Study illuminates synergistic effects of dietary cholesterol and fruit tannins in kidney stone formation

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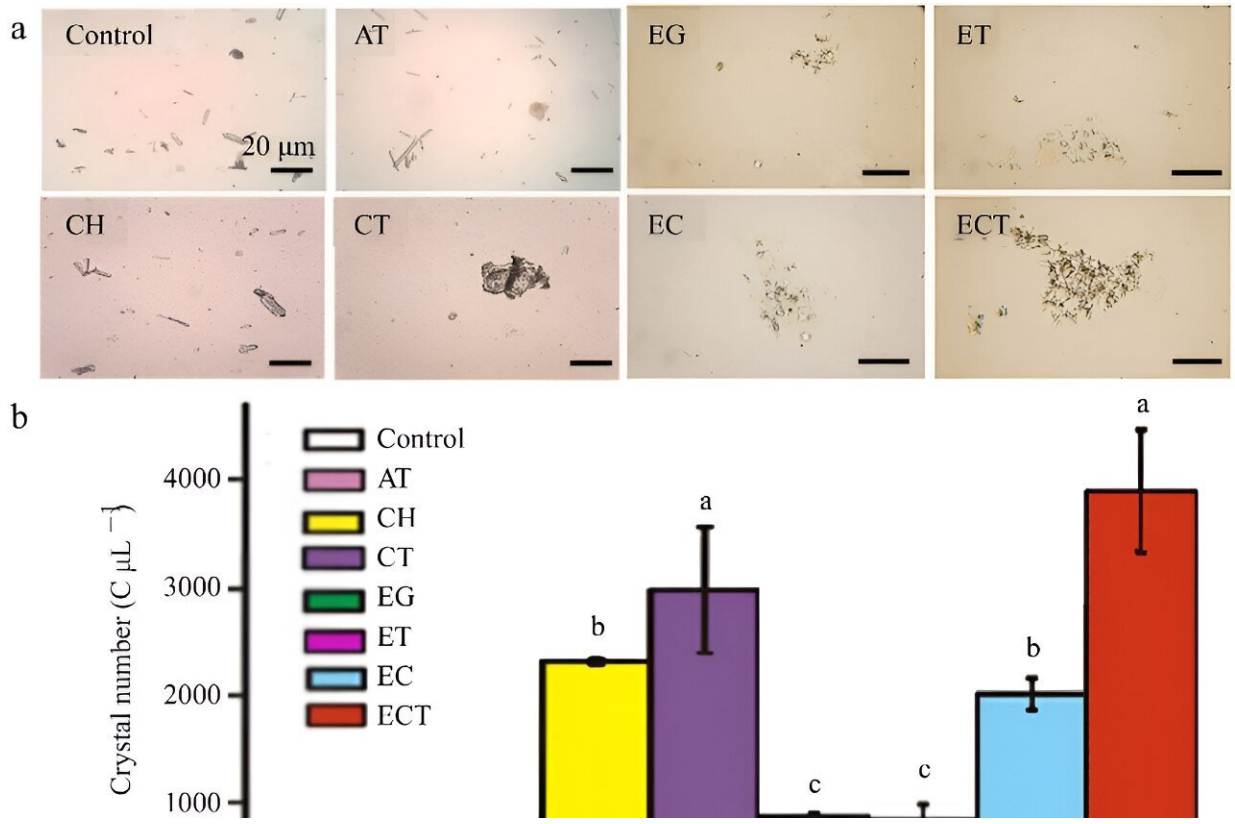

(a) Microphotography, (b) crystal numbers of urine and the (c) frozen kidney sections. Urine was collected after the mice gavaged with AT, CH, CT, EG, ET, EC or ECT for 3 d. Frozen kidney sections of the mice gavaged with CT were observed under polarized microscope, the red arrows indicate the crystals induced by the treatment of CT. The crystal numbers in different groups were about 432, 456, 2,336, 2,984, 952, 904, 2,080, 3,928 C μL−1, respectively.

Vertical bars on data in the columnar graph represented standard deviation; values with different letters are significantly different at p Food Innovation and Advances (2023). DOI: 10.48130/FIA-2023-0019

Kidney stones, hard crystalline formations that occur within the kidney, are a common condition that affects millions of people worldwide. While genetics and various other factors can contribute to kidney stones, dietary components play a significant role in their formation. Previous research has isolated specific dietary culprits such as high oxalate or calcium intake. However, understanding of the effects of specific dietary components on stone formation, especially at the microscopic level, remains limited.

Food Innovation and Advances published a paper titled "The synergistic effect of dietary cholesterol with fruit tannins in forming kidney stones" on 20 June 2023.

In this study, researchers used male CD-1 mice to explore the potential correlation between dietary intake and KS. Initially, the size of urinary sediment particles was analyzed in mice that were administered with cholesterol and fruit tannins by gavage.

The results showed that CT-mice or ECT mice had significantly larger urine sediment particles, and crystals larger than 20 μm were clearly visible in their urine compared with the other subject groups. Furthermore, ethylene glycol, a known promoter of oxalate excretion in the kidney, was identified to enhance urinary stone formation. Subsequently, crystallographic analysis of kidney tissues from CT-mice, observed under a polarizing microscope, revealed distinct crystalline substances, especially prominent in the renal papilla of ECT-mice.

These crystal grains were composed of two types: filter cake shaped grain and the multiple nuclei grain. Paraffin embedding and HE staining elucidated inflammatory responses and vascular stasis around the kidney tubules with crystalline deposits in ECT-mice. Micro-stones, visible under a polarizing microscope, were identified in the kidneys of ECT-mice.

Remarkably, tannin and cholesterol deposits in the kidney were highlighted using immunofluorescence with antibodies against apple tannins and the Filipin-fluorescence detection method, respectively. Laser-assisted visualization of crystal deposits indicated their association with tannin deposits or co-deposition with cholesterol.

In summary, this study underscores the critical synergistic role of cholesterol and tannins in KS formation. This research holds significant value for nutritional guidelines and public health recommendations, emphasizing a holistic dietary approach to prevent kidney stone-related complications in the future.

More information: Yu Xi et al, The synergistic effect of dietary cholesterol with fruit tannins in forming kidney stones, *Food Innovation and Advances* (2023). DOI: 10.48130/FIA-2023-0019