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A Randomised Open Labelled Comparative Clinical Study to Evaluate Effect of Hamsapadi (*Adiantum lunulatum* Burm) and Gokshura (*Tribulus terrestris* Linn) in Pittaja Mutrakruchra with Special Reference to UTI

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Abstract: ***Urinary tract infections (UTIs) are common, particularly among females, and can be correlated with Pittaja Mutrakruchra in Ayurveda, which presents with symptoms such as Peeta mutrata, Sadaha mutrata, Saruja mutrata, and Sarakta mutrata. Gokshura (Tribulus terrestris Linn.) is a well-documented herb with Mutrala properties and is widely used in urinary disorders. Hamsapadi (Adiantum lunulatum Burm.) is described in classical texts as Pittashamaka and Raktaprasadaka, suggesting its therapeutic potential in similar conditions, though it lacks sufficient clinical evaluation. Hence, the present study aimed to comparatively evaluate the efficacy of Gokshura and Hamsapadi in the management of Pittaja Mutrakruchra. A randomized clinical trial was conducted on 40 subjects presenting with lakshanas of Pittaja Mutrakruchra. The subjects were randomly allocated into two groups: Group A (n = 20) received Gokshura moola churna and Group B (n = 20) received Hamsapadi panchanga churna for a period of 15 days. Subjective and objective parameters were assessed before and after treatment and statistically analyzed. Both groups showed statistically significant improvement in subjective and objective parameters; however, Group A demonstrated comparatively better therapeutic outcomes. Phytochemical analysis of both trial drugs revealed the presence of alkaloids, flavonoids, tannins, carbohydrates, and other plant metabolites. It can be concluded that both Gokshura moola churna and Hamsapadi panchanga churna are effective in the management of Pittaja Mutrakruchra, with Gokshura showing superior efficacy.***

Keywords: Pittaja Mutrakruchra; UTI; Gokshura; Hamsapadi.

I. INTRODUCTION

Urinary Tract Infections (UTIs) are a common health problem worldwide. Millions of people visit hospitals for UTIs every year around 7 million annually. UTIs are especially common in women, starting from a young age. About 1-3% of school girls get UTIs, and the risk increases as they grow older and become sexually active. One in 5 women develops UTI during her life time. UTI in men are not so common but they can be very serious when they occur. UTIs are the second most common type of infection in the body. In hospitals, about 9.4% of patients get UTIs during their stay. (1) They may be confined to the lower urinary tract infection resulting in cystitis and urethritis or involve the upper urinary tract and cause pyelonephritis also till reproductive organ pathology.

The pathological process of UTI is going to be induced by E.coli, staphylococci etc. bacteria, which may affect any part of urinary system. The methods of management of UTI are mainly by antibiotics.(2) Even though they are useful, they involve considerable amount of risk, side effects and also expensive. The chances of resistance's and recurrences after administration of antibiotics are also high as fifty percent. The management of UTIs often involves antibiotics; however, the rise of antibiotic resistance and recurrent infections necessitates the exploration of alternative and complementary therapies.

The disease Mutrakruchra is an age old disease and has been documented in almost all Ayurvedic texts. It is one of the main diseases developing due to the vitiation of Mutravaha srotas.

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The disease in which urine is passed with difficulty is called Mutrakruchra, which are of 8 types. Pittaja mutrakruchra is one among them. The symptoms of different types of Mutrakruchra particularly Pittaja Mutrakruchra are similar to signs and symptoms of urinary tract infection (UTI). The condition UTI has similar symptoms of Mutrakruchra like Muhur muhur mutra pravrutti, Sadaha mutrapravrutti and Saruja mutrapravrutti.[3]

Gokshura (*Tribulus terrestris* Linn)[4] and Hamsapadi (*Adiantum lunulatum* Burm)[5] and are two herbs commonly used in Ayurvedic medicine. Both have Pittashamaka, mutrala, shothahara and krimighna karma. Gokshura attributed with Madhura Rasa, Madhura Vipaka, and Sheeta Veerya is a proven Mutrala dravya in the management of Pittaja Mutrakruchra. Hamsapadi is a type of fern whose properties are similar to Gokshura possessing Raktaprasadaka and Pittashamaka karmas. As Hamsapadi is less explored, its effect in treating Pittaja Mutrakruchra needs to be evaluated clinically. Hence, the present study has been planned entitled as "A RANDOMISED OPEN LABELLED COMPARATIVE CLINICAL STUDY TO EVALUATE EFFECT OF HAMSAPADI (*Adiantum lunulatum* Burm) AND GOKSHURA (*Tribulus terrestris* Linn) IN PITTAJA MUTRAKRUCHRA WITH SPECIAL REFERENCE TO UTI".

II. AIMS AND OBJECTIVES

A. *Aim Of The Study*

Clinical evaluation of Hamsapadi churna and Gokshura churna in the management of Pittaja Mutrakruchra vis-a-vis, Urinary tract infection.

B. *Objectives Of The Study*

1) Preliminary pharmacognostic, Physicochemical and phytochemical evaluation of the Hamsapadi churna and Gokshura churna.
2) Clinical evaluation of Hamsapadi churna in the management of Pittaja Mutrakruchra.
3) Clinical evaluation of Gokshura churna in the management of Pittaja Mutrakruchra.
4) Comparative clinical evaluation of Hamsapadi churna and Gokshura churna in the management of Pittaja Mutrakruchra.

III. REVIEW OF LITERATURE

Gokshura (*Tribulus terrestris* Linn.)- Gokshura is an important drug of Ayurveda extensively described in classical literature from the Samhita, Nighantu, and later Ayurvedic treatises. In the Brihattrayi—*Charaka Samhita*[6], *Sushruta Samhita*[7], and *Ashtanga Hridaya*[8]—Gokshura is frequently indicated in Mutravikara (Mutrakruchra, Mutraghata), Ashmari, Prameha, Shotha, Jwara, Raktapitta, and Rasayana chikitsa. It is classified under Shothahara and Mutravirechaniya Mahakashaya (Charaka), Laghupanchamoola and Vidarigandhadi Gana (Sushruta), and Vidarigandhadi and Madhura Gana (Ashtanga Hridaya). Gokshura possesses Madhura rasa, Madhura vipaka, Sheeta virya, and Guru–Snigdha guna, and exhibits Bastishodhaka, Mutrala, Ashmarihara, Vrushya, Balya, Pramehahara, and Rasayana properties.

Botanically, Gokshura is identified as *Tribulus terrestris Linn.* belonging to the family Zygophyllaceae, widely distributed in dry and warm regions of India. Modern phytochemical studies have identified steroidal saponins (protodioscin, diosgenin), flavonoids, alkaloids, and minerals. Experimental studies have demonstrated diuretic, antiurolithic, aphrodisiac, anti-inflammatory, immunomodulatory, hepatoprotective, antihypertensive, and anticancer activities, thereby validating its traditional use in urinary, reproductive, and metabolic disorders.

Hamsapadi (*Adiantum lunulatum* Burm.)- Hamsapadi is not described in Vedic literature but is well documented in classical Ayurvedic texts such as Charaka Samhita[9], Sushruta Samhita[10], Ashtanga Hridaya[11], and Ashtanga Sangraha[12] under Kanthya Gana, Vidarigandhadi Gana, and Rasayana formulations, with therapeutic indications including Visha, Visarpa, Daha, Vrana, Atisara, Raktadushti, Galaganda, and Bhutagraha. It possesses Kashaya and Madhura rasa, Madhura vipaka, Sheeta virya, and Guru guna. The whole plant is used for medicinal purposes**.**

Botanically identified as *Adiantum lunulatum Burm.* of the family Adiantaceae, Hamsapadi is a fern commonly found in moist and shady regions throughout India. Phytochemical studies have reported the presence of flavonoids (quercetin, rutin), triterpenes, sterols, tannins, and phenolic compounds. Modern research indicates antibacterial, anti-inflammatory, antioxidant, and wound-healing activities, supporting its traditional usage in inflammatory, infectious, and toxicological conditions.

IV. MATERIALS AND METHODS

A randomised, open-label, comparative clinical study was conducted to evaluate the effect of Hamsapadi (*Adiantum lunulatum* Burm.) and Gokshura (*Tribulus terrestris* Linn.) in Pittaja Mutrakruchra (UTI).

The study was carried out in two phases:

1) Analytical evaluation
2) Clinical evaluation

a) Place of Study

- Pharmacognostical studies: Department of PG Studies in Dravyaguna, TGAMC, Ballari
- Physicochemical and phytochemical analysis: Rajiv Gandhi Education Society's Ayurvedic Medical College, Ron
- Drug preparation: RSBK Department, TGAMC, Ballari
- Clinical study: OPD and IPD, Taranath Government Ayurvedic Medical College & Hospital, Ballari

b) Collection, Authentication and Preparation of Drugs

Gokshura moola was collected from Ballari district, Karnataka, and Hamsapadi panchanga from the Western Ghats of Uttara Kannada district. Both drugs were authenticated by the Department of Dravyaguna, TGAMC, Ballari. The dried raw drugs were powdered, sieved through a 100-mesh sieve, and stored in airtight containers.

A. Analytical Evaluation

1) Macroscopic and Microscopic Evaluation- Macroscopic characters (Shabda, Sparsha, Roopa, Rasa, Gandha) and powder microscopy were performed using standard pharmacognostical methods under a trinocular microscope.
2) Physicochemical Analysis- Tests including loss on drying, pH, total ash, acid-insoluble ash, water-soluble ash, water-soluble extractive, alcohol-soluble extractive, and foreign matter were carried out as per Ayurvedic Pharmacopoeia of India (API) guidelines.
3) Phytochemical Analysis- Qualitative tests for alkaloids, carbohydrates, proteins, steroids, saponins, tannins, flavonoids, phenols, triterpenoids, and starch were performed as per API standards.
4) Thin Layer Chromatography (TLC)- TLC was performed using silica gel 60 F_{254} plates with Toluene: Ethyl acetate (9:1) as the mobile phase. Plates were visualized under UV light at 254 nm and 366 nm, and Rf values were recorded.

B. Clinical Evaluation

Sample Size and Grouping- A total of 40 patients diagnosed with Pittaja Mutrakruchra (UTI) were randomly allocated into two groups:

- Group A (n=20): Gokshura churna 6 g twice daily before food with warm water for 15 days
- Group B (n=20): Hamsapadi churna 6 g twice daily before food with warm water for 15 days

ETHICAL CLEARANCE- The study was approved by the Institutional Ethics Committee, TGAMC, Ballari (No. TGAMC/SS/02/2019-20, Dt. 18-10-2023).

INCLUSION CRITERIA

- Patients aged 18–70 years with classical symptoms of Pittaja Mutrakruchra.
- Diagnosed UTI case.
- Written informed consent.

EXCLUSION CRITERIA

- Patients with pyelonephritis, prostatitis, chronic renal disorders, genitourinary TB, bladder cancer.
- Fever >101°F,
- STDs.
- Pregnant or lactating women.

ASSESSMENT CRITERIA

Subjective parameters:

Pain during micturition-

Absent	Grade 0
Mild (Occasional mild pain)	Grade 1
Moderate (Often moderate pain)	Grade 2
Severe (Severe pain, non-tolerable)	Grade 3

Burning micturition-

Absent	Grade 0
Mild (Occasional mild burning)	Grade 1
Moderate (Moderate burning with every voiding)	Grade 2
Severe (Severe burning, non tolerable)	Grade 3

Frequency of urination-

Less than 5 times per day	Grade 0
5-8 times per day	Grade 1
8-12 times per day	Grade 2
More than 12 times per day	Grade 3

Fever/chills-

Absent	Grade 0
Present	Grade 1

Urine colour-

Pale yellow colour (Normal urine colour)	Grade 0
Mild yellow colour	Grade 1
Yellow colour	Grade 2
Deep yellow colour urine	Grade 3

Objective parameters
Urine albumin-

No albumin	Grade 0
Trace	Grade 1
Present (+)	Grade 2
Present (++)	Grade 3

Urine pus cells-

0-5/hpf	grade 0
5-15/hpf	grade 1
15-25/hpf	grade 2
25-35/hpf	grade 3

Urine epithelial cells-

0-2	Grade 0
3-20	Grade 1
21-40	Grade 2
Above 40	Grade 3

Assessment Schedule-Evaluations were performed before treatment (Day 1) and after treatment (Day 15).
Pathya-Apathya- Patients were advised light, unctuous diet and adequate fluid intake, while avoiding heavy, alcohol, smoking, day sleep, and irregular dietary habits.
Statistical Analysis- Data were analysed using appropriate statistical tests to assess intra- and inter-group significance.

V. RESULTS

The observation of the study was carried out in two phases.

1) Analytical study
2) Clinical study

A. Analytical Study

1) Pharmacognostic Study

Table: Showing comparison of Organoleptic characters of Gokshura moola and Hamsapadi panchanga

	Gokshura moola	Hamsapadi panchanga
Shabda	Short fracture	Uneven Fracture
Rasa	Madhura	Kashaya
Gandha	Aromatic	No any specific odour
Sparsha	Rough	Soft and gentle texture
Roopa	Yellowish Brown, Long, Cyllindrical and Tapering	Green, Lacy fronds with crescent shaped leaflets

2) Physicochemical Study

Table: Showing the comparison of Physicochemical tests of Gokshura and Hamsapadi.

Sr. no.	Test	Gokshura churna Results	Hamsapadi churna Results
1	Foreign matter	0.8%	0.5%
2	Ash value	4%	8%
3	Acid insoluble ash	0.5%	1%
4	Water soluble ash	0.97%	0.98%
5	Alcohol soluble extract	2%	12%
6	Water soluble extract	5.4%	14.6%
7	Loss on drying	7.28%	8.69%
8	pH	8.29	8.79
9	TLC Methods: Drug ethanol Extract Mobile phase: Toluene : Ethyl acetate (9:1)	Visible light Rf value: Absent Under 254nm Rf value:0.18, 0.24, 0.47 366nm: Rf value: 0.18, 0.24	Visible light Rf value:0.04,0.07,0.24, 0.35, 0.59, 0.65, 0.78,0.85, 0.89, 0.94, 0.96 Under 254nm Rf value:0.04,0.24,0.35, 0.42,0.59,0.65,0.78,0.85, 0.88,0.94 366nm: Rf value: 0.04,0.07,0.24,0.35,0.59, 0.65,0.72,0.78,0.85,0.94, 0.96

3) Phytochemical Study

Table: Showing the comparison of phytochemical analysis of Gokshura and Hamsapadi.

Sr.no	Test	Gokshura Result	Hamsapadi Result
1	Carbohydrate	Absent	Present
2	Protein	Absent	Absent
3	Saponin	Present	Absent
4	Tannin	Present	Present
5	Steroid	Absent	Absent
6	Alkaloid	Present	Present
7	Flavonoids	Present	Present
8	Triterpenoids	Absent	Present
9	Starch	Present	Absent
10	Phenolic compounds	Absent	Present

4) Powder Microscopic Study

- The microscopic examination of Gokshura powder revealed the presence of lignified Pitted xylem vessels, fragments of cork, isolated fragments of fibres, tracheids, and stone cells.
- The microscopic examination of Hamsapadi powder revealed the presence of lignified Pitted xylem vessels, fragments of cork, isolated fragments of annualar and spiral vessels, Fragments of parenchymatous tissue and trichomes.

B. Clinical Study

1) General Status Of Patients

Total 40 patients were registered for the present study and were randomly selected to evaluate role of Hamsapadi and Gokshura churna in the management of Pittaja Mutrakruchra(UTI). Total 40 no. of patients completed the trial.

Table: General status of patients.

Group	Registered	Completed	Drop out
A	20	20	0
B	20	20	0

Demographic Data

- AGNI: Out of 40 patients, maximum 55% patients had mandagni, 35% patients had vishamagni and only 10% patients had samagni.
- KOSHTA: Out of 40 patients, maximum 70% patients had krura koshta, 15% patients had madhyama and mrudu koshta.

2) Assessement Of Parameters

Data obtained in both groups was recorded, tabulated and statistically analysed. In the group for subjective parameters done with Wilcoxon Rank sum test and in the group for objective parameters Paired T test. For between the groups in subjective parameters Man Whitney U test and for objective parameters unpaired t test.

If, p-value<0.05- indicates significant.

If, p-value>0.05- indicates non-significant.

a) Subjective Parameters

Table: Showing comparison of Saruja mutrapravrutti among Group A and Group B before treatment and after treatment by Mann-Whitney U test

Time points	Group A			Group B			Z-value	p-value
	Mean	Median	IQR	Mean	Median	IQR		
Before treatment	0.9	1.0	0.3	1.0	1.0	0.3	-0.3922	0.6949
After treatment	0.1	0.0	0.0	0.2	0.0	0.0	-0.2840	0.7764
Before -After	0.8	1.0	0.3	0.8	1.0	0.5	0.1217	0.9031

- No significant differences were observed between Group A and Group B with status of Saruja mutrapravrutti at before treatment (Z=-0.3922, p=0.6949) at 5% level of significance. This implies that, the status of Saruja mutrapravrutti at before treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with status of Saruja mutrapravrutti at after treatment (Z=-0.2840, p=0.7764) at 5% level of significance. This implies that, the status of Saruja mutrapravruttiat after treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with the changes in Saruja mutrapravrutti from before to after treatment (Z=0.1217, p=0.9031) at 5% level of significance. This implies that, the status of the changes in Saruja mutrapravrutti from before to after treatment is similar in Group A and Group B.

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Table: Showing Comparison of before treatment and after treatment with status of Saruja mutrapravrutti at in Group A and Group B by Wilcoxon matched pairs test

Group	Time points	Mean	Median	IQR	% of change	Z-value	p-value
Group A	Before treatment	0.85	1.00	0.25			
	After treatment	0.10	0.00	0.00	88.24	3.4078	0.0007*
Group B	Before treatment	0.95	1.00	0.25			
	After treatment	0.20	0.00	0.00	78.95	3.1798	0.0015*

*p<0.05

- A significant difference was observed between before treatment and after treatment with status of Saruja mutrapravrutti at in Group A (Z=3.4078, p=0.0007) at 5% level of significance. This implies that, a significant of 88.24% reduction was seen in Saruja mutrapravruttiat after treatment in Group A.
- A significant difference was observed between before treatment and after treatment with status of Saruja mutrapravrutti at in Group B (Z=3.1798, p=0.0015) at 5% level of significance. This implies that, a significant of 80.00% reduction was seen in Saruja mutrapravrutti at after treatment in Group B.
- Thus, the reduction is more in Group A as compared to Group B after treatment.

Table: Showing Comparison of Group A and Group B with status of Sadaha mutrapravrutti at before treatment and after treatment by Mann-Whitney U test

Time points	Group A			Group B			Z-value	p-value
	Mean	Median	IQR	Mean	Median	IQR		
Before treatment	2.3	2.0	0.5	2.1	2.0	0.0	0.9873	0.3235
After treatment	0.5	0.0	0.5	0.6	0.0	0.5	-0.5004	0.6168
Before -After	1.9	2.0	0.3	1.5	2.0	0.5	1.2578	0.2085

- No significant differences were observed between Group A and Group B with the changes in Sadaha mutrapravrutti at before to after treatment (Z=0.9873, p=0.3235) at 5% level of significance. This implies that, the status of the changes in Sadaha mutrapravrutti at before to after treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with status of Sadaha mutrapravrutti at before treatment (Z=-0.5004, p=0.6168) at 5% level of significance. This implies that, the status of Sadaha mutrapravrutti at before treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with the changes in Sadaha mutrapravrutti at before to after treatment (Z=1.2578, p=0.2085) at 5% level of significance. This implies that, the status of the changes in Sadaha mutrapravrutti at before to after treatment is similar in Group A and Group B.

Table: Showing Comparison of before treatment and after treatment with status of Sadaha mutrapravrutti at in Group A and Group B by Wilcoxon matched pairs test

Group	Time points	Mean	Median	IQR	% of change	Z-value	p-value
Group A	Before treatment	2.30	2.00	0.50			
	After treatment	0.45	0.00	0.50	80.43	3.9199	0.0001*
Group B	Before treatment	2.10	2.00	0.00			
	After treatment	0.60	0.00	0.50	71.43	3.7236	0.0002*

*p<0.05

- A significant difference was observed between before treatment and after treatment with status of Sadaha mutrapravrutti in Group A (Z=3.9199, p=0.0001) at 5% level of significance. This implies that, a significant of 80.43% reduction was seen in Sadaha mutrapravrutti after treatment in Group A.

- A significant difference was observed between before treatment and after treatment with status of Sadaha mutrapravrutti in Group B (Z=3.7236, p=0.0002) at 5% level of significance. This implies that, a significant of 71.43% reduction was seen in Sadaha mutrapravrutti after treatment in Group B.
- Thus, the reduction is more in Group A as compared to Group B after treatment.

Table: Showing Comparison of Group A and Group B with status of Jwara(fever) at before treatment and after treatment by Mann-Whitney U test

Time points	Group A			Group B			Z-value	p-value
	Mean	Median	IQR	Mean	Median	IQR		
Before treatment	0.3	0.0	0.5	0.3	0.0	0.3	0.2570	0.7972
After treatment	0.0	0.0	0.0	0.0	0.0	0.0	-0.0135	0.9892
Before -After	0.3	0.0	0.5	0.3	0.0	0.3	0.2570	0.7972

- No significant differences were observed between Group A and Group B with the changes in Jwara(fever) before to after treatment (Z=0.2570, p=0.7972) at 5% level of significance. This implies that, the status of the changes in Jwara(fever) before to after treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with status of Jwara(fever) before treatment (Z=-0.0135, p=0.9892) at 5% level of significance. This implies that, the status of Jwara(fever) before treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with the changes in Jwara(fever) before to after treatment (Z=0.2570, p=0.7972) at 5% level of significance. This implies that, the status of the changes in Jwara(fever) before to after treatment is similar in Group A and Group B.

Table: Showing Comparison of before treatment and after treatment with status of Jwara(fever) at in Group A and Group B by Wilcoxon matched pairs test

Group	Time points	Mean	Median	IQR	% of change	Z-value	p-value
Group A	Before treatment	0.30	0.00	0.50	100.00	2.2014	0.0277*
	After treatment	0.00	0.00	0.00			
Group B	Before treatment	0.25	0.00	0.25	100.00	2.0226	0.0431*
	After treatment	0.00	0.00	0.00			

*p<0.05

- A significant difference was observed between before treatment and after treatment with status of Jwara(fever) in Group A (Z=2.2014, p=0.0277) at 5% level of significance. This implies that, a significant of 100.00% reduction was seen in Jwara(fever) after treatment in Group A.
- A significant difference was observed between before treatment and after treatment with status of Jwara(fever) in Group B (Z=2.0226, p=0.0431) at 5% level of significance. This implies that, a significant of 100.00% reduction was seen in Jwara(fever) after treatment in Group B.
- Thus, the reduction is similar in Group A and Group B after treatment.

Table: Showing Comparison of Group A and Group B with status of Frequency of urination at before treatment and after treatment by Mann-Whitney U test

Time points	Group A			Group B			Z-value	p-value
	Mean	Median	IQR	Mean	Median	IQR		
Before treatment	2.0	2.0	1.0	1.9	2.0	0.5	0.3381	0.7353
After treatment	0.6	0.0	0.5	0.8	1.0	0.5	-0.7439	0.4570
Before -After	1.4	1.0	0.5	1.1	1.0	0.0	1.3931	0.1636

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- No significant differences were observed between Group A and Group B with the changes in Frequency of urination before to after treatment (Z=0.3381, p=0.7353) at 5% level of significance. This implies that, the status of the changes in Frequency of urination before to after treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with status of Frequency of urination before treatment (Z=-0.7439, p=0.4570) at 5% level of significance. This implies that, the status of Frequency of urination before treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with the changes in Frequency of urination before to after treatment (Z=1.3931, p=0.1636) at 5% level of significance. This implies that, the status of the changes in Frequency of urination before to after treatment is similar in Group A and Group B.

Table: Showing Comparison of before treatment and after treatment with status of Frequency of urination at in Group A and Group B by Wilcoxon matched pairs test

Group	Time points	Mean	Median	IQR	% of change	Z-value	p-value
Group A	Before treatment	1.95	2.00	1.00	71.79	3.9199	0.0001*
	After treatment	0.55	0.00	0.50			
Group B	Before treatment	1.85	2.00	0.50	59.46	3.7236	0.0002*
	After treatment	0.75	1.00	0.50			

*p<0.05

- A significant difference was observed between before treatment and after treatment with status of Frequency of urination in Group A (Z=3.9199, p=0.0001) at 5% level of significance. This implies that, a significant of 71.79% reduction was seen in Frequency of urination after treatment in Group A.
- A significant difference was observed between before treatment and after treatment with status of Frequency of urination in Group B (Z=3.7236, p=0.0002) at 5% level of significance. This implies that, a significant of 59.46% reduction was seen in Frequency of urination after treatment in Group B.
- Thus, the reduction is more in Group A as compared to Group B after treatment.

Table: Showing Comparison of Group A and Group B with status of Peeta mutrata at before treatment and after treatment by Mann-Whitney U test

Time points	Group A			Group B			Z-value	p-value
	Mean	Median	IQR	Mean	Median	IQR		
Before treatment	1.9	2.0	0.0	2.0	2.0	0.0	-0.1758	0.8604
After treatment	0.6	0.0	0.5	0.7	1.0	0.5	-0.6222	0.5338
Before -After	1.4	1.0	0.5	1.3	1.0	0.5	0.3787	0.7049

- No significant differences were observed between Group A and Group B with the changes in Peeta mutrata before to after treatment (Z=-0.1758, p=0.8604) at 5% level of significance. This implies that, the status of the changes in Peeta mutrata before to after treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with status of Peeta mutrata before treatment (Z=-0.6222, p=0.5338) at 5% level of significance. This implies that, the status of Peeta mutrata before treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with the changes in Peeta mutrata before to after treatment (Z=0.3787, p=0.3787) at 5% level of significance. This implies that, the status of the changes in Peeta mutrata before to after treatment is similar in Group A and Group B.

Table: Comparison of before treatment and after treatment with status of Peeta mutrata at in Group A and Group B by Wilcoxon matched pairs test

Group	Time points	Mean	Median	IQR	% of change	Z-value	p-value
Group A	Before treatment	1.90	2.00	0.00	71.05	3.7236	0.0002*
	After treatment	0.55	0.00	0.50			
Group B	Before treatment	1.95	2.00	0.00	64.10	3.6214	0.0003*
	After treatment	0.70	1.00	0.50			

*p<0.05

- A significant difference was observed between before treatment and after treatment with status of Peeta mutrata in Group A (Z=3.7236, p=0.0002) at 5% level of significance. This implies that, a significant of 71.05% reduction was seen in Peeta mutrata after treatment in Group A.
- A significant difference was observed between before treatment and after treatment with status of Peeta mutrata in Group B (Z=3.6214, p=0.0003) at 5% level of significance. This implies that, a significant of 64.10% reduction was seen in Peeta mutrata after treatment in Group B.
- Thus, the reduction is more in Group A as compared to Group B after treatment.

b) Objective Parameters

Table: Showing Comparison of Group A and Group B with status of Urine albumin at before treatment and after treatment by Unpaired T test.

Time points	Group A			Group B			Z-value	p-value
	Mean	Median	IQR	Mean	Median	IQR		
Before treatment	1.1	0.5	1.0	0.3	0.0	0.3	1.7853	0.0742
After treatment	0.1	0.0	0.0	0.0	0.0	0.0	0.2570	0.7972
Before -After	1.0	0.5	1.0	0.3	0.0	0.3	1.7177	0.0859

- No significant differences were observed between Group A and Group B with the changes in Urine albumin before to after treatment (Z=1.7853, p=0.0742) at 5% level of significance. This implies that, the status of the changes in Urine albumin before to after treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with status of Urine albumin before treatment (Z=0.2570, p=0.7972) at 5% level of significance. This implies that, the status of Urine albumin before treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with the changes in Urine albumin before to after treatment (Z=1.7177, p=0.0859) at 5% level of significance. This implies that, the status of the changes in Urine albumin before to after treatment is similar in Group A and Group B.

Table: Showing Comparison of before treatment and after treatment with status of Urine albumin at in Group A and Group B by paired t test

Group	Time points	Mean	Median	IQR	% of change	Z-value	p-value
Group A	Before treatment	1.05	0.50	1.00	95.24	2.8031	0.0051*
	After treatment	0.05	0.00	0.00			
Group B	Before treatment	0.30	0.00	0.25	100.00	2.0226	0.0431*
	After treatment	0.00	0.00	0.00			

*p<0.05

- A significant difference was observed between before treatment and after treatment with status of Urine albumin in Group A (Z=2.8031, p=0.0051) at 5% level of significance. This implies that, a significant of 95.24% reduction was seen in Urine albumin after treatment in Group A.
- A significant difference was observed between before treatment and after treatment with status of Urine albumin in Group B (Z=2.0226, p=0.0431) at 5% level of significance. This implies that, a significant of 100.00% reduction was seen in Urine albumin after treatment in Group B.
- Thus, the reduction is more in Group B as compared to Group A after treatment.

Table: Showing Comparison of Group A and Group B with status of Urinary epithelial cells at before treatment and after treatment by Unpaired t test

Time points	Group A			Group B			Z-value	p-value
	Mean	Median	IQR	Mean	Median	IQR		
Before treatment	0.7	1.0	0.5	0.6	1.0	0.5	0.2570	0.7972
After treatment	0.0	0.0	0.0	0.1	0.0	0.0	-0.2570	0.7972
Before -After	0.7	1.0	0.5	0.6	1.0	0.5	0.5275	0.5979

- No significant differences were observed between Group A and Group B with the changes in Urinary epithelial cells before to after treatment (Z=0.2570, p=0.7972) at 5% level of significance. This implies that, the status of the changes in Urinary epithelial cells before to after treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with status of Urinary epithelial cells before treatment (Z=-0.2570, p=0.7972) at 5% level of significance. This implies that, the status of Urinary epithelial cells before treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with the changes in Urinary epithelial cells before to after treatment (Z=0.5275, p=0.5979) at 5% level of significance. This implies that, the status of the changes in Urinary epithelial cells before to after treatment is similar in Group A and Group B.

Table: Showing Comparison of before treatment and after treatment with status of Urinary epithelial cells at in Group A and Group B by paired t test

Group	Time points	Mean	Median	IQR	% of change	Z-value	p-value
Group A	Before treatment	0.65	1.00	0.50			
	After treatment	0.00	0.00	0.00	100.00	3.1798	0.0015*
Group B	Before treatment	0.60	1.00	0.50			
	After treatment	0.05	0.00	0.00	91.67	2.9341	0.0033*

*p<0.05

- A significant difference was observed between before treatment and after treatment with status of Urinary epithelial cells in Group A (Z=3.1798, p=0.0015) at 5% level of significance. This implies that, a significant of 100.00% reduction was seen in Urinary epithelial cells after treatment in Group A.
- A significant difference was observed between before treatment and after treatment with status of Urinary epithelial cells in Group B (Z=2.9341, p=0.0033) at 5% level of significance. This implies that, a significant of 91.67% reduction was seen in Urinary epithelial cells after treatment in Group A.
- Thus, the reduction is more in Group A as compared to Group B after treatment.

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Table: Showing Comparison of Group A and Group B with status of Urine pus cells at before treatment and after treatment by Unpaired t test

Time points	Group A			Group B			Z-value	p-value
	Mean	Median	IQR	Mean	Median	IQR		
Before treatment	0.6	1.0	0.5	0.7	1.0	0.5	-0.5004	0.6168
After treatment	0.0	0.0	0.0	0.2	0.0	0.0	-0.5275	0.5979
Before -After	0.6	1.0	0.5	0.6	1.0	0.5	0.1353	0.8924

- No significant differences were observed between Group A and Group B with the changes in Urine pus cells before to after treatment (Z=-0.5004, p=0.6168) at 5% level of significance. This implies that, the status of the changes in Urine pus cells before to after treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with status of Urine pus cells before treatment (Z=-0.5275, p=0.5979) at 5% level of significance. This implies that, the status of Urine pus cells Urine pus cells before treatment is similar in Group A and Group B.
- No significant differences were observed between Group A and Group B with the changes in Urine pus cells before to after treatment (Z=0.1353, p=0.8924) at 5% level of significance. This implies that, the status of the changes in Urine pus cells before to after treatment is similar in Group A and Group B.

Table: Showing Comparison of before treatment and after treatment with status of Urine pus cells at in Group A and Group B by paired t test

Group	Time points	Mean	Median	IQR	% of change	Z-value	p-value
Group A	Before treatment	0.60	1.00	0.50			
	After treatment	0.00	0.00	0.00	100.00	2.9341	0.0033*
Group B	Before treatment	0.70	1.00	0.50			
	After treatment	0.15	0.00	0.00	78.57	2.9341	0.0033*

*p<0.05

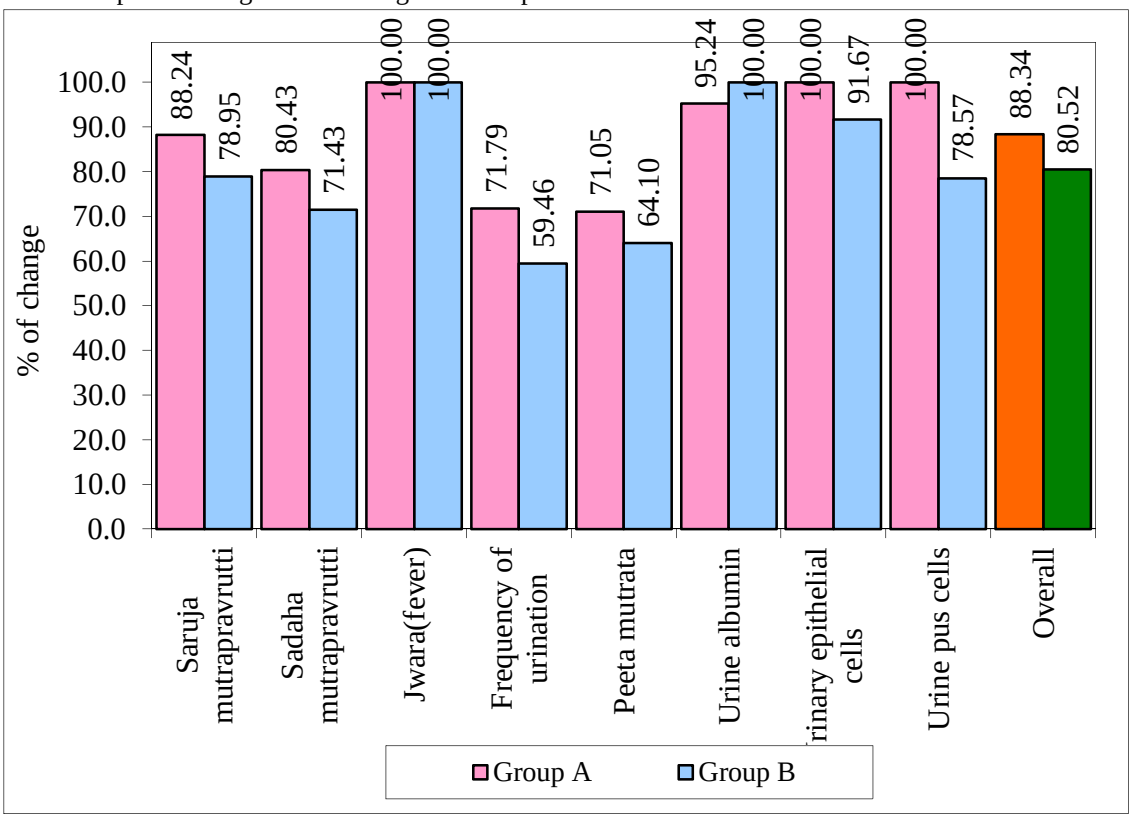
- A significant difference was observed between before treatment and after treatment with status of Urine pus cells in Group A (Z=2.9341, p=0.0033) at 5% level of significance. This implies that, a significant of 100.00% reduction was seen in Urine pus cells after treatment in Group A.
- A significant difference was observed between before treatment and after treatment with status of Urine pus cells in Group B (Z=2.9341, p=0.0033) at 5% level of significance. This implies that, a significant of 78.57% reduction was seen in Urine pus cells after treatment in Group B.
- Thus, the reduction is more in Group A as compared to Group B after treatment.

Table: Showing Overall changes in each parameter from before treatment to after treatment

Parameters	Changes from	Group A	Group B
Saruja mutrapravrutti	Before treatment-After treatment	88.24	78.95
Sadaha mutrapravrutti	Before treatment-After treatment	80.43	71.43
Jwara(fever)	Before treatment-After treatment	100.00	100.00
Frequency of urination	Before treatment-After treatment	71.79	59.46
Peeta mutrata	Before treatment-After treatment	71.05	64.10
Urine albumin	Before treatment-After treatment	95.24	100.00
Urinary epithelial cells	Before treatment-After treatment	100.00	91.67
Urine pus cells	Before treatment-After treatment	100.00	78.57
Overall assessement	Before treatment-After treatment	88.34	80.52

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Graph: Showing Overall changes in each parameter from before treatment to after treatment



VI. DISCUSSION

The present randomized, open-label comparative clinical study was undertaken to evaluate the efficacy of Hamsapadi (*Adiantum lunulatum* Burm.) and Gokshura (*Tribulus terrestris* Linn.) in the management of Pittaja Mutrakruchra, with special reference to lower urinary tract infection (UTI)**.** The study integrates classical Ayurvedic concepts with modern clinical and laboratory parameters to generate evidence-based validation.

Selection of Topic- UTI is a highly prevalent and recurrent condition, significantly affecting quality of life. In Ayurveda, its clinical presentation closely resembles Pittaja Mutrakruchra**,** characterized by daha, peeta mutra, ruja, and muhur-muhur mutrapravritti. Classical texts describe Gokshura as *Mutrala, Bastishodhaka,* and *Rasayana*, while Hamsapadi is indicated for *Dahashamana, Raktaprasadana,* and *Mutrakruchrahara* actions. Despite traditional usage, scientific validation of Hamsapadi in urinary disorders is limited. Hence, a comparative clinical evaluation was selected to assess efficacy and safety, bridging classical wisdom with contemporary research methodology.

A. Review of Literature

Classical Ayurvedic texts and Nighantus consistently describe Gokshura and Hamsapadi as effective in *Mutravaha srotas vikara*. Both drugs possess Madhura Vipaka, Sheeta Virya, and Pitta-shamaka properties. Modern phytochemical studies reveal the presence of flavonoids, tannins, alkaloids, saponins, and triterpenoids**,** supporting their antimicrobial, anti-inflammatory, antioxidant, and diuretic actions.

The samprapti of Pittaja Mutrakruchra shows close similarity with modern UTI pathogenesis—beginning with etiological factors, localization in Basti, inflammation, and manifestation of painful, burning micturition. Though complete correlation is not possible, a parallel understanding strengthens clinical relevance.

B. Analytical Study

Pharmacognostic, physicochemical and phytochemical results were within the standard limits thus confirming the genuinity and quality of both drugs.

C. Clinical Study

1) Nidana Panchaka- Most patients had Pittavardhaka nidanas such as Ushna and Katu rasa sevana, atapasevana, mutravega nigrahana, ruksha ahara, agni dushti and purvarupas like heaviness at Basti pradesha, slight change in colour of Mutra, slight burning during micturition, also, slight pain at Nabhi, Vankshana and Kukshi during micturition. They presented with symptoms like Peeta mutra, Ruja, Sadaha and Muhur muhur mutra pravrutti.

2) Chikitsa based on rasapanchaka and phytochemicals- Gokshura possess Madhura rasa, Madhura vipaka, Sheeta virya, and Guru–Snigdha guna. Thus it showed superior control over pain, frequency, pus cells, and epithelial shedding, likely due to stronger Mutrala and Apana-vatanulomana effects.

3) Hamsapadi demonstrated effective relief in burning micturition, inflammation, and mucosal healing, attributable to its Kashaya-Madhura Rasa and Raktaprasadana action. Appropriate Aushadha sevana kala (before food), Pathya palana, and Nidana parivarjana significantly supported therapeutic outcomes.

4) Demographic Observations- Higher incidence was noted among females, married individuals, middle-aged groups, housewives, and those with Mandagni and Krura Koshta, aligning with classical and modern epidemiology of UTI.

D. Subjective and Objective Outcomes

1) Saruja Mutra Pravrutti / Kruchra mutra (Pain during micturition): The overall effect of drug on Saruja mutrapravrutti registered 88.24% cure in Group A and 80% cure in Group B. The ruja is caused by Vata. Gokshura and Hamsapadi balances Vata due to its Madhura Rasa and Madhura Vipaka. They also act as Shothahara and Vedanasthapana. Thus, these drugs give significant relief of Ruja in Pittaja Mutrakruchra.

2) Sadaha Mutra Parvrutti (Burning Micturition): The overall effect of drugs in Sadaha mutrata registered 80.43% cure in group A and 71.43% cure in Group B. The drugs in both Groups have Madhura Rasa, Madhura Vipaka and Sheeta Virya which are Pittashamaka, thus the improvement can be understood based on Rasa, Virya and Vipaka of the both drugs.

3) Jwara(Fever): The overall effect of drugs in Jwara registered 100% cure in both Groups. Both the drugs are Pittashamaka, thus Gokshura and Hamsapadi showed better result in Jwara.

4) Frequent Micturition (Muhur muhur mutra pravritti): In the present study the overall effect of drugs on Muhur muhur mutrata was significant in both groups. 71.79% cure in group A and 59.46% cure in Group B. Hesitancy and urgency are due to the vikruti of Apana vayu. The drug Hamsapadi has properties of Vatashamaka causes easy excretion of Mutra. The drug Gokshura has Mutrala action causes easy evacuation of urine. This implies that it has effect on Apana vayu, thus significant result observed by group A (Gokshura).

5) Peeta Mutrata (Yellow colour urine): The overall effect of drugs on Peeta mutrata registered 71.05% cure in group A and 64.10% cure in Group B. As the both drugs having Madhura Vipaka and Sheeta Virya, both the drugs do Pitta shamana and by Mutravirechana action they reduced the Peeta mutrata, thus the patients of both Groups showed significant result.

Discussion on Objective Parameters:

6) Urine Albumin: In the present study overall effect of drugs on Urine Albumin was highly significant in both the groups, 95.24% cure in group A and 100% cure in Group B. The findings show that both the drugs effectively restore urinary tract integrity by their diuretic, wound healing and coolent actions.

7) Urine Epithilial Cells: In the present study overall effect of drugs on epithelial cells was significant in Group B and highly significant in Group A. It registered 100% cure in group A and 91.67% cure in Group B. Shedding of epithelial cells reflects inflammation and irritation of the urinary tract, commonly seen in UTI. The findings show that the anti-inflammatory, and wound healing properties of Gokshura and Hamsapadi contributed to mucosal healing.

8) Urine Pus Cells: In the present study overall effect of drugs on pus cells was significant in group B and highly significant in Group A. It registered 100% cure in Group A and 78.57% cure in Group B. Pus cells indicate active infection and inflammation in the urinary tract. The effect of both the drugs on urine pus cells may be due to the antimicrobial, anti-inflammatory and diuretic actions.

E. Overall Interpretation

The study confirms that both Gokshura and Hamsapadi are effective in the management of Pittaja Mutrakruchra (UTI). Gokshura showed comparatively superior clinical outcomes, while Hamsapadi emerged as a promising alternative, especially in Pitta-dominant presentations. The findings support the rational, evidence-based use of Ayurvedic formulations in common urinary infections.

VII. CONCLUSION

Analytical studies of Gokshura and hamsapadi confirmed their genuinity and quality as per API standards.

Both trial drugs exhibited significant reduction of clinical symptoms of UTI like burning micturition, pain, urine frequency and urine abnormalities without any adverse effects.

Both drugs are safe and effective in the management of Pittaja Mutrakruchra, with Gokshura showing better overall therapeutic outcomes.

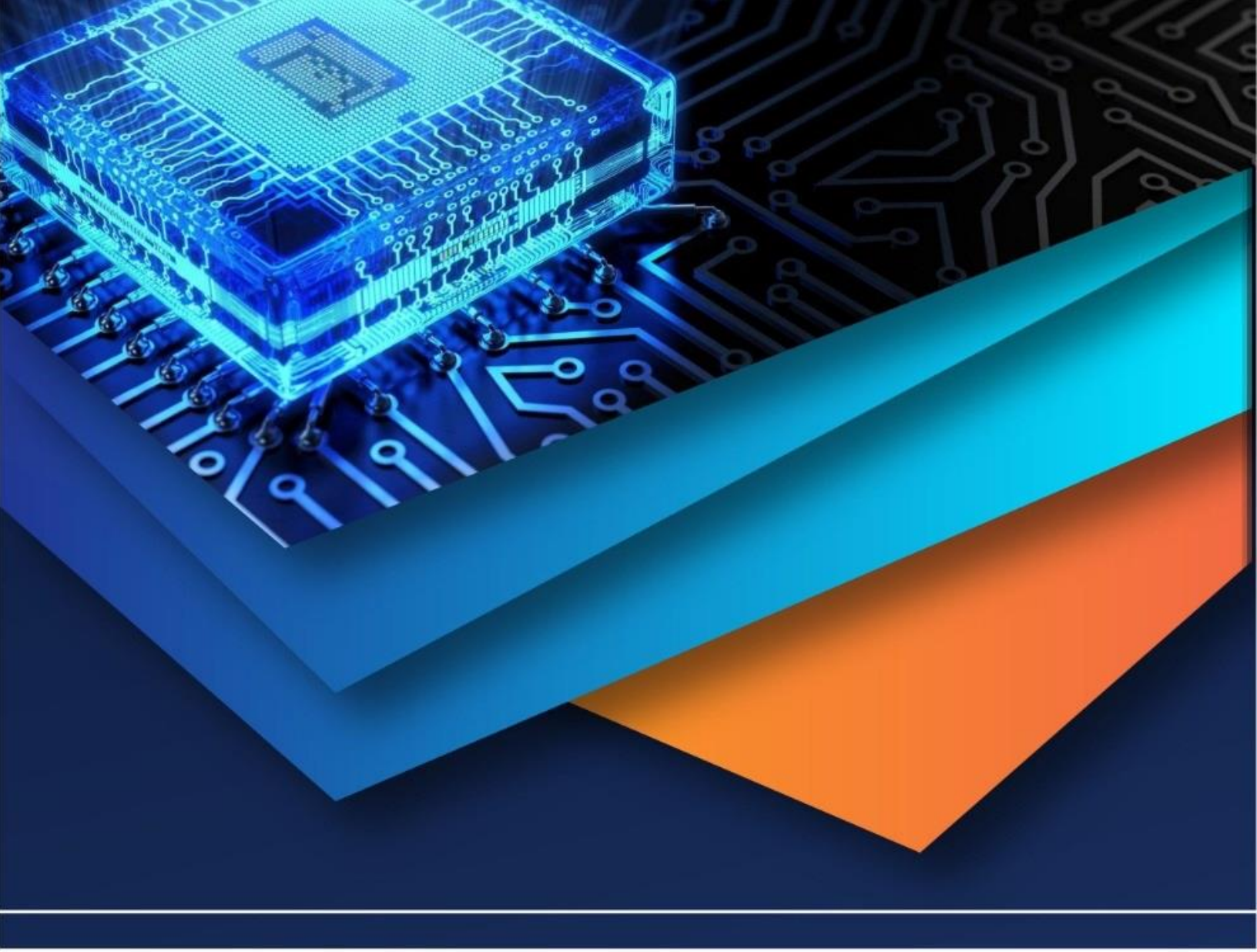
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