

The dose makes the poison: understanding chemicals in everyday life

Inaccurate claims about the dangers of chemicals are prevalent in the media. Allegations that our cereals are contaminated with pesticides, the Dirty Dozen list instilling fear about eating fruits and vegetables, and the myth that glyphosate is responsible for a long list of ailments are just a few examples. Claims like these are exacerbating a phenomenon known as chemophobia, a fear of chemicals at any level.



What are chemicals?



A chemical is any material substance with a unique chemical composition and characteristic properties. From the soil we walk on, to the food we eat, the air we breathe, and even our own bodies, our entire universe is made up of chemicals. Life wouldn't exist without chemistry!










The dose makes the poison

The fundamental principle of toxicology, "the dose makes the poison," underscores that any substance can be toxic if consumed in a large enough quantity.

In science, toxicity refers to an exposure that might cause harm to an organism. Chemicals have varying levels of toxicity – meaning, some chemicals are toxic at very low doses while others would require a much larger dose to cause harm. Whether a chemical is naturally occurring or synthetically produced does not impact its level of toxicity.

Many items we consume everyday such as salt, baking soda and coffee are perfectly safe at the levels we eat but at a high enough dose they can be lethal.



Substance	Toxic Category	Lethal Dose* LD50 (mg/kg)**
 Botulin	Super Toxic	0.00001
 Vitamin D	Extremely Toxic	10
 Caffeine	Very Toxic	192
 Copper Sulphate pesticide used in organic production	Very Toxic	481
 Acetaminophen pain killer	Moderately Toxic	1,944
 Sodium Chloride table salt	Moderately Toxic	3,000
 Glyphosate weed killer	Slightly Toxic	5,600
 Ethanol alcohol	Slightly Toxic	7,000
 Sucrose sugar	Practically Non-Toxic	30,000

* Acute toxicity/one time dose. Smaller numbers = greater toxicity

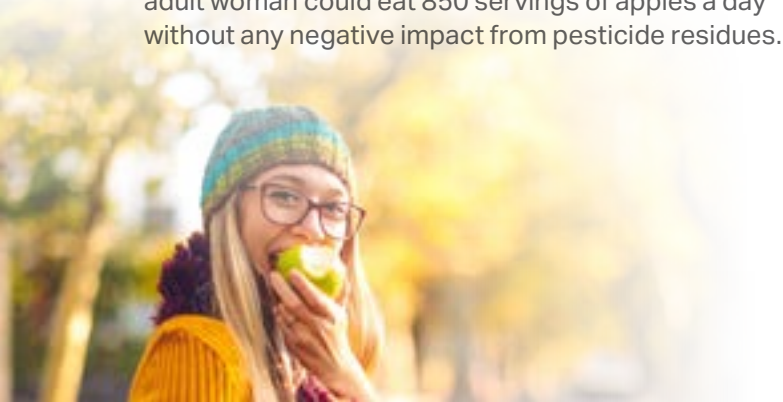
** Dose that is lethal to 50% of test animals

Pesticide residues debunked

Pesticides are a tool farmers use to grow healthy, abundant crops by protecting them against insects, weeds and diseases. Both organic and conventional farmers rely on pesticides, all of which are stringently regulated in Canada.

Health Canada's Pesticides Regulatory Directorate (PRD) determines the maximum concentration of pesticide residues legally permitted on food products, called Maximum Residue Limits (MRLs). MRLs are set far below the levels that could cause harm to human health.

Simply being able to detect a residue on a food item does not mean there is cause for concern. Regulatory agencies take into account how much potential exposure a person could have to a pesticide to accurately assess the risk. To put this into context, an adult woman could eat 850 servings of apples a day without any negative impact from pesticide residues.



The appeal to nature fallacy

It is a common misconception that natural chemicals are safer than synthetic ones. Substances sourced from nature or created in the lab are both made up of chemicals, and each have the potential to be toxic.

Take copper sulfate, for example. This pesticide, used in organic farming to control fungi and bacteria, is naturally occurring in minerals. Ingesting just 0.011 grams per kilogram can be fatal to humans, which equates to 0.77 grams for a 70 kg adult. For comparison, a quarter teaspoon of granulated sugar is about 1 gram.



Copper Sulphate
0.011 g/kg

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Fatal to Humans



Chemicals in our food supply

Everything we eat is made up of a variety of chemicals, even foods marketed as "natural" or "organic". Even an "all natural" strawberry contains a variety of chemical compounds that contribute to their flavor, aroma, and nutritional profile.

Chemical makeup of a strawberry:

pelargonidin 3-glucoside, cyanidin 3-glucoside, cyanidin 3-rutinoside, pelargonidin 3-galactoside, pelargonidin 3-rutinoside, pelargonidin 3-arabinoside, pelargonidin 3-malyglucoside Quercetin, kaempferol, fisetin, their glucuronides, glycosides, catechin, proanthocyanidin B1, proanthocyanidin trimer, proanthocyanidin B3 Sanguin H-6, ellagitannin, ellagic acid, lambertianin C, galloylbis-hexahydroxydiphenoyl-glucose, sanguin H-6, ellagitannin, ellagic acid, lambertianin C, galloylbis-hexahydroxydiphenoyl-glucose 4-coumaric acid, p-hydroxybenzoic acid, ferulic acid, vanillic acid, sinapic acid, vitamin C, vitamin B9, 4-coumaric acid, p-hydroxybenzoic acid, ferulic acid, vanillic acid, sinapic acid, vitamin K, manganese, magnesium, phosphorus, calcium, glucose, fructose, and sucrose, fibers.

In an age where fear of chemicals is often amplified by misinformation, it's crucial to understand that everything around us, including the food we eat, is made up of chemicals. Understanding the science behind chemicals and their role in our daily lives helps dispel myths and promotes a more informed perspective on food safety.