

Kaempferia rotunda Linn.- Phytochemical Profile

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Abstract— *Chengazhuneerkizhangu* is a drug widely used among the traditional practitioners of Kerala. The drug is botanically identified as *Kaempferia rotunda* Linn. belonging to family Zingiberaceae. *Hortus malabaricus*, a book describing the folklore medicines of Malabar identifies the drug and rhizome is described as its useful part. The use of the drug is limited to the state and it is away from the main stream of practice. In order to validate the traditional claim the preliminary phytochemical analysis of the drug was carried out. The preliminary phytochemical analysis aims at analysing the physico chemical property of drugs, their qualitative analysis, ash values, extractive values, moisture and volatile contents, estimation of Tannins and Phenols. On analysing the phytochemical constituents present in the crude drug, the drug revealed the presence of alkaloids, flavonoids, saponins, carbohydrates, proteins, phenols, steroids, and tannins. These phytoconstituents present in the drug may be responsible for the therapeutic potential of the drug. This preliminary phytochemical analysis of the drug validates the therapeutical claim about the drug.

Keywords— Phytochemical analysis; *Kaempferia rotunda* Linn.

I. INTRODUCTION

Plants are part of our health care system from time immemorial. According to WHO 80% of the population of the developing countries still rely on traditional medicine especially plants for their primary health care needs. Many of the folklore practices are passed on from one generation to the next and are widely practiced among communities. These medicines and practices despite their miraculous effects are away from the mainstream of health care due to the lack of scientific validation.

Kaempferia rotunda Linn. Popularly known as *chengazhuneerkizhangu* among the traditional practitioners of Kerala is such a drug with wide therapeutic potential but with limited recognition. Ayurvediya Oushadha Nighantu a regional Malayalam lexicon by Thayyil Kumaran Krishnan, identifies the drug *chengazhuneer kizhangu*¹. Description about the therapeutic uses of the drug is also available in the text book *Gunapatha* where its rhizome is said to be beneficial in bleeding conditions². Moreover *Hortus malabaricus*, a book describing the folklore medicines of Malabar identifies the drug and rhizome is described as its useful part.³

The first step to bring a traditionally used plant to main stream is to scientifically validate its pharmacological ability. The pharmacological effect of a plant depends upon its chemical constituents. These bioactive constituents capable of producing definite physiological action in the body determines the medicinal value of a plant. Phytochemical analysis which unveils the phytochemical picture of a plant is the initial step that scientifically proves its medicinal value.

In the present study phytochemical screening of rhizome of *Kaempferia rotunda* Linn is carried out to validate its therapeutic potential.

The plant *Kaempferia rotunda* Linn. was positively identified and its rhizomes were collected from Aloor, Pathanamthitta district, Kerala. Rhizomes of the plant thus collected were cultivated in Koipram village of Pathanamthitta district, Kerala. Cultivation was done during the month of May. The rhizomes had taken about 7-8 months to attain full maturity, which was indicated by the drying up of leaves. Fully matured rhizomes of the plant were collected in the months of December and January.

The freshly collected rhizomes of *Kaempferia rotunda* Linn. were washed with water thoroughly to remove physical impurities and was made into small pieces and dried well under shade. Properly dried drug was then made to a fine powder and passed through a sieve of 120 mesh size. The powder thus obtained is used for the study.

The phytochemical analysis was done at Drug Standardization Unit of Department of Dravyagunavijnanam, Government Ayurveda College, Tripunithura.



Fig. 1. *Kaempferia rotunda* Linn. Plant

II. MATERIALS AND METHODS

A. Collection of Drug



Fig 2 Rhizome of *Kaempferia rotunda* Linn. with tubers

B. Reagents

Concentrated and dilute Hydrochloric acid, Xylene, Concentrated and dilute Sulphuric acid, Concentrated and dilute Nitric acid, Sodium hydroxide solution, Lead acetate solution, KMNO₄ solution, Anhydrous Sodium carbonate, Petroleum ether, Cyclohexane, Acetone, Alcohol, Fehling’s Solution A&B, Chloroform, Dragendroff’s reagent, Mayer’s reagent, Neutral ferric chloride, Magnesium ribbon, Methylene blue reagent, Sodium bicarbonate Copper Sulphate, Catechol, Folin catechu phenol reagent.

C. Apparatus

Round bottom flask, silica crucible, Dean and Stark’s apparatus, Clevenger’s apparatus, Soxhlet apparatus, water condensers, Buchner funnel, hot air oven, muffle furnace, Bunsen burner, heating mantle, glass beakers, Petri dishes, standard flask, measuring jars, conical flask, funnel, glass rods, watch glass, burettes, pipettes, shaker, centrifuge, Whatmann filter paper.

D. Procedure

Physicochemical parameters

The rhizome of *Kaempferia rotunda* Linn. was studied for various physico chemical standards like foreign matter, total ash, acid insoluble ash, water insoluble ash, volatile oil, moisture content, fibre, tannin, total sugar, reducing sugar, phenol and pH.

Qualitative analysis of Ash

The ash was subjected to qualitative analysis to confirm the presence of acid radicals carbonate, phosphate, chloride and sulphate and basic radical potassium.

Determination of Extractive values

Extractive values of crude drugs are useful for their evaluation, especially when the constituents of a drug cannot be readily estimated by any other means. The cold alcohol soluble, hot alcohol soluble, cold water soluble and hot water soluble extractive values of the rhizome of *Kaempferia rotunda* Linn. was evaluated in the study.

Successive solvent extraction of the drug was also carried out using the solvents petroleum ether, cyclohexane, acetone and alcohol.

Phytochemical parameters

Preliminary phytochemical screening was done to confirm the presence or absence of phytochemical constituents alkaloids, flavonoids, phenols, saponins, carbohydrates, proteins, steroids and tannins.

Petroleum ether, cyclohexane, acetone and alcohol extracts of rhizome of *Kaempferia rotunda* Linn. were subjected to qualitative analysis for analysing the presence of steroids, alkaloids, flavonoids and phenols.

The physical and preliminary phytochemical analysis was done by standard procedures mentioned in the Ayurvedic Pharmacopoeia of India.⁴

III. RESULTS

Results of the preliminary phytochemical analysis done are tabulated below

TABLE 1. Results of Physico-chemical evaluation of rhizome of *Kaempferia rotunda* Linn.

S No	Experiments	Rhizome of <i>Kaempferia rotunda</i> Linn.
1	Foreign matter	Nil
2	Total ash	4.69%
3	Acid Insoluble Ash	1.2%
4	Water Insoluble Ash	1.4%
5	Moisture Content	9.2%
6	Volatile oil	Nil
7	Fiber	3.80%
8	Tannin Content	13.81%
9	Total sugar	3.67%
10	Reducing sugar	Nil
11	Phenol	0.85%
12	pH	6.8

TABLE II. Qualitative analysis of ash of rhizome of *Kaempferia rotunda* Linn.

S No	Experiment	Rhizome of <i>Kaempferia rotunda</i> Linn.
Acid radicals		
1	Carbonate	+
2	Phosphate	-
3	Chloride	-
4	Sulphate	+
Basic radicals		
5	Potassium	-

TABLE III. Extractive values (Alcohol soluble and Water soluble) of *Kaempferia rotunda* Linn.

S No	Type of Extractives	Rhizome of <i>Kaempferia rotunda</i> Linn.
1	Cold Alcohol soluble	1.7 %
2	Hot Alcohol soluble	7.4 %
3	Cold water soluble	27.13 %
4	Hot water soluble	21.2%

TABLE IV. Extractive values (in different solvents) rhizome of *Kaempferia rotunda* Linn.

S No	Solvent	% of extractive values of Rhizome of <i>Kaempferia rotunda</i> Linn.
1	Petroleum ether	2.66%
2	Cyclohexane	0.73%
3	Acetone	3.26%
4	Alcohol	0.30%

TABLE V. Qualitative phytochemical analysis of rhizome of *Kaempferia rotunda* Linn.

Experiments	Rhizome of <i>Kaempferia rotunda</i> Linn.
1) Alkaloids	
a) Dragendroff’s test	+
b) Meyer’s test	+
2) Flavonoids	+
3) Saponins	+

4)	Carbohydrates	
a)	Fehling's test	+
b)	Benedict's test	+
5)	Proteins	+
6)	Phenols	
a)	Ferric chloride test	+
b)	Lead acetate test	-
7)	Steroids	+
8)	Tannins	
a)	Ferric chloride test	+
b)	Lead acetate test	+

TABLE VI. Qualitative analysis of extractives of rhizome *Kaempferia rotunda* Linn.

S No	Extract	Steroid	Flavo-noids	Alkal-oids	Phenols
1	Petroleum ether	+			
2	Cyclohexane	+			
3	Acetone	+	+	+	+
4	Alcohol	+			

IV. DISCUSSION

The rhizome of *Kaempferia rotunda* Linn. was subjected to phytochemical analysis to assess the quality and purity of the drug. The drug was initially analyzed for the presence of foreign matter and its absence ruled out the possibility of contamination of the drug. Further ash values of the drug were assessed. Ash values are important indices to illustrate the quality as well as purity of the drug. In the assessment it was found that The percentage of total ash, acid insoluble ash and water insoluble ash were respectively 4.69%, 1.2% and 1.4%. The values obtained were almost similar to those obtained in the physical evaluation of the rhizome done as part of a research study conducted by Passah Timai.⁵ These values being minimal indicate the absence of inorganic matter and ascertain the purity of the drug. The ash of the drug when analyzed for acid and basic radicals revealed the presence of acid radicals carbonate and sulphate.

The moisture content of the powdered drug was found to be 9.2% which is within the permissible limit⁶ and makes the drug suitable for storage and accounts for the slow degradation of the drug. This also ensures the microbial stability of the drug. Qualitative and Quantitative estimation of pH of the drug in powder form was evaluated. The drug turned blue litmus paper into red indicating the acidic nature and shows an acidic pH of 6.8.

Extractive values of a drug give an idea about the nature of chemical constituents present in them and also aid to gain evidence regarding adulteration of the drug. They also point out the suitable form of formulation which may be adopted for the drug as well as the type of solvent in which we can obtain the maximum active constituents. The constituent such as mucilage is water soluble whereas resins are alcohol soluble. Constituents like tannins and glycosides are soluble in both water and alcohol. The rhizome of *Kaempferia rotunda* Linn. showed maximum extractive value in cold water (27.13%) followed by hot water (21.2%). Extractive values in hot alcohol and cold alcohol were respectively 7.4 and 1.7%. Previous research work also showed that the drug had an extractive value of 27.218% in water and 7.778% in alcohol which are similar to the results obtained in the present study.

Successive solvent extraction is a serial exhaustive extraction method which involves successive extraction with solvents of increasing polarity from a non-polar (petroleum ether) to a more polar solvent (methanol) to ensure that a wide polarity range of compound could be extracted. In successive solvent extraction of the rhizome of *Kaempferia rotunda* Linn., maximum extractive value was obtained for acetone (3.26%) followed by petroleum ether (2.66%). The extractive value for cyclohexane was 0.73% and for alcohol it was 0.30%. The extracts thus obtained were subjected to qualitative analysis for confirming the presence of phytoconstituents. The acetone extract of the drug showed the presence of alkaloids, flavonoids, steroids and phenols. Presence of steroids was detected in all the four extracts. In the available research articles where the phytoconstituents of rhizome of *Kaempferia rotunda* Linn. were analyzed presence of alkaloids, flavonoids, steroids and phenols were confirmed.

Qualitative analysis of the crude drug showed the presence of the phytochemicals alkaloids, flavonoids, steroids, proteins, tannins and phenols and the quantitative estimation of fibre, tannin and phenol content of rhizome of *Kaempferia rotunda* Linn. were found to be 3.80%, 13.81% and 0.85% respectively.

Presence of the phytochemicals alkaloids, flavonoids, saponins and phenols which had got proven therapeutic activities may be the reason for the medicinal value of the drug.

V. CONCLUSION

The drug *Kaempferia rotunda* Linn. is popular among the traditional practitioners of Kerala. In order to validate the traditional claim and to standardize the drug, its phytochemical analysis was carried out which revealed the presence of valuable phytoconstituents which accounts for the therapeutic potential of the drug.

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