**The Right Chemistry: Edible insects and antioxidants**

Sensation-seeking headlines like “Eating Ants Could Protect Against Cancer” are clearly unreasonable.

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Any youngster who has been to summer camp will be familiar with “bug juice.” That’s the drink made by dumping fruit-flavoured crystals and sugar into water.

Why bug juice? There are a couple of theories. At camp, the concoction is often made in large buckets and the sugar attracts flies and other bugs. Hence “bug juice.” But there is another possible explanation.

Carmine is a popular red food dye that is extracted from the female cochineal insect. Over the years, there have been all sorts of fruit-flavoured drink mixes that were coloured with cochineal extract, conceivably giving rise to the “bug juice” moniker. Amusingly, there is actually a commercial drink called “Bug Juice,” however, it is coloured with red dye No. 40, not cochineal.

While the origin of the term may be up in the air, it is safe to conclude that nutritionally bug juice doesn’t have much going for it. In the future, though, we may be serving up another type of bug juice, one made from insects, one that may help feed the 9 billion people who will be coming to dinner by 2050. Keeping massive hunger at bay will require a significant increase in food production with some researchers looking to “entomophagy” as an attractive possibility.

The term derives from the Greek “entemon” for insect, and “phagein,” “to eat.” Insects can be very nutritious, are relatively easy to raise, and have a much smaller environmental impact than animal agriculture. A kilo of crickets provides about 200 grams of protein, not much less than the 250 grams found in a kilogram of beef. Furthermore, cattle require about 8 kg of feed to produce 1 kg of meat while crickets can produce the same amount from just 2 kg of feed. Raising crickets instead of cattle requires less land for growing feed, because insects are not particular about their diet and will eat any sort of plant, fruit or vegetable waste that cattle would not eat. Insects also reproduce quickly and only release a tiny fraction of the greenhouse gases produced by cattle. The downside is that in general, our mouths do not water at the thought of eating insects.

However, a study of the antioxidant potential of various creepy crawlies by researchers at University of Teramo in Italy may add some appeal to dining on the little pests. Antioxidants have great commercial appeal, although the surrounding hype generally outdistances the science. The rationale for the importance of these chemicals is that they are capable of donating electrons to electron-poor species such as the notorious “free radicals” produced as byproducts of normal metabolism.

Generally, these rogue species are kept in control by naturally occurring antioxidants such as vitamin C, Vitamin E and glutathione, all capable of satisfying the free radicals’ hunger for electrons. Should that hunger not be satisfied by antioxidants, the free radicals will then endeavour to steal electrons from other molecules such as proteins, fats or nucleic acids. Since electrons are the “glue” that hold molecules together, free radicals can tear these important biomolecules apart resulting in a variety of health issues. That process is termed “oxidative stress” since oxidation is defined as a loss of electrons, which is just what is happening to these biomolecules. In other words, they are being “oxidized.” Free radicals therefore can be referred to as “oxidizing agents” and any species that neutralizes them as “antioxidants.” Oxidative stress occurs when there are more free radicals being produced than can be mopped up by antioxidants.

The Italian scientists studied the antioxidant potential of extracts of a variety of insects such as ants, grasshoppers, caterpillars, silkworms and crickets. They actually didn’t stop at insects, they even looked at tarantulas and scorpions. Surprisingly, the antioxidant capacity of crickets, caterpillars, silkworms and grasshoppers was greater than that of orange juice or olive oil, both of which are good sources of antioxidants.

That finding was seized upon by the media with articles suggesting that incorporating insects into the diet could protect against heart disease and cancer since free radicals have been implicated as a causative factor in these conditions. Sensation-seeking headlines such as the Telegraph’s “Eating Ants Could Protect Against Cancer” were clearly unreasonable.

First, there is precious little evidence that an intake of antioxidants offers protection against cancer. While there is evidence that plant-based diets are associated with a reduced risk of cancer when compared with meat-based diets, it is not clear that it is antioxidants that are responsible. Plants contain hundreds of potentially beneficial compounds, and the answer may actually lie not in what vegetarians and vegans are eating, but in what they are not eating, namely meat.

Second, there is the question of amounts. While a hundred grams of orange juice may have the same antioxidant capacity as a hundred grams of ants or grasshoppers, it is far easier to consume a hundred grams of juice than a hundred grams of insects. I know. I’ve tried it. Maybe putting the bugs in a blender may make for easier consumption, but so far, I have not been able to enlist volunteers to try this antioxidant “bug juice.”

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