

Acute kidney injury associated with ingestion of star fruit: Acute oxalate nephropathy

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ABSTRACT

Starfruit (*Averrhoa carambola*) and its juice are popular in the Indian subcontinent as an indigenous medicine. Oxalate concentration in this fruit and its freshly prepared juice is very high. We present a report of patients presenting with acute kidney injury due to oxalate nephropathy admitted in a single center. All patients had history of ingesting star fruit. Patients became symptomatic after 10–12 h of eating and main symptoms were pain abdomen and decrease in urine output. Three patients needed hemodialysis. All improved with complete renal recovery. Taking star fruit in large amount on an empty stomach and in a dehydrated state is a risk factor for nephrotoxicity.

Key words: Acute kidney injury, oxalate nephropathy, star fruit

Introduction

Star fruit (*Averrhoa carambola*) [Figure 1a and b], a member of *Oxalidaceae* family, is popular in many tropical and subtropical countries, and its consumption is high in Asia, Central America, and tropical west Africa.^[1] In India, it is recognized as *kamrakh* in Hindi and *kordoi* in Assamese. The plant grows primarily in the Northeast, the Southern States and along the coast, extending from Kerala up to West Bengal. It is a star shaped fruit with sweet and sour flavor. Traditionally use for treating diabetes, fever and sooth eye infections, throat infections, cough, asthma, colic, diarrhea, food poisoning, and mouth ulcer.

Star fruit toxicity in patients with renal failure is well known.^[2-4] These patients mainly presented as neurological involvement as hiccups, vomiting, mental

confusion, seizures, coma, and even death.^[2,4] Individuals with normal renal function, who ingest star fruit in a large amount, main symptoms are intractable and persistent hiccups. Nephrotoxicity in these people is a rare event, and only few case reports publish worldwide.^[5,6] In this report, we present five patients with normal renal function who developed nephrotoxicity after eating star fruit or drinking star fruit juice.

Case Report

All cases in our report had a history of ingesting star fruit and clinically presented as acute kidney injury (AKI). Baseline characteristics, the amount of star fruit ingested, clinical presentation and relevant investigation of all patients are summarized in Table 1. Case 1 and 3 ingested star fruit both as fruit and juice simultaneously. Two patients (Case 1 and 4) consumed fruit on an empty stomach and one patient (Case 2) after heavy work in hot weather. Patients became symptomatic after 10–12 h (except Case 5) of eating star fruit. The main clinical presentation was pain abdomen

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and decrease in urine output. The severity of renal failure was maximum in Case 1 (serum creatinine - 23.7 mg/dl) who ingested highest amount of star fruit [Table 1]. Three patients needed hemodialysis. All patients recovered completely after treatment.

Renal biopsy was done in four patients. Biopsy finding suggested typical feature of acute tubular necrosis. Light microscopy suggested unremarkable glomeruli with mild mesangial expansion. Proximal tubules show extensive loss of epithelial brush border with cytoplasmic vacuolization in cells. There was severe interstitial edema along with inflammatory cell infiltration mainly mononuclear cell. In two patients (Case 2 and 3), few irregular crystals were seen in the interstitium and within the tubular lumen [Figure 1c and d]. They were mostly colorless and birefringent on polarized light, suggesting oxalate crystal. There was no evidence of thrombus, fibrinoid necrosis, or emboli within vessels.

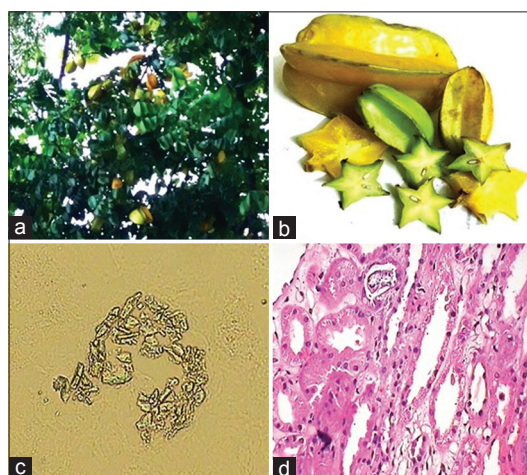


Figure 1: Star fruit or *Averrhoa carambola* (a and b). Microscopic views of biopsy specimens (c: Frozen section, $\times 40$). Dilatation of renal tubules, interstitial edema, and an interstitial deposition of oxalate crystals (d: H and E, $\times 40$)

Discussion

India is one of the largest producers of star fruit. Peak season of cultivation is September/October or January/February. Ripe fruits are golden yellow and sweet in taste while unripe fruits are lime green and taste sour, due to its high oxalate content as compared to sweet one.^[5]

To the best of our knowledge, there is no report published yet about star fruit induced renal failure from the Indian subcontinent. Though case reports are available on AKI due to other fruits as Irumban puli (*Averrhoa bilimbi*) which belongs to the same *Oxalidaceae* family as star fruit with high oxalate content.^[7] Star fruit is a rich source of oxalate. According to Chen *et al.*,^[5] oxalate content of various preparations of star fruit is different [Table 2]. Ingesting star fruit in large amount can cause secondary oxalosis that presents as nephrocalcinosis, urolithiasis, and renal insufficiency.

All patients ingested the fruit or its juice or both. The presentation was gastrointestinal (GI) upset within hours after ingestion followed by AKI, represented as decreased unit output in an otherwise healthy adult. GI symptoms were not due to uremia as uremic symptom cannot develop soon after ingestion and suggest direct corrosive injury of oxalate in the digestive tract.^[8] Patients mostly reported 10–12 h after taking star fruit. This duration was less in previous case reports.^[5,6] The reason may be due to the difference in initial clinical presentation. In the present case report, patients mainly presented with GI and renal involvement as compared to previous case reports where the neurological symptom was more common as first clinical presentation. All patients had a good outcome with complete recovery of their renal function though a long-term follow-up needed to rule out the risk of development of chronic kidney disease in future.

Table 1: Clinical features and relevant investigations of patients

Patient	1	2	3	4	5
Age (years), sex	30, male	29, male	45, male	20, male	15, female
Amount of ingested fruit	10 fruit, 500 mL juice	1000 mL juice	5-6 fruit, 500 mL juice	6-8 fruit	4-6 fruit
Precipitating event	Took empty stomach	Took after heavy labor work	-	Empty stomach	-
Time length between ingestion and first presentation (h)	6-10	12-15	10-12	10-14	28-30
Clinical presentation	Pain abdomen, decrease urine output	Pain abdomen, decrease urine output	Back pain, nausea, decrease urine output	Nausea, decrease urine output	Hiccups, pain abdomen
Urinary analysis	Albumin+, RBC plenty, pus cell 10-15	Albumin+, pus cell plenty	Albumin+, RBC 1-2	Albumin trace, pus cell 10-12	Albumin trace, pus cell 5-6
Serum creatinine at first presentation (mg/dL)	23.7	17.1	6.0	11.7	3.2
Need for hemodialysis	Yes	Yes	No	Yes	No
Kidney biopsy finding	ATN	ATN, oxalate nephropathy	ATN, oxalate nephropathy	ATN	Biopsy not done

ATN: Acute tubular necrosis, RBC: Red blood cell

Table 2: Oxalate content of star fruit from different preparations

Star fruit preparations	Oxalate content (mg/100 mL)
Fresh sour carambola juice	820
Sour carambola juice from vendors	308
Pure pickled sour carambola juice from vendors	261.2±169.1
Fresh sweet carambola	202
Diluted pickled sour carambola juice from vendors	53.7±36.8
Commercial canned carambola juice	54.6±39.7

Various experimental studies show that plant containing high oxalate content may cause nephrotoxicity in animals like rat.^[9,10] According to these studies, large content of oxalate in star fruit can cause acute oxalate nephropathy. The mechanism by which tubular damage occurred is the obstruction of renal tubules by these crystals. However, it was observed that tubular dilatation was much more extensive than the crystal deposition, especially in human cases^[5] and the focal tubular deposition of crystals were not compatible with the profound loss of glomerular filtration rates. Studies found that in addition to the obstructive effect of the crystals, the oxalate alone could act as a cellular toxin capable of producing acute cell damage by increasing apoptotic effect on the renal epithelial cell.^[11,12] Oxalate crystals were found in two biopsies, but severe AKI changes were present in all patients.

Those patients who ingest star fruit in a large amount, presents as severe AKI, though we still do not know the maximum recommended safe amount of star fruit or juice. Consuming large amount of star fruit (either fruit or juice), or even smaller amount on an empty stomach or in a dehydrated state; should be recognized as a risk factor for star fruit toxicity.^[5,6]

Conclusion

In country like India where star fruit consumed routinely, physician should educate peoples even with normal renal function, not to ingest star fruit in large amount,

especially empty stomach or in dehydrated state to avoid oxalate nephropathy.

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Conflicts of interest

There are no conflicts of interest.

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