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Systemic Oxalosis

A Root Cause for Multi-System Dysfunction

With Dr Sarah Davies

THE CRYSTAL PROBLEM

Sharp, insoluble, everywhere

While oxalic acid is highly soluble, Calcium oxalate forms hard, needle-like crystals the body cannot break down.

Once they precipitate, they damage whatever tissue they settle in.



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What are oxalates?

Oxalic acid and calcium oxalate cannot be broken down by the body. Once in the bloodstream, they must be cleared by the kidneys or or they accumulate in the tissues.

However, dietary calcium taken alongside oxalates can help bind the oxalate in insoluble form in the gut and the microbiome can also help to reduce absorption from food sources.



Endogenous sources

40-60% of total load

Can rise to 80% with B vitamin

Deficiencies / High Vitamin C intake

Produced by the liver at roughly 10–25 mg a day. Production rises substantially when vitamin B6 or B3 are deficient.



Exogenous sources

Plants in the diet

Dietary oxalates come from plant foods, with the highest levels in leafy greens, nuts and seeds, root vegetables and some fruits.



The microbiome

Doing the hard work that human cells can't

In health, *Oxalobacter formigenes* and other species, degrade anywhere from 20% to 40% of dietary oxalate in the gut before it is absorbed.

Highest Oxalate Foods

LEAFY VEGETABLES



Spinach
(Very High)

Swiss chard

Parsley

Rhubarb

ROOT VEGETABLES



Beetroot

Sweet potatoes

Potatoes

LEGUMES



Soy Beans
(including tofu and tempeh)

Black beans

NUTS AND SEEDS



Almonds

Peanuts

Sesame seeds

GRAINS



Brown rice

Teff

Quinoa

FRUITS



Raspberries

Blackberries

Kiwi

DRINKS



Black tea



Cocoa / chocolate

Lowest Oxalate Foods



ANIMAL PROTEINS



Eggs, dairy, meat and fish



OILS AND FATS

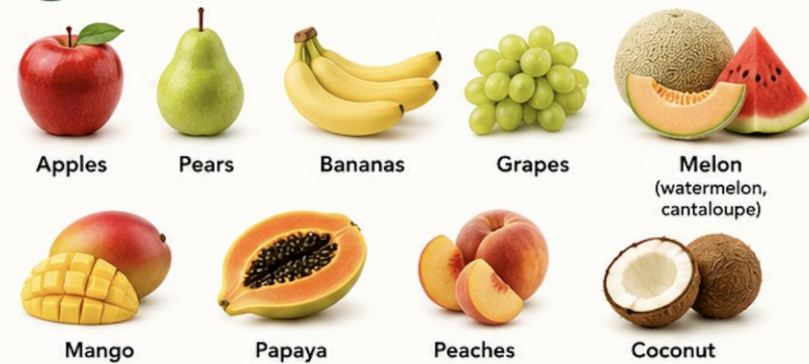


Olive oil

Coconut oil



FRUITS



Apples

Pears

Bananas

Grapes

Melon
(watermelon,
cantaloupe)

Mango

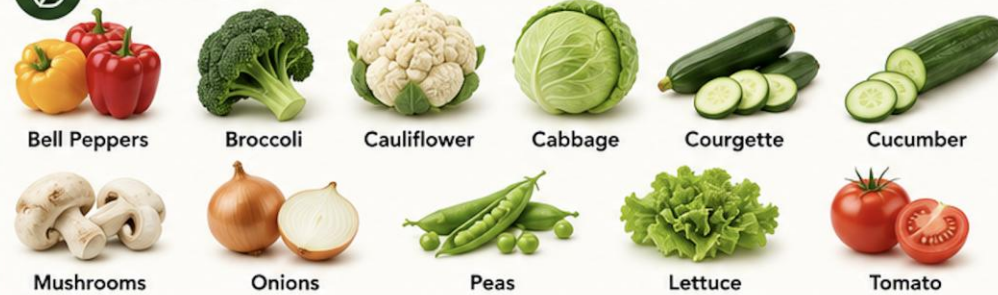
Papaya

Peaches

Coconut



VEGETABLES



Bell Peppers

Broccoli

Cauliflower

Cabbage

Courgette

Cucumber

Mushrooms

Onions

Peas

Lettuce

Tomato



NUTS AND SEEDS



Pumpkin
seeds

Sunflower
seeds

Macadamia
nuts



COCONUT



GRAINS



White rice

Basmati rice

Millet

Corn
(polenta,
corn tortillas)



DRINKS



Water
(ideal)

Milk
(helps bind
oxalate)

Peppermint or
Chamomile tea

Red Bush Tea



MILK REPLACEMENTS

(often also with added calcium fortification)



Coconut Milk
& Yoghurt

Oat Milk

What happens when oxalates run too high?

Oxalate balance can be disrupted by:

- Excessive dietary intake
- Low dietary calcium / Dairy Free diet
- Dysbiosis and loss of Oxalobacter
- Gut barrier permeability
- Bile Acid malabsorption (reduces calcium in the gut)
- Increased Endogenous production

When this occurs, plasma and urinary oxalate levels rise.

Because oxalate readily binds calcium to form insoluble crystals, it can precipitate in any tissue.

THE MECHANISM

Oxalate + calcium → insoluble crystals → precipitation in any perfused tissue

Tissues affected

Kidneys

Joints

Eyes

Skin

Thyroid

& beyond

How oxalates damage tissues

Calcium oxalate crystals are mechanically sharp and chemically reactive.

Once supersaturation is exceeded, they precipitate and trigger a cascade of injury.



1

Direct crystal cytotoxicity

Crystals adhere to and puncture cell membranes, causing oxidative stress, mitochondrial dysfunction and programmed cell death.



2

NLRP3 inflammasome activation

Crystals activate the NLRP3 inflammasome in renal and immune cells, driving macrophage recruitment and a robust inflammatory cascade, as also seen in gout.



3

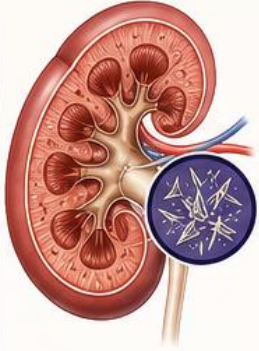
Tubular obstruction & fibrosis

Deposition in proximal renal tubules causes obstruction, tubular atrophy and fibrosis, progressing from acute injury to chronic kidney disease.

How Oxalates Can Cause Harm

Oxalates are tiny, sharp crystals (calcium oxalate) that can form in many parts of the body. When oxalate levels are too high, these crystals can damage tissues, trigger inflammation and disrupt normal function.

1. KIDNEYS



Kidneys filter oxalate from the blood. When levels are high, crystals can form and cause:

- Kidney stones
- Damage to kidney tubules and tissues
- Chronic kidney inflammation and scarring
- Reduced kidney function over time

Symptoms may include: flank pain, recurrent UTIs, burning, blood in urine, fatigue.

2. BLADDER & GENITALS



Oxalate crystals can irritate and damage the lining of the bladder and genital tissues, leading to:

- Bladder pain & urgency
- Frequent urination
- Urinary tract infections
- Prostatitis / pelvic pain
- Pain in testes, ovaries or vulvar/vaginal area

Chronic irritation can lead to inflamed, sensitive tissues and ongoing pelvic discomfort.

3. JOINTS & CONNECTIVE TISSUES



Oxalate crystals can deposit in joints, tendons and ligaments, causing:

- Joint pain and stiffness
- Inflammation
- Cartilage damage
- Reduced mobility
- Hypermobility & connective tissue breakdown

Common in knees, hips, shoulders, wrists, ankles and spine.

4. THYROID

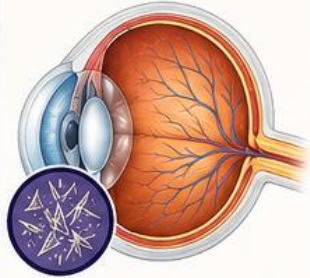


Oxalate can interfere with thyroid function by:

- Reducing iodine uptake and utilisation
- Increasing oxidative stress in thyroid cells
- Contributing to autoimmunity in susceptible individuals
- Worsening symptoms of hypothyroidism

May contribute to fatigue, weight gain, cold intolerance, brain fog and hormone imbalance.

5. EYES



Oxalate crystals can deposit in delicate eye tissues, potentially causing:

- Eye pain & irritation
- Dry, gritty sensation
- Light sensitivity
- Retinal damage
- Increased risk of cataracts and vision changes

May play a role in conditions such as retinopathy and macular degeneration.

6. SKELETAL STRUCTURE



Oxalates can negatively impact bone health by:

- Binding to calcium and reducing mineral availability
- Reducing bone mineral density
- Increasing bone brittleness and fracture risk
- Contributing to osteoporosis over time

Less calcium available for bones = weaker, more fragile skeletal structure.

7. BALANCE ORGANS (LABYRINTHS)



Oxalate crystals can deposit in the inner ear (labyrinths), disrupting balance signals and causing:

- Dizziness & vertigo
- Imbalance
- Nausea
- Tinnitus (ringing in ears)
- Hearing changes

Can significantly affect quality of life and daily function.



KEY TAKEAWAY

Oxalate crystals can affect many organs and tissues, not just the kidneys. Reducing dietary oxalates, supporting gut health and maintaining good hydration can help lower your risk and support recovery.



SUPPORT YOUR BODY

Stay well hydrated

Aim for 1.5–2.5 litres of water daily.



Add lemon juice

Citrate helps bind oxalates and protects kidneys.



Include calcium-rich foods

Helps bind oxalates in the gut and reduce absorption.



Support your gut

A healthy microbiome helps break down oxalates.



IMPORTANT

Work with your healthcare professional before making significant dietary changes, especially if you have kidney disease or other health conditions.

*It's not
all about
kidney
stones!*

Why this matters in Nutritional, Functional & Lifestyle Medicine



The dietary paradox

Removing dairy reduces calcium-oxalate binding in the gut, while adding spinach, almonds, kale and nut milks sharply raises the oxalate load.



Vulnerable patients

Gut dysbiosis, IBD, sulphur-pathway disorders and low B6/B3 raise both endogenous and exogenous oxalate risk of overload.



Multi-System Approach

Crystals deposit in kidneys, bladder, skin, joints and soft tissues, lead to multiple referrals, but often a single unifying diagnosis is not considered.

When we advise on a '*healthy*' diet, we are uniquely placed to trigger oxalate-related disorders through well-intentioned advice.

Many of our patients already carry other risk factors for higher absorption or production.

A challenging diagnosis



Far more than kidney stones

Most literature focuses on kidney stones, yet few of our patients with known oxalosis have any stone history. Extra-renal presentations are barely taught in conventional medicine.



Multi-system, seen in isolation

Symptoms surface across organ systems normally considered separately, rashes to dermatology, vulval pain to gynaecology, vertigo to ENT. A unifying view needs a whole-person approach.



Testing the hypothesis

Urinary oxalate above 40 mg/day is a useful marker, but dumping is intermittent and urine can stay normal during ongoing tissue deposition. A trial of a low-oxalate diet is the best test (but not straightforward).

THE 5 KEY STRATEGIES

1 SLOW DIETARY REDUCTION



- Reduce high-oxalate foods by 5–10% per week over 2–6 weeks.
- Start by removing the highest oxalate foods first (e.g. spinach, almonds, rhubarb, beetroot, nuts, chocolate).
- Keep some moderate oxalate foods to avoid sudden shifts.



Gentle & steady changes help your body adapt and reduce the risk of dumping.

2 CALCIUM WITH MEALS OR SUPPLEMENTS



- Calcium binds oxalate in the gut, forming insoluble complexes that are excreted in stool, not absorbed into the body.
- Include calcium-rich foods (e.g. dairy) with meals, or take calcium supplements with food (as advised).
- Avoid taking calcium away from meals.



Aim for 500–1,000 mg calcium elemental with main meals.

3 LEMON JUICE / CITRATE IN WATER



- Citrate binds with calcium in urine, reducing the risk of oxalate crystal formation (e.g. kidney stones).
- Add the juice of ½–1 lemon to water (250–500 ml), 2–3 times daily.



Aim for 1.5–2.5 litres of fluids throughout the day.

4 SUPPORT B3 (NIACIN) & B6 (PYRIDOXINE)



- B3 and B6 are required cofactors in oxalate metabolism.
- Deficiency can increase oxalate production in the liver.
- Ensure adequate intake through diet or supplementation (as advised).



Good sources: B3 – meat, fish, poultry.
B6 – poultry, fish, bananas, avocados.

5 MICROBIOME SUPPORT & GUT HEALING



- A healthy gut microbiome (e.g. Oxalobacter formigenes) helps break down oxalates.
- Support with fermented foods (if tolerated), prebiotics and probiotics.
- Heal the gut lining with a nutrient-dense, anti-inflammatory diet.

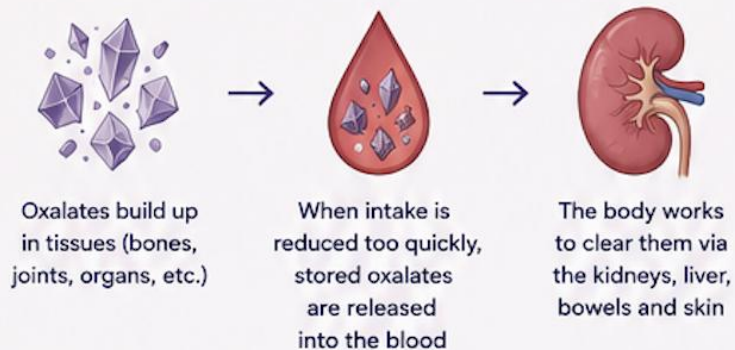


Focus on fibre-rich low-oxalate foods, polyphenols, bone broth and quality protein.



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WHY DUMPING HAPPENS



Dumping is temporary and usually settles as your body adjusts and eliminates the excess oxalates.

WHAT TO DO IF YOU ARE DUMPING



SLOW DOWN

Return to your previous oxalate level or reintroduce a small amount of moderate oxalate foods.



HYDRATE WELL

Drink plenty of water (1.5–2.5 litres/day) to help flush oxalates.



SUPPORT WITH CITRATE

Add lemon juice to water to help bind oxalates and support kidney protection.



SUPPORT MINERALS

Ensure adequate calcium, magnesium and potassium.



REST & BE GENTLE

Give your body time. Rest, reduce stress and avoid intense exercise.



SYMPTOMS OF DUMPING MAY INCLUDE:



Fatigue or exhaustion



Headaches



Joint or muscle pain



Skin irritation, rashes or itching



GI upset: cramps, nausea, bloating or diarrhoea



Cloudy urine or tiny "snowflakes" (calcium oxalate crystals)



Sandy or loose stools



Brain fog, irritability or mood changes



Heart palpitations or feeling shaky



Tinnitus or ear pressure



Flu-like symptoms or chills

HOW TO PREVENT DUMPING



Reduce oxalates slowly

Aim for a 5–10% reduction in high-oxalate foods each week.



Remove the highest oxalate foods first

Focus on foods like spinach, almonds, rhubarb, beetroot, nuts and chocolate.



Keep some moderate oxalate foods in your diet

Don't eliminate everything at once.



Be consistent

Small, steady changes lead to better long-term results with fewer setbacks.



Listen to your body

Everyone has a different threshold – adjust as needed.

Avoiding Oxalate 'Dumping'

Reducing Oxalates too quickly can result in unpleasant side effects as the body works to clear the stored oxalate crystals from around the body.



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Want to learn more?

Download the Functional Nexus patient guide to oxalates, with clear instructions, recipes and meal plans to support patients trialling Low Oxalates.



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