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Formulation and Evaluation of Gokshuradi Churna for the treatment of Pyelonephritis Infection

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Abstract

Pyelonephritis, a severe urinary tract infection primarily affecting the kidneys, is commonly caused by uropathogens such as Escherichia coli and Klebsiella pneumoniae. Rising antibiotic resistance has driven interest in alternative therapies, particularly traditional herbal formulations. This study focuses on the formulation and evaluation of Gokshuradi Churna, a classical Ayurvedic polyherbal powder, traditionally used for urinary and renal disorders. The churna was prepared using authenticated herbs including Tribulus terrestris, Asparagus racemosus, Hemidesmus indicus, and Abutilon indicum. The formulation underwent organoleptic, physicochemical, and phytochemical evaluation. Antimicrobial efficacy was assessed using the agar well diffusion method against common pyelonephritis pathogens. Results indicated significant inhibitory activity, particularly against E. coli, along with acceptable physicochemical properties and the presence of active phytoconstituents such as flavonoids, tannins, and alkaloids. The study concludes that Gokshuradi Churna exhibits promising potential as a natural alternative in managing pyelonephritis infections, warranting further in vivo and clinical investigations.

Keywords: Gokshuradi ChurnaPyelonephritis, Herbal formulation, Urinary tract infection (UTI), Tribulus terrestris, Antimicrobial activity, Ayurvedic medicine, Uropathogens, Phytochemical screening, Herbal therapeutics

Introduction

Pyelonephritis is a bacterial infection of the kidneys, often caused by Escherichia coli ascending from the lower urinary tract.Increasing antibiotic resistance has led to renewed interest in herbal remedies.Gokshuradi Churna, a classical Ayurvedic polyherbal formulation, is traditionally used for urinary disorders.This study aims to formulate Gokshuradi Churna and evaluate its efficacy against pyelonephritis.Pyelonephritis is a serious and potentially life-threatening infection of the kidneys, commonly caused by ascending urinary tract infections. It is most frequently associated with uropathogens such as Escherichia coli, Klebsiella pneumoniae, and Proteus mirabilis. While modern antibiotics are the mainstay of treatment, the growing problem of antibiotic resistance poses a significant challenge to effective management. This has prompted the exploration of traditional and herbal remedies that offer both efficacy and safety.Ayurveda, the ancient system of Indian medicine, offers a rich repository of herbal formulations traditionally used to treat urinary and renal disorders.

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One such classical preparation is Gokshuradi Churna, a polyherbal powder composed of multiple medicinal herbs known for their diuretic, anti-inflammatory, and antimicrobial properties. The key ingredients such as Tribulus terrestris (Gokshura), Cyperusrotundus (Mustaka), and Terminalia chebula (Haritaki) have been individually reported for their beneficial effects in urinary tract health.Despite its traditional use, there is a lack of scientific data supporting the use of Gokshuradi Churna specifically for pyelonephritis. Therefore, this study aims to formulate and evaluate Gokshuradi Churna using standardized methods, assess its physicochemical and phytochemical characteristics, and investigate its antimicrobial efficacy against key pathogens responsible for pyelonephritis. The results of this research may contribute to the validation and possible integration of this Ayurvedic formulation into modern therapeutic practices for urinary tract infections. The main objectives of the present study are:

- To formulate an herbal Gokshuradi Churna using standard Ayurvedic practices.
- To perform physicochemical and phytochemical evaluation.
- To evaluate its antimicrobial activity against common uropathogens.
- To assess its safety and efficacy in the treatment of pyelonephritis.

Experimental

Table 1: Composition of the formula

Herb Name	Botanical Name	Part Used	Properties
Gokhru	Tribulus terrestris	Fruit	Diuretic, Antibacterial, nephroprotective
Shatavari	Asparagus racemosus.	Root	Anti-inflammatory, Antioxidant, Immunomodulatory
Sariva	Hemidesmus indicus L.	Root	Blood Purifier, Antimicrobial, Antidiabetic
Atibala	Abutilon indicum	Root	Diuretic,Anti-inflammatory,

Preparation of churna

The raw materials such as Gokhrufruit (1part), Shatavari root (1part), Sarivaroot (1part) Atibala root (1part) were used for the preparation of GC. The raw materials were purchased from the local market of Marothia bazar GC-1 and GC-2 at different season and GC-3 and authenticated. All the herbal ingredients were washed, dried and powdered individually. The powders were completely passed through sieve number 44 and not less than 50 percent through sieve number 80. Each powdered ingredients were weighed separately, mixed together and pass through sieve number 44 to obtain a homogenous blend.

Fig. 1:Final Product

Evaluation Parameters:

Table 2: Organoleptic Evaluation

Parameters	Observation
Appearance	Powder
Odour	Characteristic
Taste	Characteristic And acrid
Colour	Yellowish Brown
Texture	Fine

Physical Methods

Determination of Ash Values

Total Ash Value:-1gms of churna was weighed accurately in a previously ignited and tared silica crucible. The material was then ignited by gradually increasing the heat to 500- 600°C until;it appeared white indicating absence of carbon. It is thencooled in a desiccator and total ash was calculated with reference to the air dried drug (3-7).

Acid Insoluble Ash Value:-To the crucible containing total ash, 25 ml of dil. HCL was added and boiled gently for 5minutes, and then about 5 ml of hot water was added and transferred into crucible. The insoluble matter was collected on an ash less filter paper. This was then washed with hot water until filtrate is neutral and the filter paper along with the insoluble matter transferred intocrucible and ignited to constant weight. The residue was then allowed to cool and then weighed (3-6).

Water-soluble Ash Value:-The ash obtained in the determination of total ash was boiled for 5 minutes with 25 ml of water. The insoluble matter was collected on an ash less filter paper and washed with hot water. The insoluble ash was transferred into a tarred silica crucible and ignited for 15 minutes at temperature not exceeding 450˚C. The weight of the insoluble matter was subtracted from the weight of the total ash. The difference inweight was considered as the water-soluble ash was calculated with reference to the air dried drug.

Determination of Extractive Values:-This method determines the amount of active constituents extracted with solvents from a given amount of medicinal plant material. It is employed for materialsfor which as yet no suitable chemical or biological assay exists.

Water Soluble Extractive Value (3-6):- 5gms of churna was accurately weighed and placed inside a glass stoppered conical flask. It is then macerated with 100 ml of water for 24 hours. It was then filtered and about 25 ml of filtrate was transferred into a china dish and was evaporated to dryness on a water bath. It was then dried at105°C, cooled and finally weighed.

Alcohol Soluble Extractive Value:-Ethanol was used as solvent in place of chloroform water and remaining procedure was the same as that of water-soluble extractive value.

Determination of Moisture Content:-A clean china dish was taken and dried in a hot air oven at 105ºC for 30 min. Then 1.0 gm of powder sample was placed into it. The sample was then dried in an oven drying was continued till a constant weight of sample was obtained (6 hours). After drying, the dish was allowed to cool to room temperature in a desiccator before weighing and then the weight of dried sample was recorded. The percentage loss on drying was calculated with reference to powder sample taken initially.

Table 3: Physical Parameters

S.No.	Parameters	Observation
1.	Total Ash Value	30%
2.	Acid Insoluble Ash Value	41%
3.	Water-soluble Ash Value	21%
4.	Water Soluble Extractive Value	29%
5.	Alcohol Soluble Extractive Value	17.8%
6.	Determination of Moisture Content	2%

Determination of Physical Characteristics:-

Bulk Densit:-It is the ratio of given mass of powder and its bulk volume. It is determined by transferring **y**an accurately weighed amount of powder sample to the graduated cylinder with the aid of a funnel. The initial volume was noted. The ratio of weight of the volume it occupied was calculated. Bulk density=W/V0 g/mlWhere, W = mass of the powder, V0 = untapped volume

Tapped Density:-It is measured by transferring a known quantity 25g of powder into a bulk density apparatus and tapping it for 100 times. The initial volume was noted. The graduated cylinder was tapped continuously for a period of 10-15 min. The density can be determined as the ratio of mass of the powder to the tapped volume.Tapped volume= W/Vf g/ml Where, W = mass of the powder, Vf = tapped volume

Hausner's Ratio:-It indicates the flow properties of the powder. The ratio of tapped density to the bulk density of the powder is called Hausner's ratio.

Hausner's ratio = Tapped density/bulk density

Angle of Repose:-The internal angle between the surface of the pile of powder and the horizontal surface is known as the angle of repose. The powder is passed through funnel fixed to a burette at s height of 4 cm. A graph paper is placed below the funnel on the table. The height and the radius of the pile weremeasured. Angle of repose of the powder was calculated using the formula; Angle of repose= tan-1(h/r) Where, h=height of the pile, r = radius of the pile.

Table 4: Physical Characteristics

S.No.	Parameter	Observation
1.	Bulk Density	0.48
2.	Tapped Density	0.96
3.	Hausner's Ratio	1.88
4.	Angle of Repose	27.08
5.	Carr's Index	29.52
6.	PH	6.50

Table 5: Phytochemical Screening of Churna

Phytoconstituets	Inference
Alkaloids	+
Carbohydrate	+
Glycoside	+
Tannin	+

Results and Discussion

There is no monograph on the standardization of GC in Ayurvedic Pharmacopoeia of India (Part II -Formulations).Loss on drying, which reveals the moisture content; foreign matter, which is the percentage of materials other than the part to be used; total ash, which is the indication of total inorganic content; acid-insoluble ash, which is the acid-insoluble part of total ash, mainly silica; water-soluble ash, which is the water-soluble part of total ash indicating inorganic content without water-insoluble inorganic salts such as silica; and alcohol- and water-soluble extractives indicating the percentage of active constituents soluble in ethanol and water were analyzed for all the raw drugs used in the preparation Organoleptic evaluation provides the simplest and fastest means of establishing the identity and thereby ensuring the quality of a particular sample, and these properties are useful in assessing the material as a whole and in powder form (7- 8). The results showed that the raw drugs used for the preparation of the formulation lie within the limit, which indicates their good quality and purity. The controlled combustion of the churn creates an ash residue consisting of inorganic material (metal salt and silicon dioxide). This value varies within relatively wide limits and is therefore an important parameter for the purposes of evaluating raw drugs. Ashing involves the oxidation of product components. A high ash value indicates contamination, substitution, adulteration, or carelessness in the preparation of the crude drug for marketing. At higher temperature, the alkali metal chloride may be volatile and may be lost through this process (9-10). Total ash typically consists of carbonates, phosphates, silicates, and silica, which include both physiological ash and non-physiological ash. Acid-insoluble ash is particularly indicative of contamination with siliceous materials, e.g. soil and sand, comparing this value with the value of total ash in the same sample will differentiate between contaminating materials and natural ash variations of the drug (10-11). Since the ash values of the crude drugs used for the formulation and the ash values of the final In house formulation and the Standard formulation lie within a fair limit, which means its quality and purity and gives an idea of the total inorganic content.Moisture is an unavoidable component of raw drugs that must be eliminated as much as possible. The preparation of crude drug from harvested drug plants involves cleaning or grinding to remove soil or other foreign materials followed by drying, which plays a very important role in the quality and purity of the material. Insufficient drying promotes spoilage by fungi and bacteria and enables enzymatic destruction of activesubstances. Not only is the final dryness of the drug important, but the rate at which moisture is removed and the conditions under which it is removed are equally important.

Conclusion

The present study focused on the formulation and evaluation of herbal Gokshuradi Churna to assess its efficacy in the treatment of pyelonephritis infection. Among the three formulations developed, Formulation 1 demonstrated the most promising results, showing faster onset of action, better antimicrobial activity, and improved patient response. In comparison, Formulation 2 and Formulation 3 exhibited slower therapeutic effects and lower efficacy. Based on the evaluation parameters, Formulation 1 can be considered the most effective and optimized formulation for the treatment of pyelonephritis using herbal components.

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