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A Novel Herbal Composition of Aqueous Extract of *Capparis decidua* and its Anti-nephrolithiasis Activity

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ABSTRACT

Kidney stone is similar to a small rock that forms in the kidney. Stones are formed when certain chemicals in the body clump together. A stone may stay in the kidney or travel through the urinary system. Small stones may pass through the urinary system without causing greatly pain. Bigger stones can block the flow of urine if they get trapped in the ureters or urethra. Kidney stones usually didn't cause any symptoms until they start to pass. The present study was undertaken to investigate the anti nephrolithiasis activity of aqueous extract of *Capparis decidua*.

Aqueous extract of *Solanum xanthocarpum* was administered via intraperitoneal route to albino wistar rat in two test doses 400mg/kg and 800 mg/kg. Experiment was performed for preventive and curative regimen. In preventive regimen aqueous extract of *Capparis decidua* (AECD) 800 mg/kg (57.35% relief) show greater creatinine clearance then standard drug cystone (34.54% relief) and in curative regimen cystone (125.33% relief) has greater effect then aqueous extract of *Capparis decidua* (AECD) 800 mg/kg (42.48% relief). Test drug show dose dependent therapeutic efficacy. Therapeutic effect of test drug increase with increasing dose.

Keywords: *Solanum xanthocarpum*, Nephrolithiasis, Aqueous extract, kidney stone.

INTRODUCTION

Nephrolithiasis

A kidney stone is similar to a small rock that forms in the kidney. Stones are formed when certain chemicals in the body clump together.[1] Stone may stay in the kidney or travel through the urinary system. Anyone can have a kidney stone, but it may be more likely if you:

• Are male
• Are Caucasian

• Are very overweight
• Have had kidney infections
• Have a family member with kidney stones
• Have had kidney stones before
• Eat a lot of animal protein (such as meat and eggs)
• Do not drink enough liquids

Other conditions and medicines can also put you at greater risk for kidney stones.

Very small stones might pass through the urinary system without causing much pain. Larger stones can block the flow of urine if they get stuck in the ureters or urethra. Kidney stones do not usually cause any symptoms until they start to pass. Some symptoms might include:

• Extreme pain in your back or side that will not go away
• Throwing up
• Blood in your urine
• Fever and chills

Activity description

Plant profile *Capparis decidua*

Collection and identification of plant material

The chosen plant, *Capparis decidua* was identified and selected by the experts of Botany Department, Institute of biomedical and industrial research, Jaipur. For the present study various parts of the *Capparis decidua* i.e., fruits, flowers and barks were collected from Jaipur (India). (See figure 1.)

It is commonly known as karer, karel, kenr, karu etc is a densely branching shrub or small tree of the Thar Desert.

It is also found in the subtropical and tropical zones and other arid regions in southern Asia with a mass of slender, 4-5 meter high or occasionally a small tree with many green vines like apparently leafless branches, hanging in bundles. The bark turns into whitish- grey colour with age but most of the branches and twigs are a glossy dark green in colour. Small light brown spines occur in pairs on the twigs at each mode. Leaves are very minute (2 mm long) with a very short life span on young shoots, so that the plant looks leafless most of the time. The new flush of leaves appears in November – January. Flowers are pink in colour, red veined in small groups along the leafless shoots, in the axils of spines. Fruits are small many seeded ovoid or sub-globulous, slightly mucronate pink berry of the size and shape of a cherry, becomes blackish when dry.

Phytoconstituent

The plant possesses a number of alkaloids, terpenoids, glycosides and some fatty acids. The different phytoconstituents of different plant parts are as follow- Capparine, Cappariline and capparinine The bark shows the presence of n-pentacosane, n-tricontanol and β-sitaosterol besides a water-soluble alkaloid, 1-stachydrine.

Besides these, six new phytoconstituents have been isolated and characterized from the root bark, which are capparisterol, Capparideciduasterol, Cappa-risditerpenol, in aliphatic hydroxyketone and capparisditerpenyl ester.[2]

MATERIAL AND METHOD

Equipment

Soxhlet assembly, Semi auto analyzer, Hot air oven, Water Bottles, Polypropylene rat Cages etc.

Chemical and drugs

Ethylene glycol, Cystone, Sodium azide. Diethyl ether, Formaldehyde, Ethanol, and Test Kit For Urinary LDL, Serum Urea, Serum Creatinine, Crcl etc.

Experimental animals

Healthy male rats of Wistar strain weighing between 150 and 175 g of equivalent age groups were obtained from

central animal house of Institute of Biomedical and Industrial Research, Jaipur. Rats were acclimatized for one month in propylene cages under hygienic conditions and provided with standard animal feed and water ad libitum. All procedures were done in accordance with ethical guidelines for care and use of laboratory animals and were approved by the Institutional animal ethical committee (ibir/iaec/02).

Preparation of extract of *Capparis decidua*

Capparis decidua was collected from the campus of botanical garden of Department of dravyaguna vigyan, National Institute of Ayurveda. Whole plant was dried and powdered. Then 100 g of the powder was mixed with a sufficient volume of distilled water and extracted with a soxhlet apparatus for 16 to 18 hours. The solvent was removed and the extract was dried in an oven with the temperature of 50°-60°C and weighted.

Toxicity studies according to OECD guideline 420

The toxic dose was determined on the basis of a pre-studied experiment which was carried out on the rats. Four doses that were less than the lethal dose (LD50) (2000 mg/kg, 4000 mg/kg, 6000 mg/kg and 8000 mg/ kg as lower and higher dose, respectively) were taken as effective dose in the current study.

Four doses for aqueous extract for *Capparis decidua* extract to achieve lethal dose (LD50) were taken as effective dose in the current study.

Groups are divided as follow:

Group A: 2000 mg/kg; 10 albino Wistar rats
Group B: 4000 mg/kg; 10 albino Wistar rats
Group C: 6000 mg/kg; 10 albino Wistar rats
Group D: 8000 mg/kg; 10 albino Wistar rats

Experimental model

Anti-nephrolithiasis activity model

Dosage

Plant extract was suspended in distilled water and was administered (i.p) at doses of 400, 800 mg/kg body weight based on preliminary experimentation.

Experimental procedure

Ethylene glycol induced hyperoxaluria model was used to assess the antilithiatic activity in albino rats following procedures as under.[3]

Prophylactic regimen (PR)

Animals were divided into five groups containing six animal in each. Group I served as a vehicle treated control and maintained on regular rat food and drinking water ad libitum. All remaining groups (Group II-V) received calculi inducing treatment, comprised of ethylene glycol (EG, 0.4% v/v) with ammonium chloride (NH_4Cl, 1% w/v) in drinking water *ad libitum* for 15 days to accelerate lithiasis. Group III - administered cystone (750 mg/kg body wt.) Group IV – aqueous extract *Capparis decidua* (400mg/kg). Group V- aqueous extract *Capparis decidua* (800mg/kg).

Group III – V were administered above mentioned doses from day one to day fifteen of calculi induction. Extract and standard drug were suspended in distilled water and given intraperitoneally once daily.

Curative regimen

Animals were divided into five groups containing six animals in each. Group I served as a vehicle treated control and maintained on regular rat food and drinking water *ad libitum*. All remaining groups (Group II- V) received calculi inducing treatment, comprised of ethylene glycone (EG, 0.4% v/v) with ammonium

chloride (NH_4Cl, 1% w/v) in drinking water *ad libitum* for fifteen days to accelerate lithiasis, followed by only EG (0.4% v/v) for next thirteen days. Group III - administered cystone (750 mg/kg body wt.) Group IV – aqueous extract *Capparis decidua* (400mg/kg). Group V- aqueous extract *Capparis decidua* (800mg/kg).

Group III – V were administered above mentioned doses from day sixteen to day twenty eight of calculi induction respectively. Extract and standard drug were suspended in distilled water and given intraperitoneally once daily.

After the treatment, the rats were placed in metabolic cages and urine was collected in a glass bottle having 20 µl of 20 % sodium azide as a preservative for twenty four hour. The urine was frozen at - 20^0C and used for determination of alkaline phosphate (ALP) and lactate dehydrogenase (LDH) and creatinine content. The rats were anaesthetized with diethyl ether and sacrificed by decapitation after twenty four hour of above treatment. Before sacrificing, the blood was taken from orbital sinus into centrifuge without anticoagulant and allowed to clot at room temperature to collect serum. Urine from urinary bladder was directly obtained by puncturing with a needle (5/8 in.) attached to a 1ml tuberculin syringe. After dissection both kidneys were removed and transverse section from both the kidneys was fixed for histological analysis.

Biochemical assays in urine and serum

Serum urea level was estimated by diacetylmonoxime method. The creatinine in both serum and urine was estimated by the method of Bonsnes and Tauskey. Creatine clearance was calculated. Urinary LDH was measured by decrease in absorbance at 340 nm resulting from the oxidation of NADH. The activity of ALP was determined by measuring the conversion of p-nitrophenyl phosphate to p-nitrophenol at 405 nm.[4]

Histopathological studies

Transverse sections of kidney tissue were fixed in formaldehyde (10%). The tissue were then dehydrated and embedded in paraffin wax. The paraffin sections (8µ) were then cut and stained in Hematoxylene & Eosine staining and viewed under light microscope.

Observation

Toxicity Study of aqueous extract of *Capparis decidua*.

Group A: No behavioral change and mortality rate observed.

Group B: 10 % mortality rate observed.

Group C: 30% mortality rate observed.

Group D: 50% mortality rate observed. (See table 1&2 and figure 2&3.)

RESULT

Aqueous extract of *Capparis decidua* (AECD) found no behavioural change and mortality at dose 2000mg while at 4000, 6000 and 8000 mg/kg, 10%, 25%, 50% respectively mortality was observed.

According to Table 1 and Table 2, test drug at both doses shows nephrolithiatic activity against ethylene glycol induced nephrolithiasis in albino wistar rat with comparison to standard drug cystone.

In preventive and curative regimen test sample show significant changes with comparison of hyperoxaluria group in Urinary LDL (Units/ml/mg prt), Urinary ALP (IU/L), Serum Urea (mg/dl) and Serum Creatinine (mg/dl).

In preventive regimen AECD 800 mg/kg (4.76ml/min, 57.35% relief) show greater Creatinine clearance then standard drug cystone (4.07 ml/min, 34.54% relief) and in curative regimen cystone (5.14 ml/min, 125.33% relief) has greater effect then

AECD800 mg/kg (3.25 ml/min, 42.48% relief).

DISCUSSION AND CONCLUSION

A kidney stone is like a small rock that forms in the kidney. Stones form when certain chemicals in the body clump together. A stone can either stay in the kidney or travel through the urinary system. Very small stones might pass through the urinary system without causing much pain. Larger stones can block the flow of urine if they get stuck in the ureters or urethra. Kidney stones do not usually cause any symptoms until they start to pass. The study was undertaken to investigate the anti nephrolithiasis activity of *Capparis decidua*. In preventive and curative regimen test sample show significant changes with comparison of hyperoxaluria group in Urinary LDL (Units/ml/mg prt), Urinary ALP (IU/L), Serum Urea (mg/dl) and Serum Creatinine (mg/dl).[6-9]

In preventive regimen AECD 800 mg/kg (4.76 ml/min, 57.35% relief) show greater Creatinine clearance then standard drug cystone (4.07 ml/min, 34.54% relief) and in curative regimen cystone (5.14 ml/min, 125.33% relief) has greater effect then AECD800 mg/kg (3.25 ml/min, 42.48% relief).

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Table 1. Anti-nephrolithiasis activity (Preventive regimen)

PR	Urinary LDL (Units/ml/mg prt)	Urinary ALP (IU/L))	Serum urea (mg/dl)	Serum creatinine (mg/dl)	Crcl (ml/min)
Control	7.49±0.6823****	33.56±0.6717****	218.63±0.5107****	0.429±0.00141****	4.56±0.74645161***
Hyperoxaluria	20.53±0.7581	81.14±1.1299	355.85±0.9431	0.921±0.012083	3.025±0.8639
Cystone 750mg/kg	9.5±0.44****	40.33±0.7704****	246.14±0.8779****	0.56±0.0125****	4.07±1.011271*
AECD 400 mg/kg	15.6±0.4254****	77.63±0.7578****	307.3±0.6848****	0.876±0.0598NS	4.6±0.69094***
AECD 800 mg/kg	13.65±1.7442****	73.24±1.0276****	298.37±5.4328****	0.79±0.0756***	4.76±0.273398****

Mean ±Standard Deviation

Table 2. Anti-nephrolithiasis activity (Curative regimen)

CR	Urinary LDL (Units/ml/mg prt)	Urinary ALP (IU/L))	Serum urea (mg/dl)	Serum creatinine (mg/dl)	Crcl (ml/min)
Control	11.49±0.8135****	45.12±2.9623****	198.43±1.9018****	0.522±0.151625****	6.058±0.9370*****
Hyperoxaluria	36.13±1.2689	106.92±4.4319	356.44±1.0147	0.971±0.024408	2.281±0.4390
Cystone 750mg/kg	15.235±2.198488****	53.86±2.9278****	231.01±0.8339****	0.5943±0.067278****	5.14±1.00281*****
AECD 400 mg/kg	27.55±1.2014****	89.82±1.0321****	341.47±0.8160****	0.860±0.0299*	2.5833 ± 1.1974^{NS}
AECD 800 mg/kg	24.69±0.7665****	82.45±1.1735****	324.29±5.5273****	0.77±0.0352***	3.25 ± 0.5284^{NS}

Mean ±Standard Deviation

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Figure 1. *Capparis decidua*

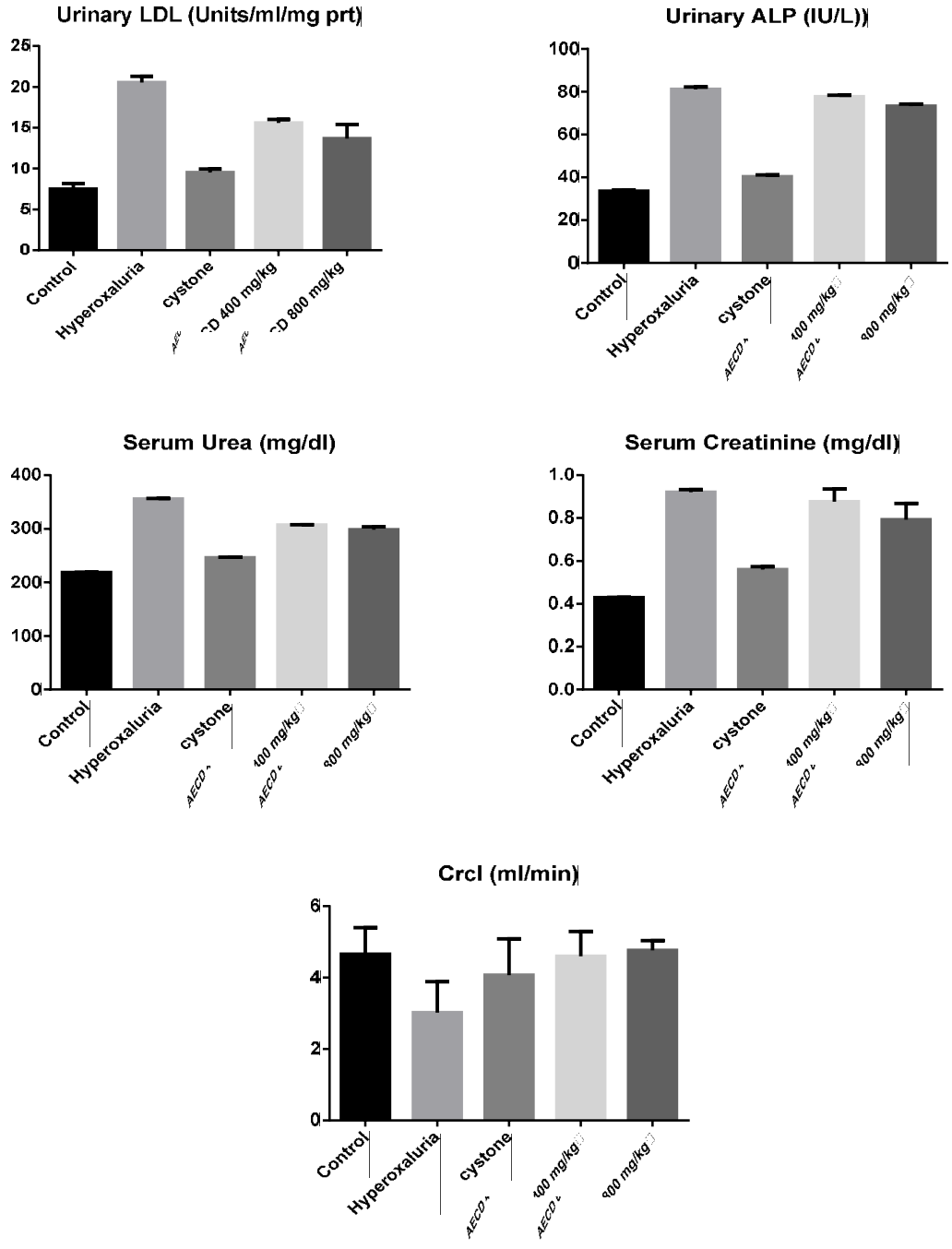

Figure 2. With table 1

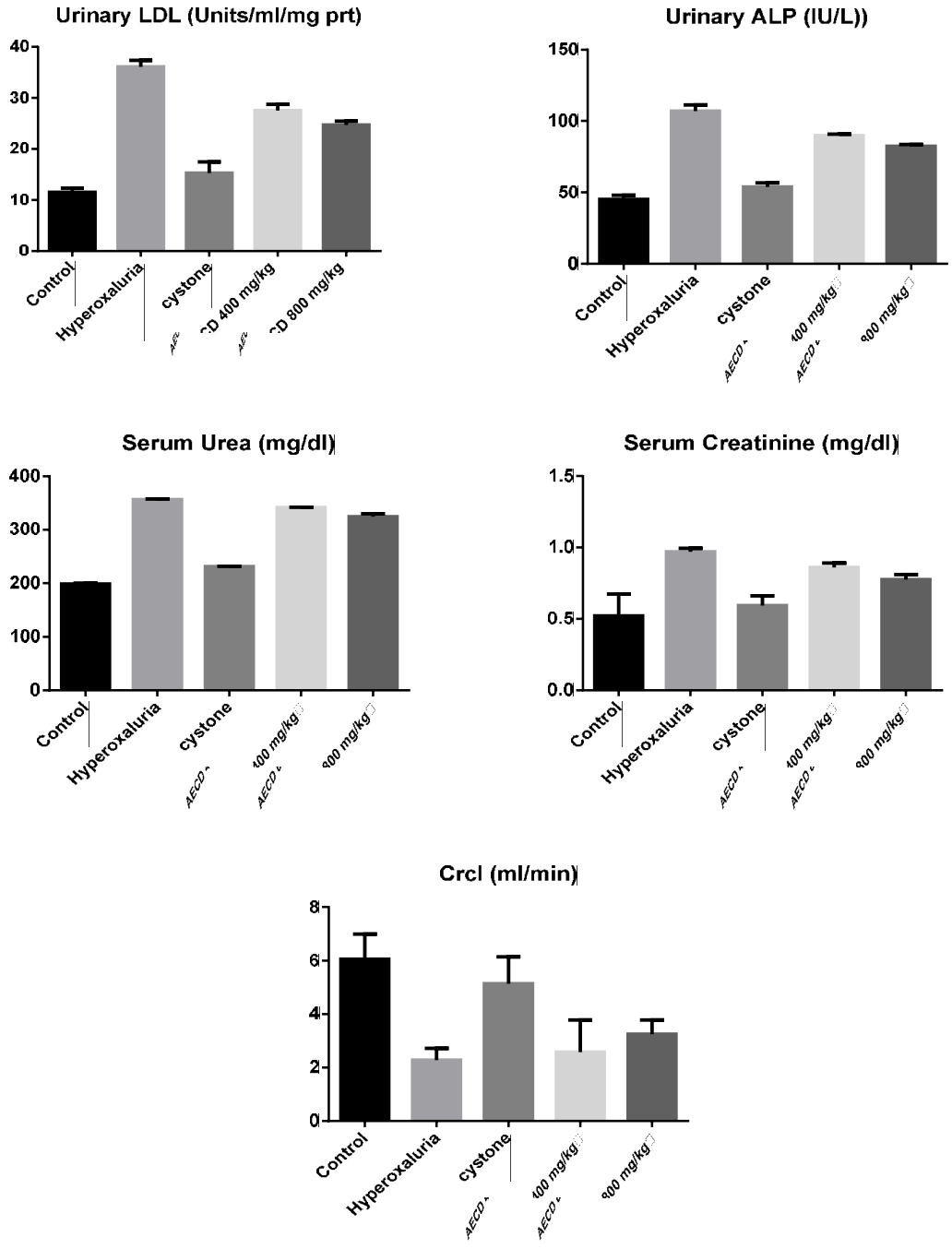

Figure 3. With table 2