DEVELOPMENT OF MUTRALA KASHAYA - A NOVEL AYURVEDIC DECOCTION

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ABSTRACT

Renal calculi, one of the most common social problems caused by incorrect urine elimination. By the process of excretion of urine in excess quantity, Mutrala drugs help in the removal of renal stones through the urine or lessen their size. A novel decoction was prepared by ingredients having diuretic and lithotropic action. Mutrala kashaya was prepared by boiling coarse powder of *Boerhavia diffusa* Linn., *Treibulus terrestris* Linn., *Bergenia ligulata* Wall., *Crateva nurvala buch Ham., Coriandrum sativum* Linn., *Vetivera zizanoids* Linn., *Benincasa hispida* Thunb. and *Vigna unguiculata* Linn. Phyto-and physiochemical values of all drugs were under standard range of API. Total solids of Mutrala kashaya is 4.92 %, pH is 4.5, specific gravity is 1.04, refractive index is 1.349, viscosity is 0.00125 mm^2 sec^{-1}. HPTLC showed 16 Rf values. It shows presence of reducing sugars (1.5%), fats, and oils along with cardiac and saponin glycosides. Mutrala kashaya can be developed by using herbal drugs having diuretic and lithotrophic effects.

Keywords: Ayurveda, decoction, mutrala, diuretics

INTRODUCTION

Disruption of harmony in the body as a result of *Doshastamoguna, rajoguna, vata, kapha* and *pitta* lead to development of curable or incurable disorders in the *srotas*(system)[1]. Among the various *srotas, mutravahasrota* (urinary system) is given the prime importance in ayurveda, as it deals with homeostasis of the body. However, *sroto gata vikaras* urinary disorders such as *ashmari, mutraghata, somaroga*, and *udavarta* often lead to the disruption of *mutravahasrota*[2].

Ashmari (urolithiasis) is the condition of abnormal concretion due to mineral deposition within the *mutravahasrota* resulting in renal failure[3]. It is mainly caused because of factors such as deficiency of vitamin A, excessive administration of vitamin D, and consumption of diet rich in purines, oxalates and calcium[4]. Treatment of *ashmari* is of high interest due to the chances of recurrence of the disease in majority of the patients[5]. However, a*yurvedic* treatment of *ashmari*, as described by *Susruta samhita* and *Charak samhita*, concentrates upon *asthasthanapariksha* and *panchakarma* along with *shaman, rasayana*, and *satwajaya* among the other methods[1].

There is description of group of drugs as well as single drugs of plant origin in *mutravikaras. Trinapanchamoola* (five small rooted plants), *Ikshu* (sugar cane), *Shali* and *Gokshura* possessing the property of diuretics have been widely administered for the treatment *srotogatavikaras* and are often referred to as *mutrala dravya* (diuretics[2]). Herbs used in the treatment of *ashmari* are referred to as *ashmarighna dravyas*.

Ashmarighna dravyas act by stimulating the *mutravahasrota,* leading to the excretion of urine and sodium in excessive amounts[2], thereby aiding in expelling the renal stones through urine or reducing its size. The *dravyas* (drugs) are usually processed to prepare *kashaya* (decoction), which aid in their shelf life and potency and make them palatable. They are widely used in ayurvedic treatments to achieve actions of pharmacological importance (*pachana, shodhana* and *tarpana*)[6].

The following study was planned to prepare a novel formulation from *Punarnava, Gokshura, Pashanabeda, Varuna, Dhanyaka, Ushira, Kushmanda,* and *Kulatha* and its quality control standardisation.

MATERIALS AND METHODS

Drugs, required for the preparation of Mutrala kashaya were authenticated and their quality analysed

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Table I: Ingredients of Mutrala kashaya

Sl. No.	Name of Drug	Latin Name	Part opted*	Quantity
1	*Punarnava*	*Boerhavia diffusa* Linn.	Whole Plant	12.5 g
2	*Gokshura*	*Treibulus terrestris* Linn.	Whole plant	12.5 g
3	*Kushmanda*	*Benincasa hispida* Thunb.	Fruit	12.5 g
4	*Dhanyaka*	*Coriandrum sativum* Linn.	Seed	12.5 g
5	*Varuna*	*Crateva nurvala* Buch- Ham.	Bark	12.5 g
6	*Kulatha*	*Vigna unguiculata* Linn	Seed	12.5 g
7	*Pashanabheda*	*Bergenia ligulata* Wall.	Rhizome	12.5 g
8	*Ushira*	*Vetivera zizanoids* Linn.	Root	12.5 g
	Total			**100 g**

**Bhavapraksha Nighantu*

Table II: Analytical results of physicochemical parameters compared with that of API

Drug	Total ash		Acid insoluble ash	Alcohol soluble extract	Water soluble extract	Loss on drying
Ushira	Results	2%	2.7%	4%	6.4%	12.5%
	API	NMT 9%	NMT 6%	NLT 4%	NLT 5%	
Punarnava	Results	6%	1.5%	9.6%	9.6%	21%
	API	NMT 15%	NMT 6%	NLT 1%	NLT 4%	
Varuna	Results	9%	1%	3.2%	10.4%	19%
	API	NMT 13%	NMT 1%	NLT 1%	NLT 8%	
Pashanabeda	Results	9%	0.5%	28%	19%	24%
	API	NMT 13%	NMT 0.5%	NLT 9%	NLT 15%	
Kulatha	Results	4.3%	0.8%	4.8%	12%	13.6%
	API	NMT 5%	NMT 1%	NLT 3%	NLT 12%	
Gokshura	Results	7.3%	1.4%	12.8 %	23.2%	16.5%
	API	NMT 15%	NMT 2%	NLT 6%	NLT 10%	
Dhanyaka	Results	5 %	1.4%	16%	22.4%	12.4%
	API	NMT 6%	NMT 1.5%	NLT 10%	NLT 19%	
Kushmanda	Results	10%	1%	12%	24%	27%
	API	NMT 12 %	NMT 1%	NLT 10%	NLT 6.1%	

API: Ayurvedic Pharmacopeia, NMT: not more than, and NLT: not less than

at AYUSH approved ASU Drug Testing Laboratory, Shri BMK Ayurveda Mahavidyalaya, KLE Academy of Higher Education, Belagavi.

A total number of eight ingredients are used for preparation of Mutrala kashaya. Punarnava (*Boerhavia diffusa* Linn), specified part of each was taken and physical impurities were removed and dried completely (Table I). Coarse powder was prepared in pulverizer (Clit Mill – 7.5 HP Motor) with mesh size 40-45 and kept separately[7]. All raw ingredients passed the organoleptic characters as per specification mentioned in Ayurvedic Pharmacopeias.

Individual coarse powder of Mutrala kashaya (Table I) was taken in a stony mortar, mixed well and compound mixture MK was prepared. MK Churna was mixed with eight parts of potable water in a stainless steel vessel and kept overnight (12 h). The container

preferred was that of stainless steel (depth: 16 cm, diameter: 11 cm).

Vessel containing soaked MK Churna was kept on gas burner. Boiling was continued till the volume reduced to approximately one fourth portion (200 mL). It was filtered after self-cooling and collected in a steel vessel.

Standardization of preparation[8] was done repeatedly in five batches during two months of one season (March/ April, temp 30° C -33 °C). Similar parameters were used for all the batches and the average value (duration 67 min, initial temperature was 31° C, final temperature was 107 °C) was taken as optimum for preparation of the formulation.

Preparation method was standardised by repeating the procedure five times.

Analytical study

Mutrala kashaya was analysed at AYUSH-certified ASU drug testing laboratory, Shri BMK Ayurveda Mahavidyalaya, KAHER, Belgavi for organoleptic properties (taste, smell, color and appearance), physicochemical properties (refractive index, specific gravity, total solids, pH and viscosity), phytochemical parameters[9] (carbohydrates, proteins, amino acids, steroids, glycosides, alkaloids, tannins and phenolic compounds), and microbial limit tests.

Refractive index[10], specific gravity[10], total solids[11], pH[11] and viscosity[11] were analysed to characterize the MK formulation.

Presence of microbes in MK was evaluated by performing microbial limit test[12] for *Escherichia coli*, *Salmonella abony*, *Staphylococcus aureus* and *Pseudomonas aeruginosa*. MK has undergone the tests of total bacterial and fungal count[13].

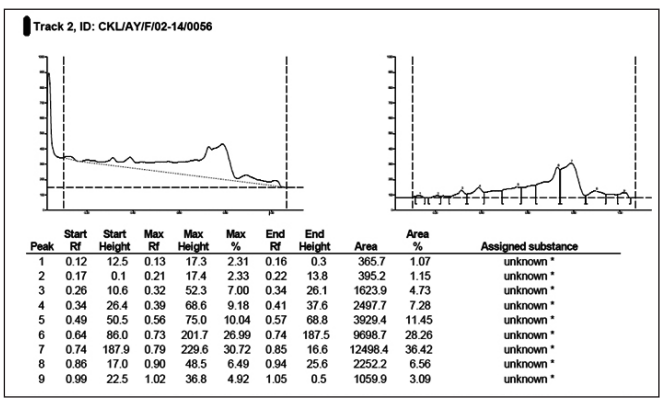
RESULTS

The results of the total study are given in Tables II -V and Fig. 1.

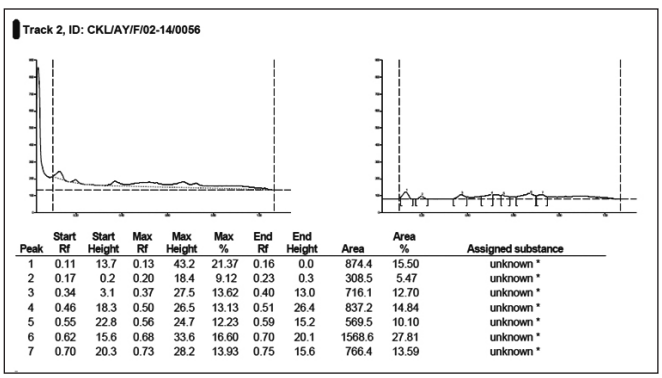
The phytoconstituents present in water soluble extracts of Kulatta are carbohydrate, reducing agents; in Gums in Gokshura are carbohydrates, reducing sugars, tannins and phenolic compounds in dhanyaka are reducing sugar, gums, alkaloids, tannins and phenolic compounds, in Kushamnda are carbohydrates, reducing sugars, glycosides, alkaloids, tannins and phenolic compounds. Calcium and magnesium, carbonate, nitrate and sulphate are absent and sodium is present in all ingredients. Iron is present in Ushira, Punarnava and Kushmanda. Phosphate is present in Varuna, Gokshura and Kushmanda. Chlorine is present in Punarnava

Table III: Retention factor (Rf) values of single drugs in TLC

	Long wave	Short wave	Normal light
Ushira	0.1, 0.28	0.21, 0.35, 0.61, 0.72, 0.84	0.26
Punarnava	0.18, 0.32, 0.64, 0.83	0.16, 0.27, 0.40, 0.49, 0.64	0.20
Varuna	0.17	0.93	--
Pashanabeda	0.04, 0.73, 0.85	0.44, 0.86	0.14
Kulatha	0.94	0.76	--
Gokshura	0.73, 0.8	--	--
Dhanyaka	0.56	0.94	--
Kushmanda	0.2, 0.26, 0.31, 0.46, 0.54, 0.87	--	0.19



Peak	Start Rf	Start Height	Max Rf	Max Height	Max %	End Rf	End Height	Area	Area %	Assigned substance
1	0.12	12.5	0.13	17.3	2.31	0.16	0.3	365.7	1.07	unknown *
2	0.17	0.1	0.21	17.4	2.33	0.22	13.8	395.2	1.15	unknown *
3	0.26	10.6	0.32	52.3	7.00	0.34	26.1	1623.9	4.73	unknown *
4	0.34	26.4	0.39	68.6	9.18	0.41	37.6	2497.7	7.28	unknown *
5	0.49	50.5	0.56	75.0	10.04	0.57	68.8	3929.4	11.45	unknown *
6	0.64	86.0	0.73	201.7	26.99	0.74	187.5	9698.7	28.26	unknown *
7	0.74	187.9	0.79	229.6	30.72	0.85	16.6	12498.4	36.42	unknown *
8	0.86	17.0	0.90	48.5	6.49	0.94	25.6	2252.2	6.56	unknown *
9	0.99	22.5	1.02	36.8	4.92	1.05	0.5	1059.9	3.09	unknown *



Peak	Start Rf	Start Height	Max Rf	Max Height	Max %	End Rf	End Height	Area	Area %	Assigned substance
1	0.11	13.7	0.13	43.2	21.37	0.16	0.0	874.4	15.50	unknown *
2	0.17	0.2	0.20	18.4	9.12	0.23	0.3	308.5	5.47	unknown *
3	0.34	3.1	0.37	27.5	13.62	0.40	13.0	716.1	12.70	unknown *
4	0.46	18.3	0.50	26.5	13.13	0.51	26.4	837.2	14.84	unknown *
5	0.55	22.8	0.56	24.7	12.23	0.59	15.2	569.5	10.10	unknown *
6	0.62	15.6	0.68	33.6	16.60	0.70	20.1	1568.6	27.81	unknown *
7	0.70	20.3	0.73	28.2	13.93	0.75	15.6	766.4	13.59	unknown *

Fig. 1: HPTLC of Mutrala kashaya

Results of Microbial limit test: The microorganisms *S. aureus*, *E. coli*, *P. aeruginosa*, *S. abony* are absent in Varuna, Ushira, Punarnava, Dhanyaka, Pashanabeda, Gokshura, Kulatha and Kushmanda.

Table IV: Results of total bacterial count and fungal count

	Bacterial count limits (30-300 cfu mL^{-1})	Fungal count limits (10-100)
Ushira	35	60
Punarnava	72	51
Varuna	33	42
Pashanabeda	52	23
Kulatha	49	73
Gokshura	40	35
Dhanyaka	39	40
Kushmanda	69	92

Note: Units is in cfu mL^{-1}

Result of various phytoconstituents of Mutrala kashaya

The qualitative analysis of Mutrala kashaya showed presence of carbohydrates, cardiac glycosides, saponin glycosides, fats and oils, absence of pentose sugar, monosaccharides, non reducing sugar, proteins, amino acids, steroids, flavonides, alkaloids, tannis and phenolic compounds and 1.5 % of reducing sugar.

The refractive index of Mutrala kashaya is 1.349, Specific gravity is 1.04, pH is 4.5, Viscosity ($mm^2 s^{-1}$) is 0.00125 and total solids (%) is 4.92.

Table V: Rf values of Mutrala kashaya at different wavelengths

Long Wave	0.13, 0.16, 0.35, 0.5, 0.68, 0.73, 0.84, 0.91
Short Wave	0.34, 0.38, 0.45, 0.54, 0.63, 0.67, 0.75, 0.84, 0.91
Normal Light	0.625, 0.675, 0.85

HPTLC

- 254 nm: 0.13, 0.21, 0.32, 0.39, 0.56, 0.73, 0.79, 0.90, 1.02
- 366 nm: 0.13, 0.20, 0.37, 0.50, 0.56, 0.68, 0.73

DISCUSSION

Standardization of kashaya preparation was necessary due to the nonclassical nature of the formulation. Therefore, the formulation was prepared in five batches for standardizing the pharmaceutical parameters (soaking, duration, temperature, reduction of water) deemed necessary for the preparation process.

Kashaya was selected as the preferred form of dosage for the formulation due to its property of incorporating water-soluble principles of herbal drugs in boiling water[14]. Additionally, boiled water is known to have bastishodhana property[15,16], as a result of which it causes increased output of urine and minerals aiding in the treatment of renal calculi (*ashmari*). The quantity of water required for the preparation of mutrala kashaya was determined by the consistency of the herbs as softer herbs require less water treatment to release the principle compounds. Since the formulation was prepared by using a mixture of herbs with varied consistency, eight times of water was added for soaking the herbs overnight. The mixture was boiled and reduced to one-fourth for effective extraction and preparation of the formulation.

Size of the herbs used is another important factor in the selection of dosage form, as it helps in proper extraction of active constituents from drugs[17]. In Mutrala kashaya preparation, all the herbs were used in coarse powder form. The coarse size decided (Table II) is according to the specified size in the API for kwatha preparation, as it is the apt size for extraction of water-soluble principles in water.

Climatic conditions, especially room temperature and humidity, have been observed to influence the preparation of kashaya, as boiling point of water is reached faster with the elevation in room temperature and humidity. The temperature for all the batches was maintained between 90 °C to 110 °C for the preparation of kashaya, as it helps to maintain the water in boiling condition, thereby enabling the dissolution of active compounds from the herbs into the water media.

Varuna (*Crataeva nurvala*) having anti-lithogenic and anti-crystallization property, prevents stone formation. It reduces the urine pH toward acidic. Diuretic action attributes the metabolic correction of the serum and urinary electrolyte levels in albino rats. *Crateva nurvala* and *Tribulus terrestris* were found to be effective in preventing the deposition of the stones in experimental rats. In Unani medicine, the concentrated water extract of kulthi seed is given for destroying stones in the kidney. The involved mechanism may be as follows,

Improvement in renal tissue anti-oxidant status, integrity of cell membrane, Inhibition of crystal nucleation, aggregation and growth, by increasing urine volume, pH and anti-calcifying activity, regulation of oxalate metabolism.

Kulatha dilutes the concentration of urinary electrolytes. By that, calcium and phosphorus are flushed out through urine, so there is less chances of precipitation, decreased formation as well as the growth of urinary stone. The antiurolithic activity in *Bergenia ligulate* mediated possibly through CaC_2O_4 crystal inhibition, diuretic, hypermagnese uric and antioxidant effects and this study rationalizes its medicinal use in urolithiasis[33].

Mutrala kashaya may show the property of Tiktha Madhura rasa, sheetaveerya, madhuravipaka, Mutrakrichrahara, Basthi shodhana, hridya, *ashmari ghna* (lekhana), Krimihara which may help in reducing the pitha by expelling it through urine, increase in urine output. Basthishodhana is the property where urine present in bladder is expelled out with ease, normalizes the pH and prevents formation *ashmari*. It may also relieve the difficulty in micturition by excreting the urine in excess quantity and acting as antispasmodic. The property of lekhana can also acts on the *ashmari* and reduce its size and may get expelled through urine. Cardiac glycoside which is present in kashaya, will act on kidney and expel more urine. Saponin glycoside will act as anti bacterial agent. Mannitol, which is present in dhanyaka, will act as an osmotic diuretic[18-33].

CONCLUSION

In the present study, drugs related to Mutravahasrotas (Urinary system), rasayana property etc are selected and a novel decoction has been developed. As it is a non-classical formulation, Mutrala kashaya was prepared in five batches by considering the influence of temperature, humidity, vessel etc. Parameters to standardise the product along with its quality control studies was ruled out. Its effect was conducted in further studies.

Kashaya was pleasant in odour, light brown with slightly bitter taste. The quality control parameters of raw drugs were within the limit of API standards. The herbs selected for the preparation of formulation were established to have low inorganic content- only sodium, potassium and iron, which are essential for the body.

The formulation was however, found to be rich in organic content with the presence of reducing sugars (1.5%), fats, and oils, total solids (4.92 %) presence of cardiac and saponin glycosides etc, supporting its function of being diuretic, anti-inflammatory, lithotropic, and antibacterial.

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