



Research Article

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DE-CRYSTALLIZATION OF CALCIUM OXALATE AND URIC ACID CRYSTALS BY USING *MUSA PARADISIACA* STEM EXTRACT

Aishwarya M H¹, Anusha A P¹, Pritam Bhat¹, Sahana Nandi¹, Geetanjali K¹, Hiremath S V² and Pavan K. J.^{3*}

¹ P.C Jabin Science College, Department of Biotechnology and Microbiology, Hubballi, Karnataka, India

² Head, School of Advanced Sciences, KLE Technological University, Vidyanagar, Hubballi, Karnataka, India

³ Assistant Professor, GM Institute of Technology, Department of Biotechnology and Microbiology, Davanagere, Karnataka, India

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***Corresponding author**

E-mail: pavanjkundur88@gmail.com

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ABSTRACT

Concentrated urine, the minerals and acid salts adhere together to form hard deposits known as kidney stone. The most common minerals found in crystals are calcium oxalate, calcium phosphate, uric acid and struvite. In majority cases renal stones were removed by surgical treatment like ESWL, ureteroscopy and percutaneous nephrolithotomy but unfortunately recurrence of stone was observed in about 50% cases. Medicinal plants have been known for long period of time as an excellent source of therapeutic agents for various diseases including urological disorders and Banana stem extract is said to be useful in de-crystallization of Kidney stones. The present study reveals the effectiveness of Banana stem extract when treated on these crystals showed decrease in the size and weight which was measured by weighing balance at different intervals. The study reveals considerable decrease in the weight of stone from 0.4440 gram to 0.3704 gram. The result shows that effective use of banana stem extract can be effectively used to degrade the kidney stones.

Keywords: Kidney stone, banana stem extract, calcium oxalate crystal, uric acid crystal.

INTRODUCTION

Kidney stones had a way back history parallel with the ancient times of civilization. A bladder stone which was observed in 4500 – 5000-year-old mummy, Egypt. However, in 1500 BC treatment for the stones were already mentioned in ancient Egyptian medical writings and also in the ancient Indian writings of the book “Sushruta Samhita” had described the treatment over 300 surgical procedures for stone diseases¹.

Kidney stone has caused a focal impact on public health in the last two decades. There are different types of calcareous (Calcium oxalate monohydrate and calcium oxalate dihydrate, apatite) and non-calcareous (uric acid, struvite, cystine, uric acid, and others) stones, among which over 80% cases of calcium oxalate and 5–10% cases of uric acid stone are found in population. As per the survey of National Health and Nutrition Examination, 7.1% of women and 10.6% of men were affected by renal stone disease². In India, approximately 12% population is suffering with renal stone every year with the high incidence states like Gujarat, Rajasthan, Punjab, Maharashtra, Delhi and Haryana³. Some endogenous factors like improper metabolism of calcium, oxalic acid, phosphorus, uric acid and nitrogenous waste products-exogenous factors like urea also contribute to renal stone formation. Besides, People's food habits, dehydration, hot climate, hard water usage are involved in kidney stone formation⁴.

Kidney stones are hard deposits of minerals and acid salts that stick together in concentrated urine. The most common crystalline minerals found in kidney stones are calcium oxalate, calcium phosphate, uric acid and struvite. The formation of stone involves complex mechanism of several physicochemical events

which includes super saturation, nucleation, growth, aggregation and retention of urinary stone constituents within tubular cells. A formation of crystal concretion within the kidney is known as kidney stone disease. About 12% of world population is affected with an increased urological disorder on health of mankind⁵. The symptoms of kidney stone usually differ with their site of formation such as kidney, ureter, urethra, urinary bladder. Some of the common symptoms seen in affected person are urinary tract infections, blockage of urine flow, flank pain, renal colic, haematuria, hydronephrosis, and obstructive uropathy. These symptoms may lead to severe pain, usually in the side of the abdomen that's often associated with nausea or vomiting.

Treatment of renal stones depends on stone size and location. Many therapies like diuretics, probiotics, citrate, chelating agents are given but they have their own pharmacological limitations, side effects on long use and are not effective in completely removing the stone. So, in majority cases renal stones are removed by surgical treatment like ESWL, ureteroscopy and percutaneous nephrolithotomy but unfortunately-recurrence of stone was observed in about 50% cases⁶. However surgical treatment causes side effects such as hypertension, tubular necrosis, haemorrhage and fibrosis of the kidney⁷. So, in renal stone treatment needs preventive as well as curative therapy for better relief. But there are not any proper effective drugs in current therapy which completely remove the stones.

Considering the complications in surgical removal of kidney stone, ancient Indian people opted an alternative method i.e., herbal medicine instead of surgeries.

Medicinal plants have been known for long period of time as an excellent source of therapeutic agents for various diseases

including urological disorders⁸. Herbal plants are used from millennia due to its efficacy, safety, traditional palatability and insignificant side effects as compared to synthetic drugs. There were many herbal methods for treating the urolithiasis such as tender coconut water, banana, horse gram, cumin seeds, ginger ale, lemon and celery leaves etc. Among this banana stem i.e., kernel part of banana stem extract gives the efficient results.

Musa paradisiaca commonly known as banana belongs to Musaceae family. The banana stem extract contains lot of bioactive compounds mainly alkaloids, flavonoids, terpenoids, tannin as the secondary metabolites. Banana stem is said to be a diuretic and helps to detoxify the body. These bioactive compounds are also responsible for de-crystallization of stones and treat kidney stones.

MATERIALS AND METHODS

The experimental materials and methodology used for study are as follows.

Kidney Stone Collection

Collection was done from Nisarga Chikitsalaya Sirsi, Karnataka State.

Plant Source

Musa paradisiaca stem pieces were collected from Gundabala village, Honnavar taluk, Karnataka state. The plant stem was collected after ripening of banana plant.



Figure 1: Banana stem extract



Kidney Stones before treatment



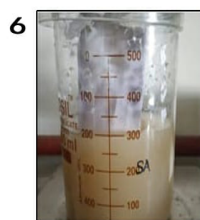
1 Banana Plant



2 Kernel



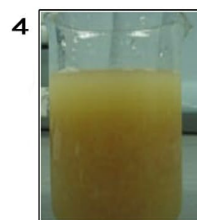
3 Kernel Pieces



6 Stone in Extract



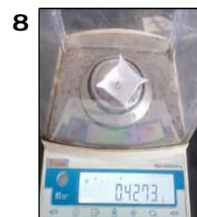
5 Kidney Stone



4 Kernel Extract



7 Experimental Setup



8 Stone's Weight & Size

Figure 2: Pictorial representation of treating kidney stone using banana stem extract

- a) Banana Plant b) stem portion collected c) Cut into small pieces d) Juice extract using grinder e) Kidney Stone f) stone place into extract g) Treating with the action of Magnetic Stirrer h) Regular weight recording using Digital weighing Balance.

Preparation of extract

A fresh, ripened banana (*Musa paradisiaca*) kernel was taken out from the banana stem. Kernel is the central and most important part of plant stem usually softer and edible. Potassium nitrate and magnesium nitrate are the major constituents present in extract. The kernel was chopped into small pieces and crushed in mixer grinder to obtain liquid extract. Through muslin cloth, the liquid extract was filtered.

Sample test

The kidney stone were measured for its size and weight using screw gauge and digital balance respectively. Measured kidney stone were placed in semi permeable cotton cloth pouch (SpCCP). Around 500 ml beaker was taken and filled it with 200 ml filtered liquid extract, lid was placed on the beaker. To that lid, semi permeable cotton cloth pouch was attached to the lid in such a way that pouch is suspended in a beaker, where its lower end is dipped in the purified liquid extract. The entire setup was placed on magnetic stirrer with low rpm (200 rpm) for 2 hours of operation at room temperature. The liquid extract was replaced once in 4 days interval. Simultaneously, the experimental result of change in size and weight of stone was recorded.

RESULT AND DISCUSSION

The recurrence of Kidney stone is a very serious problem in the medical supervision of urolithiasis (Kidney Stone). Drug treatments like thiazide as diuretic and alkali-citrate, used to

prevent the recurrence of hypercalciuria and hyperoxaluria, are considered to be less efficacious.

Although the surgical endoscopic stone removal and extracorporeal shock wave lithotripsy have revolutionized the treatment of urolithiasis, they increase the chances of new stone formation, and the shock waves in therapeutic doses may cause acute renal injury, decrease in renal function and an increase in stone recurrence (50–80%).

In view of these, the effect of leaves of *Musa Sp.*, having traditional use in the treatment of kidney stones and urinary tract troubles, was studied in *in-vitro* models of urolithiasis.

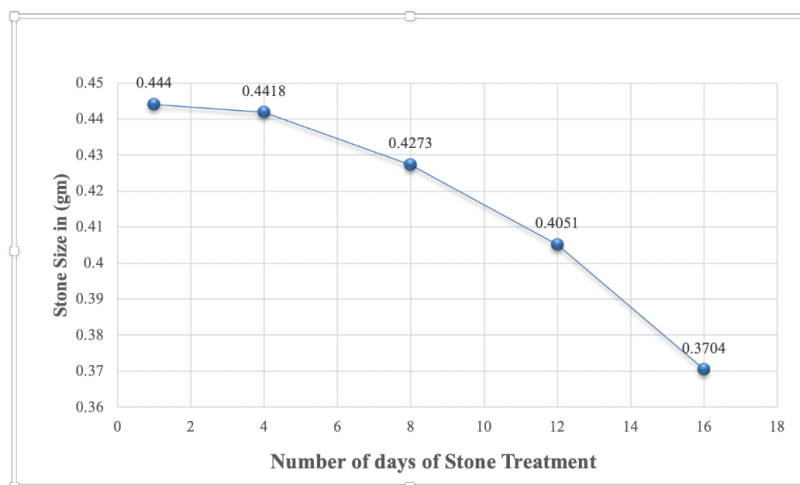
The extract of *Musa* stem juice has good kidney stone dissolving property. Potassium nitrate and magnesium nitrate are the major constituents present in *Musa* stem juice and was confirmed by chemical test and UV spectroscopy. From the two weeks in vitro studies it was found that the size of kidney stone reduced to a greater extent⁹.

Kidney stones are crystal aggregations formed in the kidneys from dietary minerals in the urine¹⁰. Dietary minerals also present in a wide range of food and drinks, including tea, coffee, chocolate, fruits and vegetables¹¹. It is an end product of endogenous metabolism of ascorbate, glyoxylate and glycine¹².

However, an attempt was made to decrystallize kidney stone by using the liquid extract of banana stem extract. The results of number of days of stone treatment.

Table 1: Days of treating stone and stone weight data

Days of Treatment	Stone Weight in (gram)
1	0.444
4	0.4418
8	0.4273
12	0.4051
16	0.3704



Graph 1: Number of days of stone treatment and reduction in stone size

Table 2: Data of length and width of kidney stone

S. No.	Date of Measuring	Length [mm]	Width [mm]
1	24/12/2019	11.88	6.51
2	27/12/2019	11.36	6.39
3	31/12/2019	11.3	6.25
4	01-04-2020	11.05	5.98
5	01-07-2020	10.8	5.8



Graph 2: Reduction in length and width of Kidney Stone

CONCLUSION

The traditional medical system of India has many active remedies for certain diseases, urolithiasis being one among them. Instead of inattentive outlook, the medical fraternity should venture to study scientifically the usefulness of these medicines. The present investigation, though of an initial nature, definitely suggests that the core of the banana pseudo stem can be used in the treatment of urolithiasis, especially of the calcium oxalate variety. The finding the Musa juice lowers serum cholesterol is also quite interesting.

The adverse and more side effects of modern medicine have diverted the attention of people towards herbal medicine. Medicinal plants play a vital role in treating stone diseases. De-crystallization of kidney stone was significantly observed when treated with banana stem extract. The kidney stone were treated with extract showed the major decreases in size and weight. The present study shows that *Musa paradisiaca* stem extract has anti urolithiatic property. The bioactive compounds present in the extract were responsible for this activity. However, use of banana stem extract for treating kidney stone proved to be best cost-effective strategy compared to the modern surgeries.

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