

Oxalates in Chaga – A Potential Health Threat
By Michael W. Beug, Chair NAMA Toxicology Committee

In January of 2019, Velma Sterenberg from Yellowknife, Northwest Territories, Canada, wrote to Leon Shernoff and to me with questions about oxalates in Chaga. She collects her own Chaga and makes both tincture and teas. She fairly consistently consumes one cup of Chaga tea and two milliliters of Chaga tincture daily. She believes that both the tincture and the tea have substantially improved her health. However, after learning of Chaga's high oxalate content from Susan Goldhor's 2017 article in *Mushroom the Journal*, she felt the need to warn NAMA members and other medicinal mushroom users about the potential hazards of consuming high levels of Chaga¹. Susan had cited a 2014 Japanese case of Chaga mushroom-induced oxalate nephropathy.² In that case, a 72 year old woman who had been diagnosed with cancer a year earlier had been taking 4-5 teaspoons of powdered Chaga daily for six months. She suffered liver damage and complete, irreversible kidney failure. In Velma Sterenberg's case, she had discovered that consuming both Chaga and high oxalate foods including spinach, beet greens, and almonds results in zinc deficiency symptoms and makes her worry about osteoporosis.

Sources report either that Chaga has high oxalate levels or extremely high levels, but give no values. I found a paper by Savage, *et al.* where they examined the soluble and insoluble oxalate content of six different commercially grown mushrooms in Uppsala, Sweden as well as three forest harvested species (*Cantharellus cibarius*, *Boletus edulis* and *Hydnum repandum*).³ All of the species that they looked at were low in oxalates with cultivated mushrooms testing in the range of 600 to 1,040 mg/kg DM and wild mushrooms testing in the range 260-440 mg/kg DM total oxalates (soluble plus insoluble). The insoluble oxalates (calcium oxalate, magnesium oxalate and iron oxalate) are not absorbed in the digestive system and pass harmlessly in the feces. However, soluble oxalates (potassium oxalate and sodium oxalate), release free oxalate anions which pass in to the blood stream. Free oxalate will bind with any free calcium to produce calcium oxalate crystals potentially resulting in gout, kidney stones, and physical damage to the kidneys while depleting calcium needed for strong bones, *etc.*

Considering only soluble oxalates, we learn from the Savage paper that in cultivated *Agaricus* species, not only are total oxalates low, but 90% are insoluble. Cultivated *Lentinula edodes*, has moderately high total oxalates (just over 1,000 mg/kg DM) but 99% of the oxalates are insoluble, and thus harmless to ingest. Cultivated *Pleurotus ostreatus*, in contrast, had moderate oxalate levels, but 90% were in the soluble form, making it a moderate over-all oxalate risk, a risk level of concern to people with serious gout or serious kidney stone problems, but no worse than foods like chocolate, almonds, cereal grains. Nile and Park examined oxalate levels in twenty species of popular wild edible mushrooms.⁴ All had very low to moderate oxalate levels. They found no soluble oxalates in *Hericium erinaceus*, *Sparassis crispa*, *Boletus edulis*, and *Ganoderma lucidum*. The highest levels of soluble oxalate were found in *Phellinus floriada* (65 mg/kg DM) and in *Morchella conica* (60 mg/kg DM) where the oxalate risk would be rated as moderate.

Finding data on oxalate levels in *Inonotus obliquus*, Chaga, proved very difficult. I failed. Tim Geho, a NAMA toxicology identifier succeeded. Glamočlija *et al.* reported on the oxalate levels in Chaga in a sample from Russia, a sample from Finland and a sample from Thailand.⁵ They performed a hot water extract of each sample (to determine the soluble oxalate levels), and

followed differences between the three samples. The Russian material yielded 1 gram of extract (from 25 g of powdered Chaga) containing 97.6 mg soluble oxalic acid and 24 mg of insoluble oxalic acid which equates to 3,904 mg soluble oxalates/kg DM and 960 mg/kg DM insoluble oxalates/kg DM in Russian Chaga. The material from Finland yielded 2.4 g of extract containing 55.62 mg/g of soluble oxalate and 9.5 mg/g of insoluble oxalates, which equates to 5,340 mg/kg DM of soluble oxalates and 910 mg/kg DM insoluble oxalates in material from Finland. For the Russian material, 97% of the organic acids extracted were soluble and insoluble oxalates. In the Finnish material, 84% of the organic acids were oxalates and 16% was para-hydroxybenzoic acid. In the material from Thailand, a region well outside of the known circumboreal range of Chaga, oxalates comprised only 25% of the organic acids, with 1,710 mg/kg DM soluble oxalates and 350 mg/kg DM insoluble oxalates. The main organic acid in the material from Thailand was para-hydroxybenzoic acid (73.6%) with 0.3% gallic acid and 1.1% protocatechuic acid. In all of these samples, oxalate levels were far higher than those found in edible mushrooms and are comparable to levels in foods like almonds, peanuts, cereal grains and chocolate that are rated as very high in oxalates. The oxalate levels are much lower than oxalate levels found in foods with extremely high oxalate levels like spinach, rhubarb and beet greens.

When I checked the NAMA database (which goes back to the early 1970s), there were no reported cases of poisoning by *Inonotus obliquus*. So was the one Japanese death from oxalate induced kidney failure a unique case or do we have a cause for concern? Are there cases out there that are not reported? It turns out there are. I had drafted a paper for *Fungi* magazine and circulated a draft to all of the NAMA toxicology identifiers. Paul Kroeger responded the next day that he and Raymond Li with the B.C., poison center knew of five Chaga poisoning cases in British Columbia since 2010 – one was due to consuming moldy, old, improperly stored Chaga, two were individual sensitivity to Chaga that triggered some gastrointestinal distress, and two were cases involving successfully treated liver and kidney damage, suggesting the involvement of soluble oxalates. Looking deeper, Paul Kroeger and Raymond Li found four cases that they had initially missed (one in 2017 and two in 2018) plus a brand new case in March of 2019.

Chaga has become popular and its use is expanding. A search of the internet yields countless entries extolling the virtues of Chaga as a medicinal mushroom and a superfood. Studies of Chaga *in vitro* (lab studies of cultures) and in animals yield some intriguing results that point to the potential for the ability of Chaga extracts to kill cancer cells, stimulate the immune system, and reduce inflammation. Dr. Andrew Weil's entry for Chaga on his website (<https://www.drweil.com/diet-nutrition/nutrition/choose-chaga-mushrooms/>) is very informative regarding both the potential benefits and the unknowns involving Chaga. He ends the Chaga entry with a link to a list of medicinal mushrooms where there is some evidence for efficacy in humans. Chaga is not on his list because there is too little evidence for its efficacy. The Memorial Sloan Kettering Cancer Center also has a web entry with a well-referenced section on Chaga (<https://www.mskcc.org/cancer-care/integrative-medicine/herbs/chaga-mushroom>). Since there little correlation between *in vitro* (e.g. petri dish studies), successful animal studies and successful human studies, it cannot be concluded that these mushrooms are truly medicinal without human clinical studies. One small human study has suggested a reduction in markers for inflammation, none of the other claims for Chaga has yet been investigated in human clinical trials.

The Memorial Sloan Kettering Cancer Center web pages on Chaga warn individuals interested in Chaga not to use it if they are taking either blood-thinning medications or diabetic medications. WebMD (<https://www.webmd.com/vitamins/ai/ingredientmono-1474/chaga>) warns against taking Chaga if you have an autoimmune disease (e.g. multiple sclerosis, lupus, rheumatoid arthritis, where the medical problem appears to be an overly-stimulated immune system), are having surgery soon (bleeding issues), or breast-feeding (just to be on the safe side).

An anonymous NAMA member reported that he has been a regular Chaga user for over 10 years, taking a cup of simmered Chaga water decoction daily, using a heaping teaspoon of ground Chaga or small chunks. Over the years, he reportedly had very few colds (much less than before Chaga), which he thought could be due to an immune enhancing property of Chaga. He knew about the “blood thinning” effects of Chaga and went off it before and after prostate surgery. Three weeks after surgery, he resumed Chaga. A few days later he passed some clots (not unexpected after his surgery), but then had quite heavy hematuria, followed by excruciatingly painful bladder spasms. He ended up in the ER and was hospitalized for 2 days, receiving irrigation via catheter until the bleeding stopped. He has a suspicion that using Chaga, even 3 weeks post surgery, could have been responsible for his bleeding episode.

Rick Van de Poll, another NAMA toxicology identifier, pointed out a case where an individual made productive use of the blood thinning properties of Chaga. In one of his mushroom workshops, a man reported that both his grandfather and father were genetically prone to heart disease and died in their 50's from heart disease. The man went to a physician and found that he had LDL levels in the 250-260 range and that he was a “walking time bomb.” The physician said that blood thinners might help. The man could not afford medications and on the advice of a herbalist, started drinking two cups of Chaga tea every day. After eight months, his LDL levels had fallen to 95, to the amazement of his doctor.

From the little that we know about the chemistry of Chaga, it is clear that the chemical composition is highly variable depending on the source of the Chaga, and different sources will thus have different effects on the consumer. Wild-harvested Chaga itself is like a cancerous growth occurring on a birch tree where the cancer is caused by the fungus *Inonotus obliquus*. The black melanized canker is harvested from living birch trees (cankers from dead trees are inactive) and is at most 10% mushroom mycelium, the rest is woody material produced by the birch tree.⁵ The mycelium does not produce spores and the fungus does not produce fruiting bodies until well after the tree has died, anywhere from ten to eighty years after the initial infection. Cultivated Chaga is very different from wild harvested Chaga since it lacks the betulin produced by the tree, and also lacks betulinic acid and phytosterols. Consequently, one would expect a different suite of effects from cultivated Chaga since the chemistry is different. The high soluble oxalate levels in wild-harvested Chaga should make people with osteoporosis think twice before using Chaga since oxalates chelate calcium, zinc and other metal cations, stripping them from the body. Oxalate levels in cultivated Chaga appear to be unstudied.

In short, from both Susan Goldhor's article and everything I can discern, while there are many interesting anecdotes about positive effects of using Chaga and there are intriguing *in vitro* and animal studies, we have too little evidence to say whether taking Chaga is healthy for humans.

References

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