www.cancer.org/cancer/cancercauses/othercarcinogens/athome/antiperspirants-and-breast-cancer-risk>>.