

Rubric

*Corresponding author

Georg A. Petroianu, MD, PhD, FCP

Professor and Founding Chair
Department of Cellular Biology and
Pharmacology
Herbert Wertheim College of Medicine
Florida International University
Miami, FL 33199, USA

E-mail: georg.petroianu@fiu.edu

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A Case of Star Fruit Diet

Georg A. Petroianu, MD, PhD, FCP*

Department of Cellular Biology and Pharmacology, Herbert Wertheim College of Medicine, Florida International University, Miami, FL 33199, USA

A 47-year-old obese woman is brought to the emergency room of the local hospital with generalized seizures, impaired consciousness and hiccapping; according to her relatives she never experienced such symptoms in the past. Her past medical history is non-contributory except for a moderate reduction in renal function. She regularly uses histamine receptor blockers (ranitidine) for acidity and nonsteroidal anti-inflammatory drugs (NSAIDs) (ibuprofen) for headaches as needed.

Her relatives report that despite numerous attempts at diet, exercise, and enrollment in a support group she never really managed to lose weight. However, she recently started a new aggressive diet based on almost exclusive consumption of organic star fruit based products (star fruit juice and dried or fresh star fruits).

Which of the foods/drinks listed below has the highest content of oxalic acid per serving?

1. Spinach
2. Black tea
3. Cashew nuts
4. Cucumbers
5. Soy beans

Which of the substances listed below is most likely responsible for the presenting symptoms in the case described?

1. Organophosphate pesticides
2. Endogenous benzodiazepines (endozepines)
3. Endogenous opioids (endorphins)
4. Caramboxin
5. Carbolines

Oxalic acid derived from food combines with divalent cations such as calcium to form oxalates which are then excreted in the urine. When oxalate concentrations are high and solubility limits are exceeded kidney stones can form and damage the kidney tubules. High oxalic acid foods are thus potentially nephrotoxic and should be avoided in patients with impaired kidney function. Spinach and rhubarb top the list of oxalate content but oxalate nephropathy has also been reported with many other foods such as cashew nuts,¹ iced-tea,² cucumber fruit (*Averrhoa bilimbi*)³ and star fruit (*Averrhoa carambola*).⁴ An aggressive diet based on almost exclusive consumption of star fruit based products (organic or not) has the potential to inflict kidney injury.

While oxalates can induce or exacerbate nephropathy they do not explain the neurotoxicity associated with star fruit (carambola) and the closely related cucumber fruit (bilimbi) ingestion.^{5,6}

The mechanism of neurotoxicity was recently elucidated by Garcia-Cairasco et al⁷, who identified in the star fruit (carambola) a phenylalanine-like molecule they named caramboxin. Caramboxin is excitotoxic and activates N-methyl-D-aspartic acid (NMDA) and alpha-

amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) receptors. Metabolic inactivation and excretion of caramboxin is impaired in renal failure. The vast majority of patients experienced hiccups and seizures.

Endozepines and endorphins are not excitotoxic; high levels are likely to be associated with sedation.

β -Carboline alkaloids are widespread in plants and animals, and frequently act as endogenous ligand is γ -aminobutyric acid (GABA_A) receptor inverse agonists and can therefore have convulsive and anxiogenic effects. Some β -carbolines may be formed naturally in the human body and possibly function as endogenous endozepine antagonists.

Star fruits are not known to contain β -carbolines; Syrian rue (*Peganum harmala*) is high in β -carboline content.⁸ The plant's seeds have been used for centuries in the rites of many cultures.

The symptoms of organophosphate exposure are due to inhibition of the esterase responsible for acetylcholine metabolism: they correspond to over-activity of the parasympathetic component of the autonomic nervous system.

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