Review article

Cow Urine (Gomutra) in Ayurveda and Contemporary Science: From Traditional Applications to Scientific Evidence

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ABSTRACT

Cow urine (Gomutra) is an essential element of the Panchagavya therapy, which has been used in Ayurveda for centuries. It has an immense role in the treatment of various diseases and is widely used in Ayurvedic formulations. With the rise in adverse effects of various chemical drugs and the development of antimicrobial resistance, the importance of traditional healing methods and remedies has increased considerably. This review aims to provide insight into the traditional and scientific aspects of cow urine, including the chemical composition, pharmacological actions, and indications. The data were collected from the literature of classical texts of Ayurveda and modern science. Water, urea, mineral salts, enzymes, hormones, volatile fatty acids, phenolic compounds, and other organic substances were found to be present in cow urine. Experimental studies conducted on animals and in vitro models revealed antimicrobial, antioxidant, anti-inflammatory, immunomodulatory, hepatoprotective, wound-healing, anticancer, and bioenhancing effects of cow urine. In addition, synergistic effects of cow urine and its distillate (Cow urine ark) on antimicrobial and chemotherapeutic agents were reported. However, most of the evidence comes from in vitro and animal studies, and more clinical trials are needed to explore the potential use of cow urine in treating various diseases and to establish its dosage, safety, and mechanism of action. In conclusion, this review highlights the potential of cow urine as a traditional, multipurpose Ayurvedic medicine that warrants further exploration to meet modern medical needs.

Key words: Medicine, Ayurvedic, Complementary Therapies, Urine.

The origin and development of Ayurveda, one of the oldest traditional medicines, is closely related to the products of cows that are commonly used in this system [1, 2]. *Panchagavya*, meaning the five products of cows, includes milk (*dugdha*), curd (*dadhi*), clarified butter (*ghrita*), urine (*gomutra*), and dung (*gobar*) [3-7]. This group of substances has been used in various forms and doses for the prevention and treatment of numerous diseases. Cow urine, in turn, is considered an indispensable material in many practical areas of Ayurveda, whose authors have studied and applied this preparation extensively and repeatedly [3-12].

Classical Ayurvedic texts, such as the *Charaka Samhita* and the *Sushruta Samhita*, describe the therapeutic application of cow urine in the treatment of diseases related to the imbalance of *Vata* (movement and cognition), *Pitta* (temperature regulation and metabolism), and *Kapha* (fluid regulation and cohesiveness) [12]. Contemporary scientific research isolates numerous active ingredients from cow urine, including but not limited to urea, minerals, enzymes, hormones, volatile fatty acids, and phenolic compounds. Consequently, the antimicrobial, antioxidant, anti-inflammatory, immunomodulatory, hepatoprotective, anti-ulcer, and bio-enhancing effects have been associated with this substance [3-10]. Cow urine's antimicrobial and immunomodulatory properties are considered especially relevant in the context of increasing antimicrobial resistance and the overall surge of interest in developing alternatives to conventional pharmacological agents.

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The present review focuses on the traditional importance, mythology, chemical constituents, pharmacological actions, therapeutic uses, and research studies on cow urine. The article gives an insight into the traditional system of medicine, i.e., Ayurveda, and emphasizes the importance of cow urine. Hence, the present review explores the multifaceted role and impact of cow urine and provides directions for future research.

2. LITERATURE SEARCH STRATEGY

A literature search was performed to identify publications exploring the traditional and medicinal uses of cow urine. The databases PubMed, Scopus, Web of Science, Google Scholar, and ScienceDirect were used to retrieve articles published up to December 2024. The traditional use of cow urine was analyzed by exploring the classical texts, including the *Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya*, and other treatises. The search strategy comprised a combination of keywords such as *gomutra*, cow urine, *gomutra ark*, cow urine distillate, Ayurveda, Panchagavya, pharmacological activities, therapeutic applications, antimicrobial activity, antioxidant activity, and bioenhancer. The articles published in the English language, including original research articles, review papers, book chapters, and reports, were included in the present study. Moreover, the studies providing evidence on the traditional applications and chemical composition, pharmacological properties, therapeutic potentials, and safety of cow urine were reviewed, and the irrelevant and duplicate publications were excluded.

3. MYTHICAL BELIEFS ABOUT COW URINE

Ayurveda, derived from the Vedas—ancient texts attributed to Lord Brahma—focuses on human welfare and is termed "*Aptopadesh*" for its trustworthiness. It emphasizes the "*prabhav*" or infinite power of natural elements, notably cow urine, which is said to promote health. Additionally, Hindu mythology recounts how Lord Shiva explained the benefits of cow urine therapy to Goddess Parvati, referencing its significance in texts like the "*Dammar Tantra*" as "*Shivambu*", or the water of Lord Shiva [2,13].

4. INHERENT PROPERTIES AND IMPORTANCE OF COW URINE AS PER CLASSICAL AYURVEDIC TEXTS

The significance of cow urine dates to ancient Vedic and pre-Vedic periods, as documented in Ayurvedic texts like "*Charaka Samhita*" and "*Sushruta Samhita*," which refer to *Ashta mutra* (eight types of animal urine) used in medicine [2,13]. These types are known to alleviate *Kaphaja* and *Vataja* disorders linked to various ailments such as worm infestations, digestive issues, and skin diseases. Cow urine is particularly esteemed, regarded in the *Rigveda* as essential for health and life, highlighting its longstanding ritual, agricultural, and medicinal applications. Classical texts detail its beneficial properties and therapeutic potential (Table 1).

5. COLLECTION AND PRESERVATION OF COW URINE

Cow urine, which is obtained from healthy cows of indigenous breeds, has numerous therapeutic applications. The animals should be healthy, free from diseases, and have a proper lifestyle of living in open fields. Therefore, Jersey and crossbred cows are not suited for this purpose, while Indian natives are preferred, with morning collection being more effective [16]. The product must be photo-activated for 72-144 hours (depending on the season) and purified by gel filtration chromatography with silica gel G-25. Cow urine should be kept at 40 °C to maintain its quality since most bacteria cannot survive in it. It also needs to be covered with clean cotton to avoid the introduction of unwanted microorganisms through dust [16].

Table 1: Inherent properties and use of healthy cow urine as per classical Ayurvedic texts

Sl. No.	Inherent properties	Consequence on Dosha	Additional beneficial outcome	References
1.	Sweet	Reduces Vata, Pitta, and Kapha	Wormicide, beneficial for several skin problems, helpful in leprosy, itching, and ascites	[10,12]
2.	Pungent, sharp, hot, light, and basic nature	Reduces Vata and Kapha	Enhances brainpower and helps in digestion. Beneficial in colic, gastrointestinal diseases, and chronic constipation. Advantageous as a laxative and for a non-lubricant enema.	[10,14]
3.	Pungent and hot	Increases Pitta and Decreases Vata and Kapha	To absorb useful constituents in between cells and particular environments; wormicide, hemorrhoid, purgative, and decoction enema.	[15]

**Vata* = functional factor responsible for movement and cognition; *Pitta* = functional factor responsible for regulating body temperature and metabolic activities; and *Kapha* = functional factor responsible for regulating body fluids and keeping the body constituents cohesive

6. BIOCHEMICAL INVESTIGATION OF COW URINE

Cow urine, primarily composed of 95% water, contains 2.5% urea and an additional 2.5% of essential minerals, salts, hormones, enzymes, and other chemical constituents. Singh et al. found that it encompasses nearly all necessary nutrients for human health, including sodium, sulphur, nitrogen, manganese, iron, vitamins A, B, C, D, and E, as well as various minerals and enzymes [17]. Regular intake of cow urine can help prevent nutrient deficiency disorders. Additionally, according to Sahu et al., cow urine possesses *rasayana tattwa* (principles of rejuvenation and longevity) properties, contributing to the regulation of bodily functions, notably immunity [16]. Detailed biochemical analyses reveal the importance of maintaining proper levels of cow urine's components to avoid health issues, with significant chemical compositions illustrated in Tables 2 and 3.

Table 2: Percentage-wise major chemical composition of cow urine [16,17]

Sl. No.	Chemical composition	Amount present
1.	Water (H_2O)	95.00 %
2.	Urea (CH_4N_2O)	02.50 %
3.	Several Minerals, Salts, Hormones, enzymes, and some other components	02.50 %

Table 3: A few other important minor chemical constituents of healthy cow urine [16]

Sl. No.	Chemical constituents	Amount present (in ml/kg/day)
1.	Ammonia (NH_3) nitrogen	~ 1.0-1.7
2.	Allantoin ($C_4H_6N_4O_3$)	~ 20.0-60.0
3.	Calcium (Ca)	~ 0.1-1.4
4.	Chloride (Cl)	~ 0.1-1.1
		Amount present (in mg/kg/day)
5.	Creatinine ($C_4H_7N_3O$)	~ 15.0-20.0
6.	Magnesium (Mg)	~ 3.7
7.	Sulphate (SO_4^{2-})	~ 3.0-5.0
8.	Uric acid ($C_5H_4N_4O_3$)	~ 1.0-4.0
		Amount present (in mmol/kg/day)
9.	Potassium (K)	~ 0.08-0.15
10.	Sodium (Na)	~ 0.2-1.1
		Amount present (in microliters)
11.	Leucocyte	< 15.0

*Healthy cow urine has a volume of ~ 17.0-45.0 ml/Kg/day. "~" indicates an approximate value.

7. TRADITIONAL USES OF HEALTHY COW URINE

In India, the cow, called 'gomata', is revered not just spiritually but also for its contributions to nourishment through products like milk, ghee, and curd. Cow urine has diverse uses steeped in tradition, primarily recognized for its medicinal properties as an antiseptic, disinfectant, and therapeutic agent, as detailed in Ayurvedic texts. It serves three main purposes: preparation of Ayurvedic formulations, purification and detoxification of herbomineral drugs, and treatment of various ailments [2,14,15]. In rural areas, cow urine is commonly used as an antiseptic for wounds and skin issues, boasting a shelf life of around five years. It is pivotal in the Sodhana process, purifying toxic substances within Ayurvedic medicine, enhancing their safety and efficacy [16,17]. Furthermore, cow urine is critical in the Bhavana process, where it aids in the preparation of herbo-mineral formulations, improving drug bioavailability while reducing dosage and cost. Comprehensive information on notable formulations and purification techniques involving cow urine is summarized in Table 4.

Table 4: Use of cow urine in some important Ayurvedic formulations/medicines and Purification processes [16,17]

Ayurvedic formulations/medicines	Cow urine Haritaki
	Kasisadi Taila
	Panchagavya Ghrita
	Kalyana Ksharam
	Sanjivani Vati
	Agnimukh Mandur
	Arshakuthar Rasa
	Ashwini Kumar Rasa
	Punarnavadi Mandur
	Tryushanadi Mandur
	Mandur Vatak
	Panchamrut Loha Mandur
Purification processes	Guggulu Purification
	Bhallataka Purification
	Vatsanabha Purification
	Dhattura Purification
	Langali Purification
	Swarna (Gold) Purification
	Tamra (Copper) Purification
	Naga (Lead) Purification
	Loha (Iron) Purification
	Abhraka (mica) Purification
	Rajavarta (Lapis lazuli) Purification
	Kharpar (Calamine) Purification

8. COW URINE VS. COW URINE DISTILLATE

Gomutra ark, a cow urine distillate, has emerged as a notable pharmaceutical product supported by multiple US patents for treating various critical diseases. It is obtained through the distillation of cow urine, retaining its phytochemical and therapeutic properties, particularly its *rasayana tattva* or chemotherapeutic potential [18-21]. The physiological properties of both cow urine and cow urine distillate reveal a pH range between 7.4 and 8.5, with minimal ammonia content, making it safe for patient consumption. Regular administration, typically 10-12 mL twice daily, is suggested to enhance health outcomes, especially in chronic illnesses. Research by Singh et al. has affirmed that consistent use leads to more significant benefits [21].

It is also highlighted that cow urine distillate's bio-enhancing capabilities confirm its effectiveness as a biopesticide when combined with cow manure, milk, and herbal components. Studies indicate that cow urine distillate significantly amplifies the efficacy of antifungal, antimicrobial, and anticancer agents compared to cow urine itself. Notably, it has been shown to reduce mortality in *Aedes aegypti* larvae, carriers of diseases like dengue and chikungunya. Improved antibiotic transport, ranging from two to sevenfold, has also been achieved using cow urine distillate with antibiotics such as Ampicillin, Rifampicin, and Tetracycline. Additionally, redistilled cow urine distillate has demonstrated protective qualities against oxidative DNA damage, a leading cause of cancer and aging, suggesting its potential role in counteracting genotoxicity in human cells.

Table 5: Physicochemical parameters of healthy cow urine and cow urine distillate [18-21]

Parameter	Cow urine	Cow urine distillate
pH	~ 7.4 to 8.5	~ 9.88
TDS (%)	~ 2.51	~ 0.47
Hardness (ppm)	~ 863	~ 4.00
Specific gravity	~ 1.0134	~ 0.9994
Water (%)	~ 95	~ 94.79

9. BIOCHEMICAL SIGNIFICANCE AND MODE OF ACTION OF COW URINE

Cow urine exhibits antimicrobial, germicidal, and antifungal properties attributed to its various constituents, including urea, creatinine, swarnkshar, phenol, carboxylic acid, and salts of calcium and manganese [17,22-27]. Recent confirmations by Nautiyal et al. and Agrawal et al. utilized gas chromatography-mass spectroscopy (GC-MS) to identify different volatile compounds in fresh cow urine [26,27], with the analysis pathway detailed in Figure 1

Nautiyal et al. and Agrawal et al. found that various amino acids and urinary peptides enhance bactericidal action by improving bacterial cell surface hydrophobicity [26,27]. They noted that photoactivation of cow urine produces volatile compounds and increases its acidity, augmenting its bactericidal activity potentially through the presence of organic and inorganic compounds. Cow urine inhibits antibacterial resistance by blocking the R-factor and enhances macrophage phagocytic activity. Fresh cow urine contains high levels of phenols, contributing to its antimicrobial effectiveness and wound healing via antioxidants that reduce collagen degradation.

Additionally, cow urine exhibits anti-diabetic effects linked to beta cell stimulation and antioxidants. Early morning cow urine, being more sterile and enriched with nutrients, shows greater efficacy. The antioxidant properties of allantoin and uric acid may benefit cancer treatment. Consuming cow urine daily boosts immunity by promoting the synthesis of various interleukins and increasing lymphocyte survival, attributed to its free radical scavenging activity. The therapeutic significance of cow urine's chemical constituents is detailed further in accompanying Table 6.

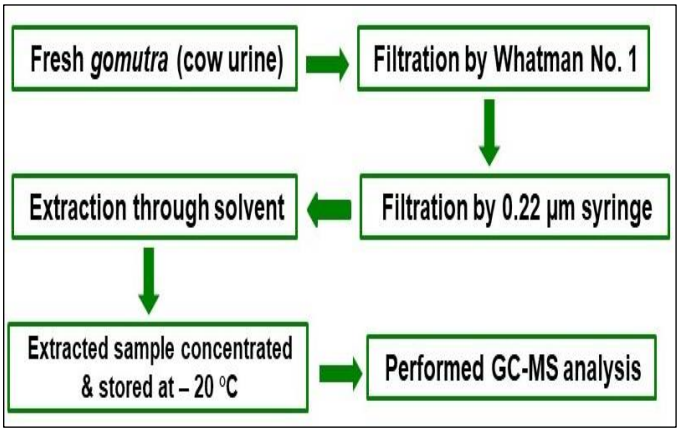


Figure 1: Schematic representation of a procedure for GC-MS analysis of cow urine.

10. MULTI-DIMENSIONAL APPLICATIONS OF COW URINE

Cow is regarded as a divine gift to humanity, with all its products deemed beneficial [3,6,7]. The sacred secretion, cow urine, has been used traditionally in various applications [16, 24].

10. 1. Therapeutic utilization of cow urine

Cow urine therapy is an intriguing research area that represents a rich source of traditional healthcare practices [16-18]. By applying contemporary science and technology, these traditional methods can be transformed into evidence-based therapies. The integration of cow urine therapy into traditional Indian medicine is facilitated by its effective *dravyaguna* (Ayurvedic materia medica), which suggests its potential to aid in curing various human diseases [16, 24].

Table 6: Therapeutic significance of chemical constituents present in cow urine [17,23-27]

Sl. No.	Chemical constituents	Therapeutic significance
1.	Ammonia	Help in stabilizing the bile, mucus, and air of the body. Moreover, it improves the integrity of blood corpuscles.
2.	Urea	Strong antimicrobial agent.
3.	Uric acid	Decreases cardiac swelling, controls cancer, and prevents secondary bacterial infection. Additionally, its diuretic property helps to destroy toxins.
4.	Nitrogen	Eradicates irregularities in the blood and the effects of toxins. It is a natural stimulating agent of the urinary tract & activates the kidneys due to its diuretic character.
5.	Sulphur	Boosts bowel action of the intestines and helps to maintain blood purity.
6.	Copper	Manages unnecessary fat deposition & serves as an antidote for a variety of poisons.
7.	Iron	Boosts the creation of red blood cells (RBC) and thus stabilizes their working power.
8.	Phosphate	Prevents stone formation in the urinary tract.
9.	Sodium	Due to its antacid nature, it helps to purify blood by decreasing the acidic content of the blood.
10.	Potassium	Acts as a natural remedy for hereditary rheumatism and eliminates muscular weakness and laziness.
11.	Calcium	Provides essential strength to bones and improves blood purification due to its germicidal power.
12.	Manganese	Keeps away decay leading to gangrene as it prevents the growth of germs.
13.	Vitamins A, B, C, D & E	Protects from extreme thirst, builds stamina, and therefore prevents nervousness.
14.	Enzymes	Helps in the secretion of digestive juices and therefore improves digestive power. It also boosts immunity.
15.	Water	Manages body temperature & maintains the fluidity of blood.
16.	Phenols	Shows strong anti-microbial activity.
17.	Lactose	Helps in strengthening the heart by protecting it from unnecessary stress, anxiety & nervousness.
18.	Creatinin	Acts as an anti-bacterial agent
19.	Swarna Kshar	It is germicidal and boosts the immunity potential of the body. Powerful antibiotic and anti-toxic in nature.
20.	Carbolic Acid	Prevents the growth of germs due to its strong germicidal power is also able to prevent gangrene.
21.	Anticancer substances	Protects from cancer by preventing the multiplication of carcinogenic cells.

10.1.1. Antimicrobial activity

Microbial diseases are increasingly problematic, particularly in developing countries like India. Recent research indicates that cow urine demonstrates considerable antimicrobial efficacy against various microbial strains [26-34], with fresh cow urine showing greater effectiveness compared to photo-activated cow urine due to its lower pH. Studies have demonstrated that concentrations of cow urine (5, 10, 15% v/v) effectively inhibit pathogens such as *Fusarium oxysporum* and *Rhizoctonia solani*, achieving up to 78.5% growth inhibition [30]. Noteworthy compounds with antimicrobial properties have been identified in cow urine, including 1-triethylsilyloxy heptadecane, n-heptadecanol-1, 1-henei-cosanol, 2-pentanone, n-nonadecanol-1, pentadecanal, and 4-hydroxy 4-methyl [26].

In comparative analyses, cow urine exhibited significant activity against *E. coli* while being relatively safe for mammalian cells [28]. The effects of cow urine on plant pathogens were also explored, confirming complete inhibition of specific strains at varying concentrations. Tested against numerous pathogens, cow urine showed the strongest inhibition against *Aspergillus* species while indicating varying effectiveness against others. Additionally, recent advancements involved the synthesis of cow urine-mediated nanoparticles [29,32], which targeted both Gram-positive and Gram-negative bacteria. Given the rise of antibiotic resistance, natural antimicrobial agents like cow urine are gaining attention for their potential effectiveness against resilient bacterial strains, supported by traditional Ayurvedic context and modern empirical findings [26,27].

10.1.2. Antioxidant activity

Both cow urine and cow urine distillate possess significant antioxidant properties primarily due to their content of various volatile fatty acids, which can neutralize oxidative stress [17,36,37]. Singh et al. reported a concentration of approximately 1500 mg/dl of these acids in re-distilled cow urine [17]. The human body is continuously exposed to toxic free radicals from sources like smoke and radiation, leading to potential cell damage and various diseases. Figure 2 gives a brief idea about the role of free radicals and oxidants in the development of various human diseases. Antioxidants present in cow urine play a crucial role in protecting cells from these harmful effects. The antioxidant properties of cow urine may offer therapeutic benefits against oxidative damage and potentially contribute to anti-aging effects. Furthermore, Sharma et al. [37] evaluated the free radical scavenging capacity of cow urine using the DPPH assay, confirming its significant antioxidant properties through observed decreased absorbance at 517 nm.

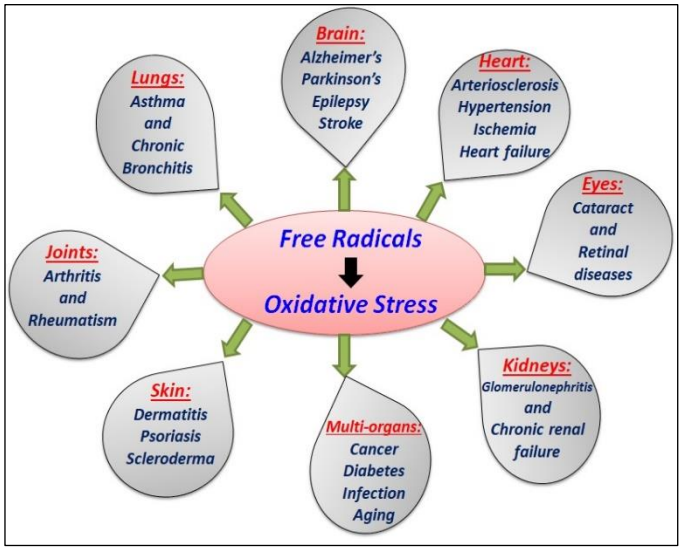


Figure 2: Role of free radicals in creating oxidative stress, which may develop a variety of human diseases

10.1.3. Antidiabetic activity

Sahu et al. [16] demonstrated that the daily intake of cow urine can help regulate blood sugar levels by enhancing glucose transport across cell membranes, leading to increased peripheral glucose utilization. The study indicated that cow urine promotes glycogen synthesis from glucose and stimulates insulin release from pancreatic beta cells, subsequently improving insulin receptor sensitivity, reducing insulin resistance, and lowering intestinal insulin absorption. The presence of various volatile fatty acids in cow urine, such as acetic acid methyl ester and butanoic acid-3-methyl, may contribute to its anti-hyperglycaemic properties. Additionally, Ghumare et al. [38] provided evidence that cow urine distillate effectively reduces elevated blood glucose, serum cholesterol, serum triglycerides, AST, and alanine aminotransferase (ALT) levels in alloxan-induced diabetic Wistar rats, yielding results comparable to standard antidiabetic medications.

10.1.4. Analgesic activity

Wate et al. studied the analgesic properties of cow urine and cow urine distillate using the rat-tail immersion technique, comparing their effectiveness to the standard analgesic Diclofenac sodium [39]. The results confirmed that both cow urine and cow urine distillate exhibited excellent analgesic activities. Their effects are linked to the presence of steroidal compounds and volatile fatty acids, supported by various studies involving chemical and instrumental analyses.

10.1.5. Anticancer Activity

Recent reports indicate that cow urine exhibits anticancer properties, effectively combating malignant cancers and aiding in DNA repair. It has also been reported to protect against mitomycin-induced chromosomal aberrations in human leukocytes and to enhance lymphocyte viability, suggesting its potential antigenotoxic and immunoprotective effects [40-42]. Furthermore, the antioxidant properties of cow urine may help reduce free radical-induced cellular damage, thereby contributing to protection against oxidative stress associated with carcinogenesis and aging. Several experimental studies have evaluated the anticancer potential of cow urine and cow urine distillate against different cancer models. Thavasuraj et al. reported that a combination of cow urine distillate and *Anisomeles malabarica* exhibited promising activity against cervical cancer [40].

Similarly, Vinotha et al. demonstrated that cow urine combined with *Plectranthus amboinicus* significantly reduced cancer cell viability and prolonged the survival of hepatocellular carcinoma-induced rats [41]. Malik et al. further documented the therapeutic potential of cow urine distillate, reporting a reduction in cancer-associated symptoms, including pain and inflammation, during treatment [42]. In addition, the anticancer and bioenhancing properties of cow urine have been recognized through the grant of a United States Patent (No. 6896907), providing further support for its potential therapeutic applications [40].

10.1.6. Anthelmintic activity

The study by Nisha et al. investigated the anthelmintic activity of cow urine on *Ascaris lumbricoides* and *Trichuris trichiura*, demonstrating that evaporated cow urine distillate diluted with saline effectively destroyed helminth eggs [19]. Additionally, Sahu et al. reported that cow urine can paralyze and kill worms in a dose-dependent manner and is also effective against vegetative forms of fungi [16]. Collectively, these findings

suggest that cow urine is a more effective anthelmintic agent compared to the standard drug Piperazine citrate.

10.1.7. Anti-urolithiatic activity

Both cow urine and cow urine distillate have shown exceptional efficacy in treating renal calculi and in restoring impaired renal function. Research by Shukla et al. highlighted the anti-urolithiatic properties of cow urine distillate in male Wistar rats, revealing its ability to significantly reduce urine oxalate, serum creatinine, blood urea levels, and CaO_x deposits, alongside restoring kidney weight [43]. Similarly, Meena *et al*. confirmed cow urine's anti-urolithiatic effects [24]. The primary mechanism behind this activity is believed to be the obstruction of calcium oxalate (CaC_2O_4) deposits, thus preventing their crystallization. Both cow urine and cow urine distillate are viable treatment options for kidney stones and gallbladder stones.

10.1.8. Cow urine on cardiovascular disorder

Cow urine, a traditional medicine, is notably effective in treating cardiovascular disorders. Research by Rajkishor et al. demonstrated that cow urine distillate possesses lipid-lowering properties, significantly reducing serum triglycerides and very low-density lipoprotein-cholesterol (VLDL-C) in guinea pigs on a high-cholesterol diet [44]. At a dosage of 0.8 mL/kg, cow urine ark lowered these lipids, while a higher dose of 1.6 mL/kg decreased total serum cholesterol, triglycerides, and VLDL-C, while also elevating High-density lipoprotein cholesterol levels. Studies by Sahu et al. and Singh et al. indicated that cow urine and cow urine distillate contain multiple components essential for cardiovascular health [16,17].These include the urokinase enzyme, which acts as a fibrinolytic agent; ammonia (NH_3), which helps maintain blood corpuscle integrity; and various elements such as nitrogen, sulphur, sodium, and calcium, which function as blood purifiers. Additionally, erythropoietin and iron contribute to maintaining haemoglobin levels. Kallikrein, also found in cow urine, acts as a vasodilator, helping to mitigate hypertension, and the presence of erythropoietin makes it beneficial in treating anemia.

10.1.9. Wound healing activity

Research indicates that external application of cow urine distillate significantly enhances wound healing rates in dogs, both diabetic and non-diabetic. Studies by Kumar et al. and Hirapara et al. show that cow urine distillate boosts granulation tissue formation and collagen content while improving wound contraction. The effectiveness of cow urine distillate in diabetic wound healing suggests its potential role in increasing granulation tissue and collagen, although further clinical studies are needed. Its antioxidant properties, possibly due to volatile fatty acids, may help reduce oxidative stress in diabetic wounds [45,46].

10.1.10. Immunomodulatory activity

The use of herbo-minerals, such as *chyawanprash* and *panchgavya*, is integral to the Indian medicinal system for enhancing immunity against common illnesses and pathogens. Research by Nautiyal et al. and Joshi et al. examined the immunomodulatory effects of cow urine in Wistar albino rats, revealing its capability to modulate the immune system through both cellular and humoral responses [47,48]. Cow urine contributes positively to immune health by boosting the production of B and T lymphocytes, enhancing blastogenesis, and increasing levels of IgG. Classical Ayurvedic texts also assert that regular consumption of cow urine enhances both humoral and cell-mediated immune responses [24,47,48].

10.1.11. Hepatoprotective Activity

Nithya et al. [49] and Gururaja et al. [50] conducted studies on the hepatoprotective effects of cow urine distillate, particularly in relation to CCl_4-induced liver damage and antioxidant enzyme levels. Their findings indicate that cow urine distillate effectively reduces serum levels of serum glutamic-oxaloacetic transaminase, Serum Glutamic-Oxaloacetic Transaminase (SGOT), aspartate aminotransferase, (AST), serum glutamic-pyruvic transaminase (SGPT), alanine aminotransferase (ALT), alkaline phosphatase (ALP), gamma-glutamyl transferase (GGT), and total bilirubin in a dose-dependent manner, comparable to silymarin's effects. Both traditional Ayurvedic texts and contemporary research suggest that daily consumption of 1 to 2 ounces of lukewarm cow urine ark may benefit individuals with liver cirrhosis. Additionally, cow urine, sometimes mixed with honey and table salt, is recommended for liver and related health issues, and it is also used alongside antimony sulphides for treating malignant jaundice [2,14,15,49,50].

10.1.12. Cow urine on skin diseases

In the Indian System of Medicine (ISM), skin disorders are classified according to *doshic* imbalances, with treatment aimed at correcting these issues through dietary changes and medication. Clinical studies by Girhepunje et al. [51] indicate the efficacy of cow urine distillate, both with and without purgation, in treating psoriasis, while Sahu et al. report cow urine's therapeutic benefits for various skin conditions, including eczema, sunburn, itching, and acne [16]. Cow urine is noted for its antiseptic properties and effectiveness in softening and cleansing skin and hair.

10.1.13. Anti-obesity activity

Several studies demonstrate the anti-obesity effects of cow urine and cow urine distillate when administered orally in models of high-fat diet-induced obesity. Research by Sharma et al. [52] compared the effects of cow urine distillate and fresh

cow urine on obesity in Wistar rats, while Singh et al. [21] also noted cow urine's anti-obesity potential. Key evaluation parameters included body mass index, atherogenic index, abdominal circumference, obesity index, lipid profile, and histopathological analysis following two months of consistent oral consumption. Results indicated a significant reduction in body mass index, abdominal circumference, obesity index, triglycerides, total cholesterol, atherogenic index, low-density lipoprotein cholesterol (LDL-C), and VLDL-C, alongside an increase in High-Density Lipoprotein Cholesterol (HDL-C) levels. The antioxidant properties of cow urine and cow urine distillate contribute to their cytoprotective and lipid-lowering effects.

10.1.14. Cow urine on epilepsy

Panchagavya ghrita is a traditional Ayurvedic mixture composed of five key cow products: cow milk, clarified butter, cow urine, curd, and cow dung juice. According to Joshi et al., incorporating *panchagavya ghrita* alongside conventional antiepileptic medications may enhance therapeutic effectiveness, allow for reduced dosages, and lessen adverse effects associated with these drugs [53]. This suggests that cow urine, combined with other *panchagavya* components, holds potential for treating epilepsy effectively.

10.1.15. Cow urine on hemorrhoid

Hemorrhoids (*Arsha*) are a prevalent anorectal disorder characterized by the enlargement and distal displacement of anal mucosa, often accompanied by inflammatory reactions and vascular hyperplasia. Research by Talokar et al. [54] explored the clinical efficacy of cow urine as an oral supplement for patients with hemorrhoids, while Sharma et al. [55] examined its non-surgical application in treating the condition. The findings indicate that cow urine distillate supplementation significantly reduces the painful and expensive complications associated with hemorrhoids.

Its *Agnivardhak* (digestive stimulant) effect enhances digestive power and counters *Agnimandya* (impaired digestion), potentially contributing to the development of hemorrhoids. Moreover, cow urine's *Mala-bhedana* (laxative action) effect aids in the purgative action on the large intestine, promoting easier stool excretion and relief for patients suffering from hemorrhoids.

10.1.16. Use of cow urine with several medicinal drugs

Cow urine has been utilized for therapeutic purposes by millions of rural individuals from ancient to modern times. It features prominently as an ingredient in numerous classical Ayurvedic formulations. According to traditional Ayurvedic texts, various significant applications of cow urine alongside other medicinal drugs are documented, as illustrated in Table 7.

10. 2. Agricultural utilization of cow urine

Inspiration for adopting green practices in agriculture is increasingly recognized globally, particularly with bio-fertilizers, bio-pesticides, and bio-fungicides. Research by Hariprasad et al. highlights the microbial diversity and functional properties of Jeevamrutha, a microbial bioformulation sourced from cow dung, cow urine, jaggery, pulse flour, soil, and water, which plays a key role in traditional Indian organic agriculture [57]. Devasena et al. found that cow urine is rich in macronutrients such as nitrogen, potassium, and phosphorus, making it an exceptional bio-fertilizer that enhances soil nutrient content [58]. The application of cow urine, whether diluted or as part of formulations, contributes significantly to soil health and reduces the need for external agricultural inputs. Additionally, cow urine contains various micronutrients, including sulphur, sodium, manganese, iron, enzymes, and chlorine, positioning it as an effective natural pest repellent. Seema et al. affirm its multiple applications in sustainable agriculture as a bio-fertilizer (in vermicompost), bio-pesticide, and bio-fungicide, while also improving soil physical and chemical properties such as pH, salt concentration, and organic matter content [17,29,57-59].

The detailed applications of cow urine in agriculture signify its importance in promoting sustainable farming practices. Cow urine, when combined with decontamination waste, is effective in producing vermicompost, which is rich in macro- and micro-nutrients. Studies by Kabir et al. [60] have explored its use as a bio-fertilizer and bio-pesticide in “Boro” rice cultivation in Bangladesh, highlighting its safety as it does not accumulate in the food chain and lacks the harmful effects of chemical pesticides [60]. Further research by Rawat et al. demonstrated that cow urine, combined with certain plant extracts, inhibits both human and plant pathogens due to its high nitrogen content and other biochemical components [61]. This nutrient-rich profile also enhances soil fertility and increases the potassium and phosphorus levels in grass and clover. Additionally, cow urine serves as an antiseptic, disinfecting the atmosphere and improving land utility, thereby reducing the need for hazardous chemicals in agriculture [17,60,61].

10.2.2. Cow urine as bio-fungicide

Sadhukhan et al. examined the effectiveness of cow urine in managing brown spot disease in *Oryza sativa*, concluding that cow urine spray significantly reduces infection by the fungus *Helminthosporium oryzae* [62]. The study highlights cow urine's fungicidal properties against various pathogens, including *C. glabrata*, *Aspergillus*, *Malassezia*, and *C. tropicalis*. Remarkably, a cow urine concentration of approximately 5.0% demonstrated impressive antifungal activity, achieving reduction rates of 83% against *A. flavus*, 92.67% against *A. oryzae*, and 93% against *A. niger* [17,62].

Table 7: A few important traditional utilizations of cow urine with several medicinal drugs according to classical Ayurvedic texts [2,14-17,21,24,56]

Sl. No.	Composition containing cow urine along with various medicinal drugs	Traditional uses for diseases to be controlled
1.	Haridra and cow urine	*Kushta* (Leprosy)
2.	Cow urine, pepper, curd, and ghee	*Jvara* (Fever)
3.	Trikatu, cow urine, kshar, and mushkakadi gana	*Kaphaja Udara* (Ascites)
4.	Guda, haritaki, and cow urine	Hemorrhoids
5.	Mahish Ghrita, cow urine, and daruharidra	*Pandu* (Anemia)
6.	Pippalyadi churna and cow urine	*Hrudrog* (heart disease)
7.	Neem bark, somapada bark, mustard oil, and cow urine	Epilepsy
8.	Sarshapa and cow urine	*Urusthambha* (Stiffness of thighs)
9.	Cow urine, chitrak & trikatu (Suntha, Marich, Pippali)	*Kshwitra* (Vitiligo)
10.	Narayan churna and cow urine or Patoladi churna and cow urine or Hapushadya churna and cow urine	*Udara* (Ascites)
11.	Milk and cow urine	*Vatajshotha* (Swelling caused by vitiated *Vata*)
12.	Cow urine and haritaki churna	*Kaphajshotha* (Swelling *caused* by *vitiated Kapha*)
13.	Cow urine and dhruhardi or cow urine and Nimbuchal (in severe condition)	*Kushta* (Leprosy)
14.	Siddha milk and cow urine	*Virechan* (Purgation) in *Pittodar*
15.	Guduchyadi Taila and cow urine	*Vataj Yonivyapad* (Vaginal diseases caused by vitiated Vata)
16.	Guggulu and cow urine or shilajit and cow urine	*Urusthambha* (Stiffness of thighs)
17.	Kukkutpurish, gunja, haridra, pippali and cow urine	Hemorrhoids
18.	Cow urine and haritaki	*Kaphaj Pandu* (Anemia caused by vitiated Kapha)
19.	Cow urine, haritaki, and honey	Internal Piles
20.	Milk, cow urine, and tripala or (milk, Cow urine, and loh Bhasma)	Anemia

10.2.3. Cow urine as Bioenhancer

Bioenhancers refer to substances that do not exhibit drug activity but enhance the bioactivity or bioavailability of drugs used in combination therapy. Classical Ayurvedic literature refers to this as the '*yogvahi*' principle, highlighting the bio-enhancing characteristics of medicines. Cow urine has been shown to increase oral bioavailability, which may lead to lower drug doses and reduced adverse side effects. By integrating traditional Ayurvedic practices with modern scientific findings, practical therapeutic drugs can be developed. Cow urine contains *rasayana tattva*, linked to its bio-enhancing effects [2,14-16,63,64]. Research by Dave et al. identified the strong bioenhancing properties of cow urine through network pharmacology, demonstrating its efficacy with twenty-five referenced medicines that possess antibacterial, antifungal, antiviral, and anti-inflammatory actions [63]. Specifically, cow urine distillate has been noted for its capacity to promote the absorption of antibiotics like ampicillin, rifampicin, and tetracycline across intestinal walls and membranes [16,24]. This presents cow urine as a valuable adjunct in various treatments, including being patented in the U.S. for its enhancement properties with anticancer medications and antibiotics. Additionally, cow urine serves as an enhancer for bioactive molecules in organic agriculture, as evidenced by a study on summer groundnut cultivation using different cow urine-based bioenhancers and botanicals, which confirmed its bioenhancing capabilities alongside other cow-derived enhancers [64].

10.2.4. Use of Cow urine for better rearing of honeybees

Ibrahim et al. investigated the antioxidant and antimicrobial effects of cow urine compared to terramycin against European Foulbrood in honeybee colonies [65]. They found that cow urine significantly reduced disease prevalence within 21 days, surpassing the efficacy of terramycin, while improving brood growth and colony health without contaminating hive products. Tiwari et al. studied cow urine combined with plant-based products against *Varroa destructor* mites, revealing significant reductions in mite infestation and increased sealed worker brood area, without negatively impacting bee activity [66]. The findings suggest cow urine as an effective, eco-friendly solution for managing European Foulbrood and mite diseases in honeybee colonies [65,66].

11. ADVERSE EFFECTS OF COW URINE

Sahu et al. reported that regular cow urine consumption can lead to common adverse effects such as itching, soreness, diarrhea, fatigue, pain, fever, shoulder soreness, and allergies, typically lasting 3-7 days but sometimes extending to 1-6 months [16]. Despite these challenges, perseverance may result in improved health. Elegbe et al. found that regular intake could lead to severe poisoning, potentially fatal in children. Adverse effects may vary based on cow breeds, diet, health conditions, and environmental factors. While consumption of cow urine distillate is increasing, fresh raw cow urine remains prevalent in rural areas [67]. Proper hygiene in collection is essential to reduce contamination risks, and controlled dosing is crucial to maximize benefits and minimize side effects.

CONCLUSION

The available traditional and contemporary evidence highlights the multifaceted therapeutic potential of cow urine and cow urine distillate in Ayurveda, including their reported roles in digestive, antimicrobial, antioxidant, immunomodulatory, and other pharmacological activities. However, further well-designed experimental and clinical studies are warranted to establish their safety, efficacy, standardization, appropriate dosage, and mechanisms of action.

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