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A Systemic Role of Boerhaavia Diffusa for the Management of Chronic Kidney Disease by Herbal Formulation

Seema Kashyap, Dr. Kavita Lokesh, Dr. Gaurav Jain

IES Institute of Pharmacy, IES University, India
Email: kashyapseema85@gmail.com

Kidney dysfunction encompasses a spectrum of conditions that impair the kidneys' ability to effectively filter blood and maintain metabolic balance in the body. This abstract explores the multifaceted nature of kidney dysfunction, examining its causes, manifestations, and clinical implications. Key factors contributing to kidney dysfunction include chronic conditions like diabetes and hypertension, as well as acute insults such as infections or drug toxicity. The consequences of impaired kidney function extend beyond fluid and electrolyte imbalances to encompass systemic effects on cardiovascular health, bone metabolism, and erythropoiesis. Diagnostic approaches, including laboratory tests and imaging modalities, play pivotal roles in identifying and stratifying kidney dysfunction severity. Treatment strategies encompass lifestyle modifications, pharmacotherapy, and, in advanced cases, renal replacement therapies like dialysis or transplantation. Ultimately, understanding kidney dysfunction requires a comprehensive approach that integrates clinical, biochemical, and therapeutic perspectives to optimize patient outcomes and mitigate the burden of kidney disease on global health.
Additionally, it might discuss common kidney disorders, such as chronic kidney disease and kidney stones, highlighting their impact on health and potential treatment options. Overall, the abstract serves to provide a concise overview of the kidneys, emphasizing their critical role in maintaining homeostasis and overall well-being.
Keywords: kidney dysfunction, Chronic Renal Failure, Chronic Kidney Disease.

1. Introduction

Types of kidney dysfunction diseases:

1.Chronic Kidney Disease (CKD):

If nephrons are injured, chronic renal failure, also known as chronic kidney disease, is an irreversible, progressive illness that reduces renal function and ultimately results in death.Like all developing nations, India is dealing with a silent pandemic of chronic renal failure, which is one aspect of the health transition brought on by industrialization and partially driven by an increase in sedentary behavior[1]. lifestyle, birth weight, and malnourishment. Chronic kidney disease (CKD) is defined as a kidney disorder with glomerular filtration, or as impaired kidney function that lasts longer than three months. Renal disease's high magnitude and impact burden is well defined in developed and emerging nations [2].

Defined as persistent abnormalities in urine, abnormalities in structure, or reduced excretory renal function suggestive of a loss of kidney function, chronic kidney disease (CKD) of nephrons in operation.[3] The majority of CKD patients run the risk of dying young and developing cardiovascular disease [4]. In many regions of the world, the restricted availability of renal replacement therapy is a challenge for patients who develop end-stage renal disease. The infrastructure for renal care facilities is quite limited in India, with only a few centers located in large cities.[5] Indian Patients are expected to visit the government's primary health centers, although the government spends very little on healthcare annually. Patients avoid going since they would have to forfeit a day's pay [6]. The average Indian cannot afford this expensive medication, especially for CKD, an incurable illness. These expenses must be paid for the rest of one's life, if one can still afford it. The patient and his or her family are burdened to an unbearable extent by this. The primary cause of the 2-3% treatment rate of kidney failure patients in India is this. Rest desires a premature demise in order to lessen the financial strain on their [7].

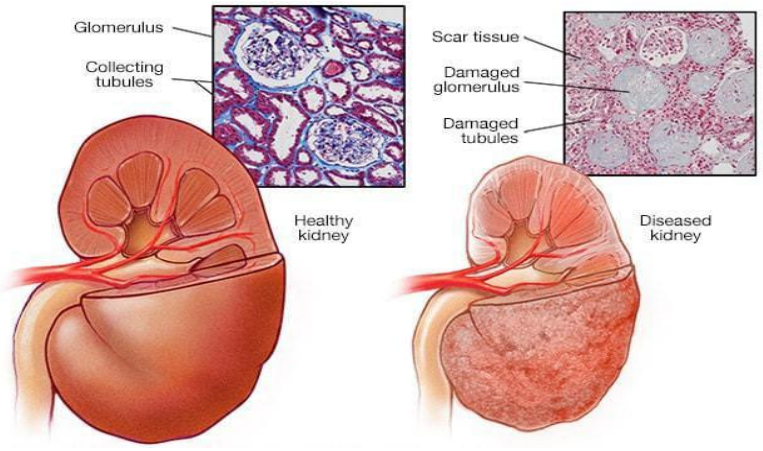

Fig: 1 Normal kidney And Disease Kidney (Anatomy & TS of kidney)

Sign And Symptoms Chronic Kidney Diseases (CKD):

Chronic kidney disease (CKD) can present:

1. Fatigue: Feeling unusually tired or weak, which can be persistent.
2. Fluid Retention: Kidneys' inability to remove excess fluid from the body.

3. Increased or decreased urination: Changes in urination frequency, such as needing to urinate more often, especially at night (nocturia), or in smaller amounts than usual.

4. Blood in urine: Also known as hematuria, which can be a sign of damage to the kidneys or another part of the urinary tract.

5. Foamy or bubbly urine: Proteinuria can cause urine to appear frothy or foamy due to excessive protein leaking into the urine.

6. Persistent itching: Pruritus, or persistent itching, can occur due to waste buildup in the bloodstream, which the kidneys would normally filter out.

7. Nausea and vomiting: These symptoms can occur due to waste buildup in the blood (uremia) affecting the digestive system.

8. Loss of appetite: A general feeling of not wanting to eat, often due to nausea, taste changes, or feeling full quickly.

9. Muscle cramps and twitches: Electrolyte imbalances, such as high levels of potassium or low levels of calcium, can lead to muscle cramps or twitching.

10. Sleep problems: Difficulty sleeping or restless legs syndrome may occur due to imbalances in electrolytes and fluids.

11. Shortness of breath: Fluid buildup in the lungs (pulmonary edema) can cause difficulty breathing, especially when lying down. [8]

Causes for CKD :

- Diabetes and high blood pressure are the primary causes.
- Heart Condition
- Smoking And obesity
- Unusual Kidney Architecture
- Kidney disease in the family history [9]

Table-1.1

STAGES OF CHRONIC KIDNEY DISEASE

Stage	Description	GFR ml/min/1.73m2	Terms
1	Kidney damage with normal GFR	Less than 90	Albuminuria , proteinuria
2	Mild GFR	60-89	Albuminuria, Proteinuria
3	Moderate GFR	30-59	Chronic renal insufficiency,
4	Severe GFR	15-29	Pre-ESRD
5	Kidney failure	More than 15 or dialysis	Uremia, end stage renal disease

CKD :

Glomerular Filtration Rate

GFR can be estimated using equations that take into account factors such as serum creatinine levels, age, sex, and race. One commonly used equation for estimating GFR is the Modification of Diet in Renal Disease (MDRD) equation. Another widely used equation is the CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration) equation. [10].

PUNARNAVA:-

Traditionally used to treat kidney stones and other kidney disorders, punarnava has diuretic and anti-inflammatory qualities that help lower the risk of inflammatory kidney diseases. The aqueous decoction and powdered extract of the punarnava plant can help manage nephrotic syndrome [11]. In an experiment, punarnava was shown to be a nephroprotective agent. Histopathological changes revealed that acetoaminophen significantly damaged the kidney's structure, causing tubular necrosis, glomerular damage, and congestion, all of which were reversed by boerhaaviadiffusa [12].

Boerhavia diffusa is found in many parts of the world. It grows up to 2000 meters high and is found in warmer regions of India. In the Himalayas, and six of the forty species—B. diffusa, B. chinensis, B. erecta, B. repens, B. rependa, and B. rubicunda—can be found in India. Many phytochemicals, including lignans, lipids, proteins, carbohydrates, rotenoids, alkaloids, triterpenoids, steroids, and glycoproteins etc [13].

Fig: 2 Punarnava Medicinal herb

Fig: 3 Dried stem of punarnava

Scientific Classification Punarnava:-

- "Punarnava" refers to a group of plants belonging to the genus Boerhavia within the family Nyctaginaceae. Here is the scientific classification of Punarnava:
- Kingdom: Plantae (Plants) ,Tracheophytes (Vascular plants), Angiosperms (Flowering plants) , Eudicots
- Order: Caryophyllales

- Family: Nyctaginaceae (Four o'clock family)
- Genus: Boerhavia

There are several species of Boerhavia that are commonly referred to as Punarnava, with Boerhavia diffusa being one of the most widely recognized and used species in traditional medicine. These plants are known for their medicinal properties and are used in various herbal formulations, particularly in Ayurveda, for their diuretic, anti-inflammatory, and hepatoprotective properties.[14]

Punarnava may be used in the following ways to treat CKD:

1. Whole Plant:Ayurvedic medicine uses the entire Punarnava plant, including the leaves, roots, and seeds. Each component might have a little different therapeutic quality that is good for kidney function.

2. Punarnava Root: Known for its strong diuretic and anti-inflammatory properties, punarnava root is frequently used to treat edema and other CKD-related symptoms.

3. Punarnava Leaves: These leaves, which are frequently used in food preparations, have therapeutic qualities as well and may be beneficial to kidney health.

4. Punarnava Juice: Due to its diuretic qualities, which aid in the control of fluid retention and promote kidney function, fresh juice made from Punarnava leaves or the entire plant is occasionally advised.

5. Punarnava Powder: The root of the plant, when dried and powdered, can be consumed orally with water. This form is utilized for long-term CKD management and convenience.
6. Punarnava Decoction: This herbal infusion, which is thought to help with kidney health and detoxification, is prepared by boiling the roots or the entire plant of Punarnava.
7. Punarnava Supplements:Punarnava supplements are standardized extracts that are available as tablets or capsules and are designed to give users a convenient way to take the herb with a constant potency.

8. Ayurvedic Formulations:Punarnava is frequently mixed with other herbs in age-old Ayurvedic formulations designed to target particular aspects of chronic kidney disease (CKD), such as kidney function, fluid retention, and general vitality [15].

Chemical constituents:-

Punarnava (Boerhavia diffusa) is known to contain various chemical constituents that contribute to its medicinal properties. Here are some of the important chemical constituents found in Punarnava herb:

1. Alkaloids: Punarnavine, punarnavoside, and boeravinones are alkaloids found in Punarnava. Punarnavine has been studied for its potential anti-inflammatory and hepatoprotective effects.

2. Flavonoids: Punarnava contains several flavonoids such as kaempferol, quercetin, luteolin, and their glycosides. Flavonoids are known for their antioxidant properties and ability to reduce inflammation.

3. Saponins: Punarnava contains saponins, which are glycosides with soap-like properties. Saponins have diuretic effects and may contribute to Punarnava's traditional use for kidney disorders.

4. Phytosterols: Punarnava contains various phytosterols, including β-sitosterol and stigmasterol, which contribute to its cholesterol-lowering effects.

5. Polysaccharides: These are carbohydrate compounds found in Punarnava that may contribute to its immune-modulating properties.

These chemical constituents collectively contribute to Punarnava's therapeutic effects, which include diuretic action, anti-inflammatory properties, hepatoprotection, and potential benefits for various renal conditions. [16]

Therapeutic uses of punarnava:-

1. Herb is used as diuretics.

2. Expectorants.

3. Stomachic.

4. CKD.[17]

2. Materials and Methods:

Table-1.2 Ingredients required for preparations

s.no.	Ingredients	Quantity
1.	Punarnava	10gm
2.	Ethanol	250ml
3.	Dextrose	66.6gm
4.	Methyl Paraben	0.5gm
5.	Distilled Water	q.s.

Preparation of Herbal Syrups:-

1. Prepare work area set up a clean workspace and gather all necessary equipment.

2. Take 10gm of punarnava.

3. Then take 250 ml of ethanol and extract it through soxhlet extraction at 40* C for 24 hours.

4. Prepare a 100ml simple syrup by using 66.6gm dextrose and distilled water q.s

5. Prepare a 100ml simple syrup by using 66.6gm dextrose and distilled water q.s.

6. Simple syrup has been prepared.

7. Then extracted punarnava extracts mixed with simple syrup.

8. Kidney syrup has been prepared.[18]

Fig -4 Punarnava

Fig: 5 Extraction process in Lab.

Fig-6 Extracted liquid in lab

Fig -7 Simple syrup in lab

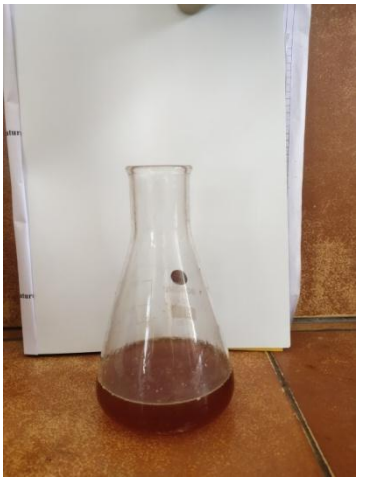

Fig-8 Herbal formulation (Final product)

Evaluation Test of Herbal Syrup:

The formulation were evaluate for different pharmaceutical parameters

1. Physical appearance: The formulation herbal syrup were absorbed for there visual appearance and colour.

* Apperance - liquid in nature

* Colour - dark yellow or orange[19]

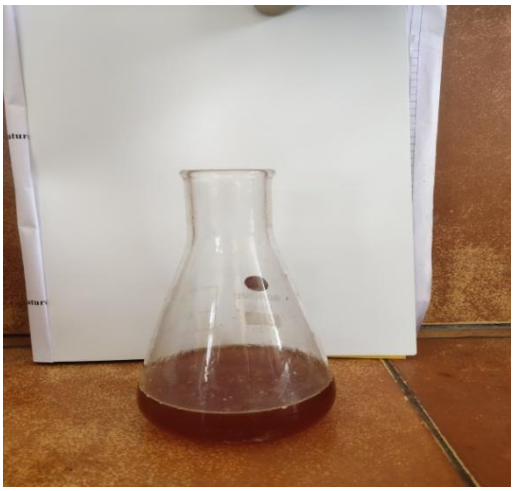

Fig- 9 Herbal Syrup in lab

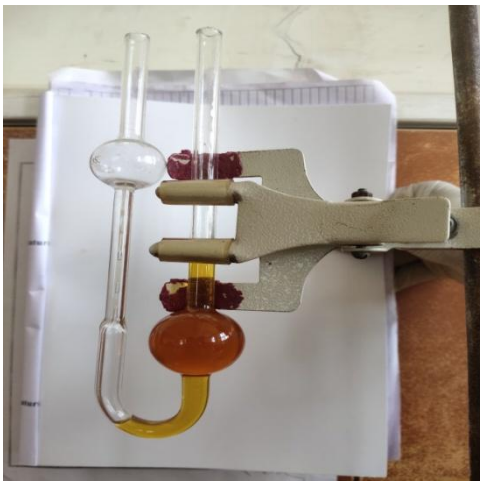

Fig-10 Ostwald viscometer in lab

2.Viscosity -The viscosity of formulated syrup is determined by used ostwald viscometer.

3.Density - The density of formulated syrup is determined by used specific gravity bottle.

Fig-11 Density test in lab

4. UV absorbance -The lamda max value absorption of the formulated syrup has been checked by using UV spectrometer.

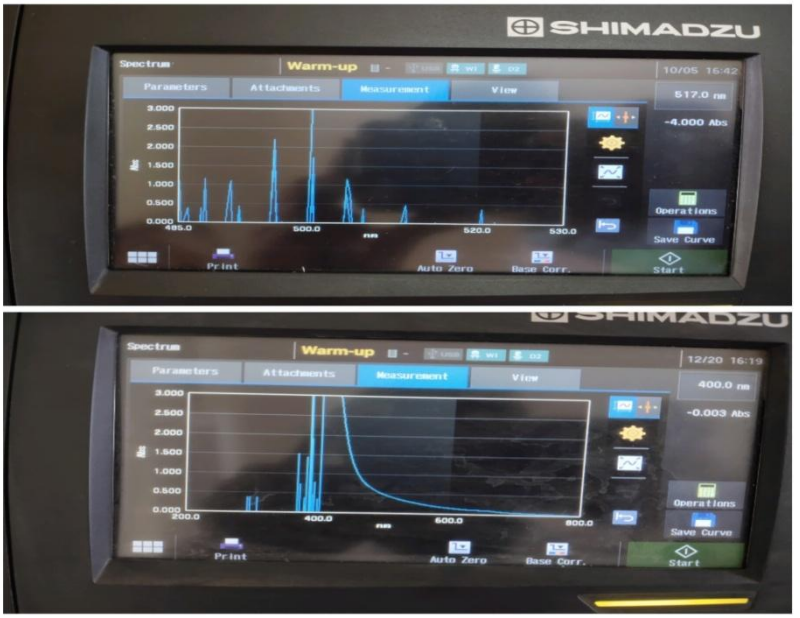

Fig-12 UV absorption in lab

5. Chemical Test :

Fig- 13 Alkaloid test

Fig-14 Flavonoid Test

Alkaloids Test of Standard Compound: [20]

Table-1.3

Test	Observation	Inference
1. Mayers Test	Negative	Alkaloid Absent
2. Wagner's Test	Negative	Alkaloid Absent
3. Hager's Test	Negative	Alkaloid Absent
4. Dragndorffs Test	Negative	Alkaloid Absent

Flavonoid Tests of sample :[21]

Table-1.4

Test	Observation	Inference
1.Shinoda test	Positive	Flavonoid present
2.Alkali reagent test	Positive	Flavonoid present
3.Sulphuric acid test	Positive	Flavonoid present
4.Lead acetate test	Positive	Flavonoid present

Characterization of Formulated Herbal Syrup:[21]

Table-1.5

S.No	Parameter	Standard value	Value
1.	Density	3.3gm/ml	1.1gm/ml
2.	Viscosity	10.85 cps	12.98 cps
3.	UV absorbance	517nm	520nm

Nephroprotective activity of Punarnava:-

The kidney is a vital organ that helps the body expel waste[22]. Many medicinal substances also create acute renal failure. 4 According to recent reports, the majority of diabetic complications, including diabetic nephropathy, have a vascular origin. [23]. Numerous investigations have demonstrated an impact on renal stone dissolution and nephrotoxicity in animals that have undergone substantial alterations in recovery from diverse drug-induced toxicity. [24].

Diuretic properties:

Punarnava is known for its diuretic properties, which can play a significant role in managing chronic kidney disease (CKD). By promoting the removal of excess fluids and toxins from the body through increased urine production, Punarnava can help alleviate some symptoms associated with CKD, such as fluid retention. This action supports kidney function by reducing the workload on these organs, thereby potentially slowing the progression of kidney damage [25].

Anti-inflammatory properties:

Punarnava has anti-inflammatory properties, which are beneficial in managing chronic kidney disease (CKD). These properties help in reducing inflammation in the kidneys, which is crucial since inflammation can exacerbate kidney damage and contribute to the progression of CKD. By mitigating inflammation, Punarnava can potentially aid in protecting the kidneys from further damage, improving kidney function, and contributing to the overall management of CKD [26].

Antioxidant properties:

Punarnava has antioxidant properties, which are important in the management of chronic kidney disease (CKD). Antioxidants help in combating oxidative stress, a condition associated with chronic diseases, including CKD. Oxidative stress can lead to further kidney damage by promoting inflammation and cell damage. Therefore, the antioxidant effects of Punarnava can contribute to protecting the kidneys from oxidative damage, potentially slowing the progression of kidney disease and supporting overall kidney health [27].

Hepatoprotective activity:

The hepatoprotective activity of Punarnava (Boerhaviadiffusa) in managing chronic kidney disease (CKD) involves its potential to protect and promote liver health, which is crucial for patients with CKD due to the interconnected functions of the liver and kidneys. The liver plays a key role in detoxifying substances and metabolizing drugs, and its health is essential for overall well-being, particularly in individuals with kidney diseases [28].

3. CONCLUSION:-

Punarnava have capacity to normalize associated clinical symptoms and laboratorial parameters presenting to chronic kidney disease (CKD) patient. Punarnava show diuretic, anti-inflammatory and the anti-oxidant properties, which are beneficial in managing CKD the diuretic property is important for promoting the removal of excess fluid and toxics from the body through increased urine production[29]. Punarnava can help alleviate some symptoms associated with CKD, such as fluid retention. Punarnava is help to reduce the inflammation in the kidney. It can potentially aid in protecting the kidney's from further damage, improving kidney function and the contributing to the overall management of CKD. [30]

Punarnava (Boerhavia diffusa) in Ayurvedic medicine for kidney disorders. Here's a conclusion on its potential use for chronic kidney disease (CKD) based on available evidence, Punarnava is well-known for its diuretic properties, which can help in increasing urine output. This may be beneficial in managing fluid retention, a common issue in CKD.[31] Compounds like alkaloids and flavonoids in Punarnava exhibit anti-inflammatory properties. Chronic inflammation in the progression of kidney damage, and these effects could potentially slow down this progression. The presence of flavonoids, phenolic compounds, and other antioxidants in Punarnava suggests potential benefits in reducing oxidative stress, which is implicated in CKD progression.[32] Punarnava extracts have renoprotective effects by reducing markers of kidney damage and improving kidney function parameters. preclinical and some clinical evidence supporting the use of Punarnava for kidney health, its efficacy and safety specifically for CKD. Punarnava shows potential as a complementary therapy for managing chronic kidney disease because diuretic, anti-inflammatory, antioxidant, & nephroprotective properties[33]. It should not replace standard medical treatments but may be considered as part of a holistic approach to kidney health under the supervision of healthcare professionals.[34]

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31. Pharmacognosy and Phytochemistry Books: Books such as "Textbook of Pharmacognosy and Phytochemistry" by Biren Shah and A. K. Seth may provide methods for the qualitative and quantitative analysis of flavonoids in medicinal plants.
32. Research Articles: Scientific journals like Journal of Chromatography A, Phytochemical Analysis, and Journal of Pharmaceutical and Biomedical Analysis publish research articles on analytical methods for flavonoids. These articles may include specific studies on Gokhru or related plant species.
33. PubMed and Google Scholar: These platforms are valuable for finding scientific articles and studies on Tribulus terrestris and its effects on kidney function. Searching for terms like "Tribulus terrestris CKD", "Tribulus terrestris nephroprotective", or "Tribulus terrestris kidney health" can provide you with relevant research articles and reviews.
34. Ayurvedic Pharmacopoeia of India: This official document may provide insights into traditional Ayurvedic formulations involving Tribulus terrestris for urinary tract health, which can indirectly relate to kidney function.
35. Clinical Trials: While specific clinical trials focusing solely on CKD and Tribulus terrestris may be limited, there could be studies investigating its effects on markers of kidney health or related conditions. Websites like ClinicalTrials.gov can provide information on ongoing or completed trials.