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Oxalates — The Hidden Dangers in 'Healthy' Foods

Analysis by Dr. Joseph Mercola | April 28, 2024

STORY AT-A-GLANCE

- Oxalates, or dicarboxylic acids, are natural compounds found in many foods like leafy greens and nuts. Despite their simple carbon dioxide-based structure, they can form harmful crystals in the body and disrupt biological processes
- Oxalates can bind to calcium to form insoluble crystals that may lead to kidney stones and other health issues
- Oxalates can also inhibit crucial enzymes in the mitochondrial electron transport chain, reducing energy production and increasing oxidative stress
- If you struggle with chronic health issues related to mineral imbalances or metabolic inflexibility, minimizing your oxalate intake is advisable
- Foods high in oxalates that should be avoided if sensitive include spinach, almonds, peanut butter and sweet potatoes

In today's episode, I am thrilled to welcome back Sally Norton, an esteemed authority on oxalates, whose expertise is invaluable for anyone seeking to understand this topic.

Norton has dedicated years to meticulously analyzing data and compiling an authoritative guide on oxalates, "Toxic Superfoods: How Oxalate Overload Is Making You Sick — and How to Get Better." In it, she reviews how and why foods we've been told are healthy can undermine your health.

Her academic background includes a bachelor's degree in nutritional science from Cornell University and her master's degree in public health from the University of North Carolina, Chapel Hill. In this interview, we explore the broader implications of oxalates on health, Norton's personal journey with oxalate sensitivity, and her innovative solutions for common nutritional misunderstandings.

What Are Oxalates?

Oxalates are natural compounds found in many foods, including leafy greens, nuts, and seeds. Another term for oxalate is dicarboxylic acid, which is made up by two carbon dioxide (CO_2) molecules. As I've discussed in previous articles, **CO_2 is essential for health and life itself**, so how is it that two CO_2 molecules together cause so much harm?

The key problem with oxalates is not their CO_2 origin but rather their ability to form crystals that interfere with normal biological processes. Dicarboxylic acids, such as oxalate, are characterized by having two carboxyl groups (COOH), which can lose protons under physiological conditions, leaving them with a negative charge.

This negative charge allows them to bind positively charged ions like calcium. When oxalates bind with calcium, they form calcium oxalate crystals, which are not soluble and can accumulate, leading to the formation of kidney stones or other tissue deposits.

Moreover, the electromagnetic properties of these charged oxalate ions can interfere with cellular functions. For example, the negatively charged oxalate can disrupt enzyme functions that are crucial for cellular energy production.

The enzymes in the mitochondrial electron transport chain, which are vital for ATP (energy) production, can be inhibited by the binding of oxalate ions, resulting in decreased energy production and increased oxidative stress within cells. In this way, oxalates contribute to broader metabolic and physiological dysfunctions.

> **"Oxalate is another big one that's messing up mitochondrial health — your ability to generate**

> energy.” ~ Sally Norton

This paradoxical nature of oxalates — arising from a simple and essential molecule like CO_2 but leading to complex health challenges — illustrates the nuanced interactions within human biochemistry. In essence, the "charging" of dicarboxylic acids like oxalate transforms them into reactive molecules that can disrupt normal cellular processes through electromagnetic interactions.

As a result, people with compromised kidney function aren't the only ones who need to be concerned about oxalates. Just about anyone struggling with chronic health issues related to mineral imbalances and/or metabolic flexibility may be adversely impacted by them and would do well to minimize their intake.

Oxalate Rashes Are a Common Symptom of Oxalate Toxicity

Oxalate toxicity can cause several problems that are very common, such as oxalate rashes — intensely itchy rashes that have no apparent cause. I struggled with that for 15 years before I finally discovered the cause. While using my aloe vera plants helped me, the best solution is to avoid oxalate-rich foods, as they're what's causing it.

Topical calcium citrate can also help resolve those itchy rashes. The reason topical calcium citrate works so well is twofold. Calcium binds to and forms precipitates with oxalates. It also addresses the calcium and electrolyte interference caused by oxalates.

> *"This interference with electrolytes and calcium is a major toxic effect,"* Norton says. *"And as the immune system is trying to deal with those oxalates in the subdermis, you're getting additional electrolyte disturbances.*
>
> *I don't really know the mechanism of why that calcium topically is so powerful, but it's amazing [for] any skin injury, People who are doing hair removal or whatever, damaging their skin, putting calcium on top of it, it just heals like overnight …*

Interestingly, you can see it in the primary hyperoxaluria literature where high oxalate levels turn fascia and other connective tissues into calcified sheets. You can see it in the X-rays in kids that end up dying of oxalate poisoning that, just because the body is high oxalate, it causes calcification in tissues …

Calcium encourages oxalate clearing depending on how much oxalate is already in the diet, but once you're low in oxalate, adding more calcium can increase the mobilization of oxalate."

Citrate, such as fresh-squeezed lemon juice, taken internally, will also help dissolve oxalates.

Oxalate-Rich Foods to Avoid

In the interview, Norton specifies several foods that are particularly high in oxalate and need to be avoided if you're sensitive. Top examples include:

- **Spinach —** Typically, spinach can have oxalate levels as high as 600-800 mg per 100 grams
- **Almonds —** Almonds generally contain about 122 mg of oxalates per 100 grams. Nuts in general tend to be problematic, not only for oxalates but also for linoleic acid. As noted by Norton:

  "These seeds from the trees are designed with all these multiple anti-nutrients to kick you in the gut. All the anti-nutrients are gut toxic. They're all causing some degree of gut damage. Nuts are just designed to be indigestible. They're designed to dismantle your ability to digest food. If you want a healthy gut, you don't want nuts kicking your gut over and over again."

- **Peanut butter —** Peanut butter can have around 140 mg per 100 grams

- **Sweet potatoes —** They contain about 30 mg of oxalates per 100 grams, which is considered high compared to other vegetables but much lower than spinach or nuts

- **Figs —** Figs have approximately 40 mg per 100 grams

Surprisingly, collagen-rich protein sources, including gelatin, bone broth, animal skins, tendons and ligaments, meat cuts that include a lot of connective tissues such as oxtail, neck and shank, and organ meats like heart and liver, can also be aggravating if you're sensitive to oxalates or struggle with recurring kidney stones. So, it is wise to avoid oxalates until your gut is healed and you can tolerate them.

Decreased Mitochondrial Energy Production Contributes to Oxalate Toxicity

Metabolic inflexibility refers to your body's reduced ability to switch between fuel sources, particularly between carbohydrates and fats, efficiently. This inflexibility can impair your energy production capabilities. When energy production is compromised, especially at the cellular level in the gut lining, it impairs your body's ability to maintain a low oxygen environment in the large intestine, which is required to keep pathogenic bacteria in check.

The large intestine is typically an anaerobic (low oxygen) environment where beneficial bacteria thrive. These bacteria are crucial for various functions, including maintaining the integrity of the gut barrier and modulating immune responses.

A healthy gut with a properly maintained anaerobic environment supports the growth of beneficial obligate anaerobes, such as the keystone species Akkermansia. When the oxygen gradient is disturbed due to insufficient energy production (as seen in metabolically inflexible individuals), it allows facultative anaerobes (bacteria that can utilize oxygen when available) to proliferate.

These bacteria often produce endotoxins, also known as lipopolysaccharides (LPS), which can cause inflammation if they translocate across the compromised gut barrier into the systemic circulation.

Oxalates indirectly contribute to this scenario by exacerbating mitochondrial dysfunction and reducing cellular energy production. This reduction in ATP production can impair the maintenance of the anaerobic conditions necessary in the large intestine, facilitating the overgrowth of facultative anaerobes and the subsequent production of endotoxins.

The Intricate Relationship Between Gut Bacteria and Oxalates

Another important bacterium is Oxalobacter formigenes, a beneficial bacterium in the gut that plays a crucial role in the metabolism and regulation of bodily oxalate levels. It digests oxalate crystals and basically signals the gut wall to excrete oxalate for its own nourishment.

In this way, Oxalobacter helps reduce the concentration of oxalate in your gut, which can consequently lower the risk of oxalate crystallization and the formation of kidney stones and other health problems. However, the relationship between oxalates and Oxalobacter also has a hazardous aspect.

While these bacteria can mitigate some of the risks associated with high oxalate levels, their presence and effectiveness can be compromised if the oxalate levels become too high or if the gut environment becomes inhospitable due to other dietary or metabolic imbalances.

Excessive oxalates can overwhelm the gut system, inhibit other beneficial gut flora, and contribute to a reduction in Oxalobacter populations, thus diminishing their protective role. But the reason oxalates are able to overwhelm your system goes right back to having low or impaired metabolism again.

Your body's inability to produce cellular energy to maintain the oxygen gradient in your gut causes the Oxalobacter to disappear in the first place, which allows the oxalates to accumulate. It's basically a self-perpetuating cycle in the wrong direction. As noted by Norton:

"It's this vicious cycle because one of the major ways that oxalate itself is toxic is by breaking down cellular production of ATP. It blocks the last step of glycolysis. It blocks Complex II.

It causes all this oxidative stress and inflammation that messes up the mitochondria. It's messing up the membranes of the mitochondria in the cell. So, this is one of its mechanisms of harm. And then you have these redundant ways in which the energy production is being destroyed.

And unfortunately, the body really tries hard to look like everything's fine. So, this can go on under the hood for decades. Then suddenly in your late 30s or in your 40s, you suddenly feel old and broken."

How to Minimize the Harmful Effects of Oxalates

We cover a lot of ground in this interview, so here's a quick summary of the strategies and food choices discussed that can help minimize the harmful effects of oxalates or aid in their elimination:

Limit high-oxalate foods — This is of course a no-brainer. Reducing your intake of foods known to be high in oxalates such as spinach, almonds, and peanut butter will decrease your overall oxalate load.

Increase your calcium intake — Consuming foods high in calcium or using calcium supplements can bind to oxalates in the gut, preventing their absorption and facilitating their excretion through the stool. Foods rich in calcium include dairy products and leafy greens.

Hydrate adequately — Drinking sufficient water is crucial as it helps to flush out oxalates through the urine and prevents kidney stones from forming.

Balance your collagen intake — While collagen is extremely beneficial, it's important to moderate its intake if you are sensitive to oxalates, given that collagen breakdown

can lead to oxalate production. So, do consume sources of collagen like bone broth, but do so in moderation.

Optimize your gut health — Promoting a healthy gut microbiome by consuming probiotic-rich foods like yogurt, kefir and fermented vegetables can support the growth of beneficial bacteria, including those that can degrade oxalates like Oxalobacter.

Citrate consumption — Citrate, found in citrus fruits like lemons and oranges, can help by binding with calcium and oxalate, thereby reducing the formation of kidney stones. Avoid over-supplementation with ascorbic acid, however, as high doses can convert into oxalate. Ascorbic acid is the most common form of vitamin C used in dietary supplements.

Cook high-oxalate foods well — Cooking methods that involve boiling can help reduce oxalate content in foods as the oxalates will leach into the cooking water.

Topical calcium for oxalate-related skin irritations — If oxalates are causing skin irritations, applying topical calcium can alleviate symptoms by precipitating oxalates at the site.

More Information

To learn more, pick up a copy of "**Toxic Superfoods: How Oxalate Overload Is Making You Sick — and How to Get Better**." You can also find more information on her website, **SallyKNorton.com**, or follow her on **YouTube**, **Facebook**, **Twitter/X** and **Instagram**.