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**Topic of Research:** Therapeutic and toxicological evaluation of phytochemicals in nephrolithiatic model

## Findings

The results obtained in the present work indicate the remarkable antiurolithiatic activity in the Caffeic acid is comparable with the herbal formulation, Cystone. Caffeic acid is able to scavenge superoxide, hydrogen peroxide, nitric oxide and DPPH radicals, has high reducing power, total antioxidant capability, and conferred protection against biological macromolecular damage. The Caffeic acid also exhibited inhibition in CaOx crystal aggregation in dose dependent manner, the agglomeration of particles which is critical step in urinary stone formation, as larger crystals are less likely to pass spontaneously in the urinary tract.

*In vivo* study and *in silico* study suggests that the Caffeic acid has the good antioxidant and antiurolithiatic properties. So, it can be used a potent antiurolithiatic agent.

The second phytochemical Chlorogenic acid is an organic compound contenting ester function group that is naturally derived produced by many species of plants, especially wintergreens. Chlorogenic acid biosynthesis takes place via shikimic pathway. The present study shows that when Chlorogenic acid was given along with Ethylene glycol and ammounium chloride urolthiasis inducer the serum and urine bio-chemicals levels remains to that of control level and almost bring back the level of MDA and antioxidant enzyme to almost normal control. The docking study showed the chlorogenic acid can play important role in the inhibition of CaOx

crystal formation.

The third phytochemical in our study is Baicalin, that has shown antioxidant activity in the results of *in vitro* assays. We studied the effect of it in the inhibition of crystallization, nucleation and aggregation of stone in urinary tract or kidney. The study reveals that Baicalin inhibits the CaOx crystal aggregation in the dose dependent manner. Prevention of this step is an important step in the stone formation so that piling of CaOx does not cause block in the urinary tract. The animal model and histological studies also showed good results. Docking study also supports the efficacy of the Baicalin.

The last but not least, Quercetin has demonstrated significant antioxidant activity. Different pathways of ROS and inflammation pathways are interconnected. Thus, Quercetin can combat ROS generated pathway of urolithiasis. Results showed that Quercetin and Cystone (positive control) prevent stone formation and bring back the architecture of kidney almost to the level of normal control. The levels of the antioxidant enzymes bring back by Quercetin to the normal level.

The present study concluded that the Caffeic acid, Chlorogenic acid, Baicalin and Quercetin possess antiurolithiatic property which was demonstrated through *in vitro, in vivo* and *in silico* experiments. All four phtochemicals have potent anti-oxidant, anti-nephrolithiatic and anti-urolithiatic action on calcium oxalate crystals.