Research Paper

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In Vitro Study of the Litholytic Effects of Selected Food Extracts on Renal Stones

Home Science

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ABSTRACT

Present study investigated the in vitro renal calculi dissolving activity of plant foods of Indian origin namely Papaya fruit, Coconut flower, Drumstick leaves, Flax seeds and Radish. Renal stones were treated with plant extracts and kept in constant stirring conditions for a period of 6 weeks. NaCl (9 g/L) solution was used as control. At the end of every two weeks, the stone was removed from the experimental medium and weighted after a 5 hour drying period at 100°C.The parameters measured were reduction in stone weight after 6 weeks, % of weight reduction and dissolution rate. All the food extracts were found to reduce the weight of the stones after 6 weeks. Drumstick leaves extract was found to cause highest solubility (39.39%) in the stone which is higher than the control (26.72%) followed by coconut flower (25.42%) and papaya fruit (24.54%). In general, solubility of stone and dissolution rate (mg/24 hours) was more in 1st 2 week period as compared to 2nd and 3rd 2 week period for all the extracts except for flax seeds and radish. These results provide a baseline data for the use of food extracts as potential agents in the treatment of renal stones.

Introduction

Renal calculi or stone formation in the kidneys and urinary bladder is a most painful disorder [1]. Stone formation commonly occurs due to imbalance between promoters and inhibitors of crystallization in urine, inadequate urinary drainage, foreign bodies in urinary tract, microbial infections, excess calcium and oxalate consumption, vitamin abnormalities such as vitamin A deficiencies, excess vitamin D, and metabolic diseases like hyperthyroidism and gout [2].

In India, 12% of the population is expected to have urinary stones, out of which 50% may end up with renal complications progressing to renal damage. In northern India, nearly 15% of the population suffers from kidney stones while in southern India occurrences of urinary calculi are found to be low which may be due to habitual intake of tamarind [3]. About 75 to 90% of calculi that commonly occur are the calcium containing stones, especially calcium oxalate monohydrate, calcium oxalate dehydrate and basic calcium phosphate, while 10-15% are Magnesium ammonium phosphate stones, 3-10% are of uric acid and 0.5-1% are cystine stones [4].

Life style and dietary factors are the important biological events that are responsible for formation of stones [5].Calcium oxalate formation is attributed to intake of cereals rich in calcium and phosphorus besides lack of animal proteins and high intake of oxalate rich vegetables [6]. It is best to avoid oxalate rich foods such as beets, beans, blueberries, grapes, chocolate, strawberries, spinach, tea, bran, almonds and peanuts as preventive measure [7-8]. Possible treatment for calculi includes surgery, use of ultrasonic energy, extracorporeal shock wave lithotripsy (ESWL) and drugs. Medical therapy is often efficient but poorly tolerated, not effective in all cases, expensive, associated with risk of reoccurrences, might cause renal damage and hypertension [9].

Use of herbs and medicinal foods is an ancient Indian form of medicine used by tribes and older generations. After a lapse of century, it is gaining much importance due to its less severe side effects and also due to its holistic approach towards health. In traditional medicine several foods have been used to treat renal stones. There seems to be paucity in the scientific investigation of these foods. Therefore, the aim of the present investigation was to assess the litholytic potential of commonly used foods as a treatment for stones in folk medicine.

Materials and methods:

Preparation of plant extracts:

Five different foods popularly believed to be litholytic in folk lore of India were selected for the study. They include Papaya fruit (*Carica papaya*), Coconut flowers (*Cocos nucifera*), Drumstick leaves (*Moringa oleifera)*, Flax seeds (*Linum usitatisimum* L.) and Radish (*Raphanus sativus*). About 80 gm of fresh samples were taken and shade dried and powdered. 2 gm of each powdered sample was taken and boiled in 100ml of Nacl (9g /L) for 30 minutes and were used as extracts.

***In vitro* study:**

Surgically removed Kidney stones of 7 different patients were collected and in vitro study was conducted on these stones. The size and weight of the stones was measured initially and noted. Each food extract was filtered and thereafter set in a flask containing a renal stone. The medium was maintained under constant stirring for 6 weeks. NaCl 9 g/L solution was used as control. At the end of every two weeks, the stone was removed from the experimental medium and weighted after a 5 hour drying period at 100°C.The parameters measured were reduction in stone weight after 6 weeks, % of weight reduction and dissolution rate.

Results

Results obtained revealed that there was a definite reduction in weight of kidney stones after 6 weeks of treatment with control Nacl as well as the food extracts. Table 1. shows the reduction in the weight of the stones after every 2 weeks. Drumstick leaves extract was found to cause highest % of solubility in the stone followed by coconut flower and papaya fruit. Flaxseed and radish though failed in reducing the weight of the stone in first 2 weeks, proved successful after 6weeks (Table2).

Table 1. Weight of the stones after 2nd, 4th and 6th week of treatment with food extracts

Sample	Initial weight of the stone (gm)	Weight remained after 2nd week (gm)	Weight remained after 4th week (gm)	Weight remained after 6th week(gm)	reduction in weight of the stones after 6 weeks (gm)
Nacl (Control)	1.22	1.10	1.06	0.90	0.32
Papaya fruit	1.1	0.96	0.87	0.83	0.27
Coconut flower	1.18	0.92	0.90	0.88	0.30
Drumstick leaves	0.99	0.79	0.64	0.60	0.39
Flax seeds	1.1	1.1	1.0	1.0	0.1
Radish	1.0	1.0	0.9	0.88	0.12

Table 2. Solubility % of the stones observed during 6 weeks of treatment with food extracts

Sample	% Solubility after 2 weeks	% Solubility after 4 weeks	% Solubility after 6 weeks
Nacl (Control)	9.83	13.11	26.22
Sodium citrate	7.27	10.90	10.90
Papaya fruit	12.72	20.90	24.54
Coconut flower	22.03	23.72	25.42
Drumstick leaves	20.20	35.35	39.39
Flax seeds	No solubility	09.09	09.09
Radish	No solubility	10.00	12.00

It is evident from the observations that solubility of stones was more in coconut flower extract during the 1st 2 weeks, while it was more in drumstick leaves extract during 2nd 2 weeks of treatment when compared to other extracts. In general, solubility of stone was more in 1st 2 weeks as compared to 2nd and 3rd 2 week intervals for all the extracts except for flax seeds and radish (Table.3). Similar results were observed for dissolution rate (mg/24 hours) of the stones as evident from Table 4.

Table 3.Solubility of the stones observed during 2 week intervals of treatment with food extracts

Sample	1st 2 weeks(gm)	2nd 2 weeks(gm)	3rd 2 weeks(gm)
Nacl	0.12	0.04	0.16
Sodium citrate	0.08	0.04	0
Papaya fruit	0.14	0.09	0.04
Coconut flower	0.26	0.02	0.02
Drumstick leaves	0.20	0.15	0.04
Flax seeds	No solubility	0.10	0
Radish	No solubility	0.10	0.02

Table 4. Dissolution rate (mg/24 hours) of the renal stones Observed during 2 week intervals of treatment with food extracts

Sample	1st 2 weeks	2nd 2 weeks	3rd 2 weeks
Nacl	8.57	2.85	11.42
Sodium citrate	5.71	2.85	-
Papaya fruit	10.00	6.42	2.85
Coconut flower	18.57	1.42	1.42
Drumstick leaves	14.28	10.71	2.85
Flax seeds	0	7.14	0
Radish	0	7.14	1.42

Discussion

All the food extracts were found to be effective in dissolving renal stones. Drum stick leaves were found to be more effective followed by coconut flower and papaya fruit. Various mechanisms have been proposed to explain the litholytic effects of plants. These include, diuretic effect that allows the easy passage of small calculi out of the body in urine, promoting a balance between inhibitors and promoters of stone formation there by inhibiting crystallization, preventing crystal aggregation, anti oxidant, anti microbial, analgesic and anti inflammatory activities, improvement of renal function and regulation of oxalate metabolism which help in reducing the re occurrence of renal calculi [10].

From the available literature Drumstick leaves were found to possess anti inflammatory and antioxidant functions. These leaves are particularly rich in potassium, calcium, phosphorous, iron, vitamins A and D, essential amino acids as well as antioxidants such as β-carotene and flavonoids [11]. In ancient ayurvedic literature ripe fruit of papaya is used as a diuretic and for urinary tract infections. Papaya contains broad spectrum of phytochemicals including vitamins, minerals, enzymes, alkaloids, carotenoids and flavonoids [12]. Flaxseed has biologically active components such as alpha linolenic acid and the lignan secoisolariciresinol diglycoside (SDG) which has antioxidant activity [13]. Radishes are an alternative treatment for a variety of ailments including gallbladder problems, arthritis, gallstones, kidney stones etc. Presence of some biochemical substances such as methins, sapogenins, polyphenolics such as protocatechuic acid, vanillic acid, antibacterial substances such as Sulphoraphene and raphanin makes radish therapeutically important[14]. In the present study, the inherent vitamins, minerals, phytochemicals and antioxidants might have contributed to the litholytic effect. Dissolution of stone probably may also result from the formation of complexes between components of stone and polyhydroxylated molecules present in the extracts [15].

Conclusion

In the light of above observations it is proved that the food extracts studied have litholytic potential. Such activity may explain why these foods are used locally for the treatment of renal stones. The protective action could be attributed to a combined action of proposed mechanisms, presence of anti oxidant vitamins, minerals and phytochemicals. With further studies, the specific active constituents may be indentified and their mechanism of action may be elucidated. The plant products as such may not replace the existing treatments but may surely help in decreasing the recurrence rate of renal calculi.

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