Int J Ayu Pharm Chem
ISSN 2350-0204
www.ijapc.com

REVIEW ARTICLE

A Chemotherapeutic Exploration of *Gomutra*: A Review

Author: Rakesh Mishra[1]

Co Authors: Kshama Kulkarni[2] **and Ankita Mishra**[3]

[1]Ayurved Chikitsak/Scientist, Kamdhenu Panchagavya Research and Extension Centre, DSVC Kamdhenu University, Durg, Chhattisgarh, India
[2]Bhagvan Mahaveer Jain Ayurvedic Medical College, Gajendragad, KA, India
[3]SSSUTMS, Sehore, MP, India

ABSTRACT

In the ghastly scenario, around 70%-75% of pathogenic bacteria are resistant to at least one of the drugs for the treatment aspect,is to be taken from traditional medicine to tackle it urgently. In *Ayurveda*, Bos indicus is placed at a high pedestal for numerous uses of its various products. *Gomutra* is one of the byproducts of a cow with many benefits and without any toxicity. Various studies showed a good antimicrobial activity of *Gomutra* comparable with standard drugs such as ofloxacin, cefpodoxime, gentamycin, and against various pathogenic bacteria, more against Gram-positive than Gram-negative bacteria. Interestingly antimicrobial activity has been found against some resistant strains such as multidrug-resistant (MDR) Escherichia coli and Klebsiella pneumoniae. Antimicrobial action is increased further by it being an immune-enhancer and bioenhancer of some antibiotic drugs. *Gomutra* also has anthelmintic and antineoplastic action. In addition, *Gomutra* has antioxidant properties and it can prevent the damage to DNA caused by the environmental stress. In the management of various infectious diseases, *Gomutra* can be used alone or as an adjunctive as to prevent the development of resistance and enhance the effect of standard antibiotics.

Key Words *Antibiotic, Antineoplastic, Antifungal, Bioenhancer, Bos Indicus, Immune-Enhancer, Gomutra*

Received 01st September 22 Accepted 06th November-22 Published 10th November 2022

INTRODUCTION

Major infectious diseases remain a threat to the public health despite tremendous progress in human medicine. Emergence of widespread drug resistance to the currently available antimicrobials is a matter of deep concern. A high percentage of nosocomial infections are commonly caused by highly resistant bacteria such as methicillin-resistant Staphylococcus aureus or multidrug-resistant (MDR) Gram-negative bacteria. Every year in the United States, atleast 2 million people are more infected with antibiotic resistant bacteria and at least 23,000 people die every year as a consequence of these infections. Many people die from other conditions that are complicated by an antibiotic-

REVIEW ARTICLE

resistant infection[1]. In 2012, there were about 450000 new cases of MDR tuberculosis seen. Extensively drug-resistant tuberculosis has been identified in 92 countries. Development of resistance to oral drug of choice fluoroquinolones, for urinary tract infections caused by Escherichia coli is very widespread, often sensitivity remains only for injectables2. Infections that are caused by resistant microorganisms often fail to respond to the standard treatment, results in prolonged illness, higher health care expenditures, and land up with a greater risk of death. There is a dire need for the development of new antimicrobial agents with sensitivity intact against microorganisms[3,4]. The rational designing of novel drugs from traditional medicines to treat these difficult to treat infections offers a new prospect for the modern health-care system.

In India, Cow (*Kamadhenu*) has been considered as a sacred animal. In *Rigveda* (10/15), *Gomutra* is compared to *amrutha* (nectar). In Ayurveda Gomutra has been explained in detail and illustration seen in "*Sushruta Samhita*"[5], "*Ashtanga Sangraha*"[6] and other *Ayurvedic* classical texts as an effective medicinal substance/secretion of animal origin with innumerable therapeutic properties. *Bhav Prakash Nighantu*[7] describes *gomutra* as the one of the best of all types of animal urine (including human) and enumerates its various therapeutic uses. A Person who drinks *gomutra* on regular basis are said to live a healthy life, remaining unaffected by the erratic conditions of old age, even at age 90[8]. *Gomutra* is said as "*Sanjivani*" and "*Amrita*" in *Ayurveda*.

In addition, it has applications as a biopesticide in organic farming along with cow dung, cow's milk and other herbal ingredients. There are several medicinal properties of *Gomutra* have been mentioned such as weight loss, reversal of certain cardiac and renal diseases, indigestion, stomach ache, diarrhea, edema, jaundice, anemia, hemorrhoids and skin diseases including vitiligo. *Gomutra* has capacity of removing all the imbalances from the body, thereby helps in maintaining the general health[9]. *Gomutra* contains 95% water, 2.5% urea, minerals, 24 types of salts, hormones, and 2.5% enzymes. It also contains iron, calcium, phosphorus, ammonia, potash, nitrogen, manganese, sulfur, phosphates, potassium, urea, uric acid, carbonic acid, amino acids, enzymes, cytokine and lactose[10].

Gomutra is an effective antibacterial agent against a broad spectrum of Gram-positive and Gram-negative bacteria and also against some drug-resistant bacteria. It acts as a bio-enhancer of some antimicrobial drugs. It is antifungal, anthelmintic, antineoplastic action, is useful in hypersensitivity reactions and in various other diseases including increasing the life-span of a person. Recent researches have shown that *Gomutra* is an immune-enhancer also[11].Therapeutic properties of *Gomutra* have been validated by modern science too.

Mechanism and Action of Cow Urine:

Different fractions of *Gomutra* possess

REVIEW ARTICLE

antimicrobial activity due to the presence of certain components such as volatile and nonvolatile ones[12]. Presence of creatinine, *swarna kshar* (aurum hydroxide), calcium carbolic acid, phenols, urea, and manganese has strongly explained the antimicrobial and germicidal properties of *Gomutra*[13]. Presence of amino acids and urinary peptides may enhance the bactericidal effect[14], by increasing the bacterial cell surface hydrophobicity. *Gomutra* increases the phagocytic activity of macrophages. Presence of higher amounts of phenols in fresh *Gomutra* than in *Gomutra arka* makes it more effective against microbes.

After photo-activation, few biogenic volatile inorganic and organic compounds such as CO2, CH4, NH3, acetone, methanol, propanol and some metabolic secondary nitrogenous products are also formed[15]. Photo-activated cow urine/*gomutra* (PhCU) becomes highly acidic in comparison to fresh *gomutra*. An increase in bactericidal action may be because of the significant decrease in pH, presence of chloride, inorganic phosphorus, and dimethylamine may also play an important role[16], along with increased formation of some reactive compounds such as formaldehyde, ketones, sulfinol, and some amines during photo-activation and long term storage[17]. *Gomutra* helps to prevent the development of antibacterial resistance by blocking the R-factor, a part of plasmid genome of bacteria[18].

Gomutra contains phenolic acids (gallic, caffeic, ferulic, o-coumaric, cinnamic, and salicylic acids), and antifungal characteristics[19].

Antioxidant property of uric acid and allantoin that are present in *Gomutra* correlates with its anticancer effect. *Gomutra* reduces apoptosis activity in lymphocytes and helps them to survive better. This action may be because of the free radical scavenging activity of the urine components, and these components may prevent the process of aging. It efficiently repairs the damaged DNA.

Daily consumption of *Gomutra* improves immunity due to the presence of *swarna kshar* and fastens the wound healing process that is due to allantoin. *Gomutra* increases the immune-competence by facilitating the synthesis of interleukin-1 and -2[20], augments B - lymphocyte and T- lymphocyte blastogenesis, and IgA, IgM and IgG antibody titers[21].

Early morning first voided *Gomutra* is more sterile and has more macro and micronutrients along with other enzyme/urea content could be more effective[22].

1) As a Antimicrobial agents:

Antimicrobial activity of *Gomutra* from both indigenous and hybrid breeds against E. coli, Salmonella typhi, Proteus vulgaris, S.aureus, Bacillus cereus, Staphylococcus epidermidis, Klebsiella pneumonia, Pseudomonas aeruginosa, Pseudomonas fragi, Streptococcus agalactiae, Enterobacter aerogenes, Aeromonas hydrophila, Micrococcus luteus, Streptococcus pyogenes, Streptomyces aureofaciens, Lactobacillus acidophilus and Bacillus subtilis, and Leishmania donovani has been observed in various studies.In

REVIEW ARTICLE

these studies the antimicrobial activity of *Gomutra* was found to be comparable with ampicillin, chloramphenicol, ofloxacin, ciprofloxacin, nalidixic acid, rifampicin, streptomycin, tetracycline, cefpodoxime and gentamycin in different studies[23].

Recent Studies carried out with Indigenous Bos indicus Breeds of Cow:

Fresh *Gomutra*, Sterile, PhCU and Gomutra arka from a healthy Gir cow, was used to assess the antibacterial effect against different strains of bacteria. Against E. coli, Fresh Gomutra had the bigger mean of inhibition zone (15 mm) than Sterile, PhCU, and CUD (~10 mm).Fresh *Gomutra* had good activity of 15, 16 and 20 mm of inhibition against E. coli, B. subtilis, and S. typhi, respectively. Other forms of *Gomutra* showed activity against E. coli, S. typhi, P. vulgaris, S. aureus and B. subtilis[24].

Rana and De[25] observed a greater activity against Gram-positive than Gram-negative bacteria with CU obtained from Geer cow. The minimum inhibitory concentration (MIC) in all the four tested Gram-positive bacteria was 134 mg/ml. Among Gram-negative organisms, P. aeruginosa was more sensitive (MIC 134 mg/ml) than P. vulgaris (MIC 268 mg/ml). Mean zone of inhibition (mm) ± standard error of the mean against B. subtilis was found to be 18.67±1.15, which was less than 27 for Gentamycin 10 mcg and cefpodoxime 10 mcg. Activity (18.67±1.15) against B.cereus and was similar to that of cefpodoxime (19) but less than with gentamycin (26). Activity (16) against S. aureus and S. epidermidis was <25 for Gentamycin and ~23 with Cefpodoxime. No inhibition against P. aeruginosa was observed with Cefpodoxime while CU had an inhibition of 19.33 ± 1.15 mm and Gentamycin 35 mm. Against P. vulgaris inhibition was comparable between CU (16 ± 1.73), gentamycin (21) and cefpodoxime (20).There was comparable inhibition of P. vulagris by CU (16 ± 1.73), gentamycin (21) and cefpodoxime (20). Against K. pneumoniae, inhibition observed with CU (15.67 ± 0.57) was less than gentamycin (34) and cefpodoxime (20). Comparatively Fresh *Gomutra* obtained from Gujarati Geer cow was found to have more antimicrobial activity than its *Arka* (**Table 1).**

Table 1 Antimicrobial activity

Gomutra	E. coli	S. epidermidis	S. aureus	K. pneumoniae	P. vulgaris	B. subtilis
Fresh Gomutra	23	22	24	25	23	24
Gomutra Arka	20	20	18	20	20	21
Oflaxacin	30	28	25	28	29	32

Antimicrobial activity of *Gomutra*, *Gomutra arka* (Gujrati Geer cow) in comparison to standard drug Ofloxacin.

Similar findings were reported by Jarald et al.[26] Mean zone of inhibition (mm), using Sahiwal *Gomutra arka*, was found to be 19.2 for S. aureus, 20.2 for P. fragi, 18.8 for E. coli, 23 for B. subtilis, 19 for S. agalactiae and 17 for P. vulgaris. There was a progressive decrease in optical density (indicator of antimicrobial activity

REVIEW ARTICLE

and was measured by spectrophotometer at 600 nm) over 5 h when fresh *Gomutra* was added to the respective inoculums.

The antibacterial efficacy (as mean zone of inhibition in mm) of *Gomutra arka* obtained from Karnataka breed, Amrit mahal was comparable with Streptomycin on B subtilis (16:18), S. aureus (16:19), E. coli (14:18) and E. aerogenes (15:18) using Disc diffusion method[27].

In an in vitro study, 30 µL of PhCU of Hariana breed was found to be comparable in efficacy to Tetracycline (30 µg mL). Antimicrobial activity (mean zone of inhibition in mm) of PhCU and Tetracycline, respectively against B. cereus was 17 and 22, S. aureus was 18 and 21, S. typhimurium was 21 and 22, A. hydrophila was 22 and 24, E. aerugenes was 13 and 18 and M. luteus was 15 and 17[28]. Similar results were found in another study with PhCU of Hariana breed against these bacteria[29].

Studies where breed of cow is not mentioned:

In an in-vitro test, activity of Fresh *Gomutra* was comparable to Streptomycin. Similar mean zone of inhibition (mm) was seen against gram positive organisms E.coli (16:16:13), K. pneumonia (15:17:12) and P. aeruginosa (17:19:15) with Fresh *Gomutra* and Streptomycin and lesser with PhCU (by keeping urine in sunlight in sealed glass bottles for 72 h), respectively. Comparatively lesser antibacterial activity against gram negative organisms S. aureus (18:26:17), coagulase negative Staphylococci (18:29:15), B. subtilis (20:29:15), and S. pyogenes (20:26:14) was seen for Fresh *Gomutra* than streptomycin, and still lesser than with PhCU[30].No antibacterial activity was seen for *Gomutra Arka* , which is contradictory to some previous reports[31].

Vats et al.[32] studied the synergistic antimicrobial effect of PhCU and herbs against bacterial and fungal strains. PhCU and *Nimba* (A. indica) combination showed a remarkable synergistic antimicrobial activity against Candida tropicalis, Candida glabrata, P. aeruginosa, and S. aureofaciens. PhCU and *Haritaki* (Terminalia chebula) showed maximum activity against S. auereofaciens (45 mm), and P. aeruginosa (zone of inhibition of 40 mm). *Pippali* (Piper nigrum),*Haritaki* (T. chebula) and PhCU in combination were most effective against C. glabrata (35 mm) and C. tropicalis (45) mm.

Upadhyay et al. found in in-vitro tests that PhCU has better bactericidal activity against S. aureus, B. cereus, L. acidophilus, M. luteus, K. pneumonia, S. pneumonia and E.coli, when compared with Tetracycline, Ampicillin and Ciprofloxacin. PhCU showed MIC value of 0.25 µl/ml against S. aureus, B. cereus, L. acidophilus and M. luteus, while it was found to be 0.125 µl/ml against E. coli, which was less than that for antibiotics. A combination of *Gomutra* with *Nimba taila* (A. indica) oil and *Bakuchi* (Psoralea coryfolia) oil showed a synergistic effect (MIC 0.125-0.25 µl/ml), which was less than that for antibiotics.*Nimba tailam* (Neem oil) and *Gomutra* showed 33-35 mm inhibition zones against B. cereus, L. acidophilus, M. luteus, K. pneumoniae and S. pneumonia.

REVIEW ARTICLE

Sathasivam et al.reported the antibacterial activity of *Gomutra Arka* (5, 10 and 15 µl) against the B. subtilis, P. aeruginosa, K. pneumoniae and S. typhi. Antibacterial activity (mean zone of inhibition in mm) was observed against B. subtilis (7.6 ± 0.04, 8.6 ± 0.17, 8.8 ± 0.17,

respectively) P. aeruginosa (12.6 ± 0.04, 13.6 ± 0.17, 15.4 ± 1.23, respectively) and S.

typhi (12 ± 1.23, 13.6 ± 0.17, 15.4 ± 1.23, respectively).This antibacterial activity was more than the positive control of ampicillin (30 mg/disc), which was 7.1 ± 0.01 mm against B. subtilis, 11.2 ± 0.01 mm against P. aeruginosa and 9.6 ± 0.02 mm of inhibition zone against S. typhi. Antibacterial activity against K. pneumonia was 11 ± 0.14 mm with 15 µl of *Gomutra Arka*, which was more than the activity (9.5 ± 0.05 mm) with Ampicillin.

Yadav et al.reported the antimicrobial property of a herbal formulation containing *Gomutra*, *Shisham* (Dalbergia sissoo), and *Dhattura* (Datura stramonium). The antimicrobial activity of *Gomutra* alone was also found to be significant (P > 0.001). It was found that *Gomutra* extract showed the highest inhibition in gram-positive S. aureus (CI, 213%) and comparable activity in S.pneumoiae (95%) compared to chloramphenicol (30 µg), nalidixic acid (10 µg), rifampicin (30 µg), and ampicillin (10 µg). In gram-negative bacteria all antibiotics were inactive, except chloramphenicol (30 µg), while *Gomutra* extract showed significant (P < 0.05) activity (35% and 37%, respectively) against E. coli and K. pneumonia as compared to Chloramphenicol.

Gomutra has anti-Leishmania donovani effect (Kala-azar) in an in-vitro study[33]. This fact can be further validated by more intensive studies.

2. PREVENTION OF ANTIBIOTIC RESISTANCE:

Pathogenic bacteria are remarkably resilient and have developed several ways to resist antimicrobial drugs. Due to increasing use and rampant misuse of existing antibiotics in human and veterinary medicine, and also in agriculture, threat from antimicrobial resistance is increasing. Resistant strains like Penicillin- and Methicillin-resistant S. aureus, vancomycin resistant Enterococcus, and ciprofloxacin resistance P.aeruginosa are an ever increasing global threat. After photoactivation and purification, *Gomutra* has been found to be effective against certain drug resistant bacteria strains34. *Gomutra* extract of *nimba* (A. indica) showed better MIC values than the organic fractions for MDR E. coli (12.68 mm) and K. pneumonia (9 mm). *Gomutra* extracts of A. indica showed >8.66 mm zone of inhibition for MDR S. aureus, P. aeruginosa and P. vulgaris[35].

3.FUNGICIDE AND BIOFUNGICIDE:

Fungicidal effect against Aspergillus fumigatus, Aspergillus flavus, Aspergillus niger, Aspergillus, Malassezia, C. tropicalis and C. glabrata has been observed in various studies. *Gomutra* was highly stable and capable in inhibiting the growth of Malassezia fungi (90-95%) responsible for causing dandruff for a

REVIEW ARTICLE

longer time (4-5 days), than rice water (due to B. cereus growth in rice water) which was stably capable of inhibiting 85-90% of the growth for 3-4 days.

Neem leaves extract and Lemon Juice extract were comparatively less effective in this study[36].

15% Gomutra was most active against Aspergillus, Rhizophus and the percentage of inhibition obtained with it was 85%[37]. 5% concentrated *Gomutra* showed maximum antifungal activity against A. niger (93%), followed by A. oryzae (92.67%) and A. flavus (83%).

Gomutra arka showed better antifungal activity against A. fumigatus and C. albicans with mean zone of inhibition of 13 and 11 mm than PhCU. More fungal growth suppression (as mm in diameter) was observed with *Gomutra Arka* in A. niger (8 ± 0.14, 11.3 ± 1.2 and 12.6 ± 0.04, respectively) than A. flavus (7.3 ± 0.25, 10 ± 0.26 and 11 ± 1.2, respectively) with the use of 5, 10 and 15 µl of *Gomutra arka.*

In vitro antifungal activity (in mm) of Geer gomutra against A.flavus (17.33 ± 0.57) was in between 50 µg of amphotericin B (15) and 10 µg of clotrimazole (24) and against C. albicans, activity was similar with CU (18.67 ± 1.15) and amphotericin B (19), but less than clotrimazole (30). Antifungal activity of Geer gomutra is better than the others where source of *Gomutra* is not mentioned.

In an in vitro study, it was found that the urine samples of outdoor feeding cow (OCU) was more effective and inhibited growth of fungi more strongly as compared to indoor feeding CU (ICU). This inhibition was concentration dependent. No growth of Penicillium notatum, Trichoderma viridae, and Alternaria solanii was observed with 10% OCU and with 20% ICU and that of Claviceps purpurea, Rhizopus oligosporius, C. albicans and A. candidus, no growth was observed with 20% of OCU only[38].

1. **ANTISEPTIC:**

Sanganal et al. observed the enhanced wound healing activity of *Gomutra* in Wistar albino rats[39].On 4th day, the external application of *Gomutra* showed significant and progressive increase in wound healing in rats compared to different concentrations of *Gomutra* and 1% w/w nitrofurazone ointment locally. Similar findings were also observed by Maheshwary et al.[40.]

5. ANTHELMINTIC ACTIVITY:

Gomutra Arka was found to be more effective than piperazine citrate as anthelmintic agent at both 1% and 5% concentrations. For anthelmintic activity, adult Indian earthworm Pheretima posthuma was studied due to its anatomical and physiological resemblance with the intestinal roundworm parasite of human beings. Paralysis of earthworm occurred in 53 and 48 min with 1% piperazine and *Gomutra arka*, respectively and 16 and 13 min with 5% piperazine and *Gomutra* arka , respectively.Time taken for the death of earthworms decreased from 72 min with 1% piperazine to 60 min with 1% *Gomutra arka*, respectively. It further decreased from 28 min with 5% piperazine to 18 min with 5% *Gomutra arka*, respectively.

REVIEW ARTICLE

Different compositions of Panchgavya (five products of cow namely *dugdha, dadhi, ghrita, gomutra* and *gomaya*) alone and combination of *Panchgavya* and ethanolic extract of Bauhinia variegata Linn (10%, 50%, 75% in Panchgavya) were found to have excellent anthelmintic activity against adult Indian earthworm (P.posthuma) when we compared to control Piperazine (50 and 100 mg/ml). In combination, the anthelmintic activity was synergistic and with increasing doses, time (in minutes) of onset of paralysis and death in earthworm decreased[41].

6.BIOENHANCER:

A 'bioenhancer'/'biopotentiator' is an agent that enhances the bioavailability and efficacy of a drug so that it is co-administered, without any pharmacological activity of its own at the therapeutic dose used. In *Ayurveda*, this concept is understood as *'yogvahi*' and it is used to increase the efficacy of medicines by increasing the oral bioavailability, decreasing their dose and adverse effects, and were used to circumvent the parentral routes of drug administration. We can develop more such useful and economically viable drug combinations, by integrating the knowledge of time tested Ayurveda with modern methods of research. *Gomutra* is the only byproduct of animal origin that acts as bioenhancer of, antifungal, antimicrobial and anticancer agents. The indigenous *Gomutra* contains '*Rasayana*' *tatva*, and is responsible for modulation of the immune system and act as a bioenhancer as well.

Gomutra Arka is considered to be more effective bioenhancer than *Gomutra*[42]. *Gomutra Arka* enhances the transport of antibiotics such as ampicillin, rifampicin, tetracycline and across the gut wall by 2-7 folds[43]. It enhances the potency of taxol against MCF-7 cell lines[44]. It increases the bioavailability of rifampicin by 80 fold in 0.05 microgm/ml concentrations, ampicillin by 11.6 fold in 0.05 µ g/ml concentrations and clotrimazole by 5 fold in 0.88 µ g/ml concentration[45].The activity of rifampicin increases by about 5-7 folds against bacteria, E. coli and 3-11 folds against Gram-positive bacteria, when used along with CU[46]. Potency of paclitaxel has been observed to increase against MCF-7, a human breast cancer cell line in in-vitro assays. The bioenhancing capacity is by facilitating the absorption of drugs across the cell membrane.The *Gomutra* has been granted as US Patents for its medicinal properties, particularly as a bioenhancer along with antibiotics, antimicrobial, antifungal and anticancer drugs (6896907, 6410059).

Gomutra Arka alone caused more inhibition of Gram-positive bacteria. Inhibition caused by streptomycin (1 mg/ml) alone was higher (31-34 mm) than that of *Gomutra arka* alone (19-22 mm).

With the combination of Pinguicula longifolia, *Gomutra Arka* and streptomycin together, S. aureus was inhibited to a more extent (38 mm) followed by P. aeruginosa (37 mm) and an equal inhibition was exhibited by B. subtilis and E. coli (36 mm)47. S. aureus and P. aeuroginosa have

REVIEW ARTICLE

been recognized as most common bacteria, that have developed resistance against several antibiotics and is a major hospital borne pathogen, which is particularly dangerous to immune-compromised patients. This study is of importance in this scenario.

This bioenhancing activity of *Gomutra* has been widely used in our various *Ayurvedic* formulations and in the treatment aspect as well. It is one of the constituents of *Hingvadhi ghrita, Lashunadhi ghrita, Siddhartak ghrita* for psychiatric illness used in abdominal tumors and in other formulations like *Mandurvatak, Darvi ghrita*, and *Punnarva-mandur.Gomutra* is used as *yogvahi* along with *Haritakyadi yoga, Swarnkshiryadi yoga, Swarnmakshik bhasma* and *Gvakshyadi churna. Ghritas* are available as semisolid preparations while *bhasma's, yoga's*, and *churna's* are in the powder form.

7.ANTICANCER PROPERTIES:

Gomutra has antioxidant properties and is a free radical scavenger, and thus it neutralizes the oxidative stress. Scientists proved that the pesticides even at very low doses cause apoptosis of lymphocytes and tissues through fragmentation of DNA while *Gomutra* helps the lymphocytes to survive by inhibiting their apoptosis and by repairing the damaged DNA and is, therefore, effective as anti-cancer therapy[48].

In a study, chemopreventive potential of *Gomutra* was observed, which was conducted on 70 Swiss albino mice for the duration of 16 weeks. Papillomas (tumor) were induced by 7, 12 dimethyl benzanthracene and later promoted by repeated application of croton oil. In mice treated with *Gomutra*, the incidence of papillomas (tumor), tumor yield, and its burden was statistically less than the untreated group[49].

Jain study shows the effect of *Gomutra* therapy on various types of cancers in Mandsaur area. The severity of symptoms (pain, inflammation, difficulty in swallowing, and irritation) decreased from day 1 to day 8 with *Gomutra* therapy. Percent of patients with severe symptoms decreased from 82.16 to 7.9 on day 8, patients with moderate symptoms increased from 15.8 to 55.3 and with mild symptoms, patients increased from 1.58 to 36.34. The severity of symptoms decreased further with continued *Gomutra* therapy.

Dutta et al. reported the anti-clastogenic and anti-genotoxic effect of *Gomutra arka* (redistilled form) in human peripheral lymphocytes, that has been challenged with manganese dioxide (MnO2) and hexavalent chromium (Cr+6).Protection in number of chromosomal aberrations and frequency of micronuclei were more prominent when these cells were pretreated with *Gomutra* than simultaneous treatment with *Gomutra*[50].

8. IMMUNO-STIMULANT:

The use of herbominerals for improving the overall resistance of the body against common infections and pathogens has been a core principal of *Ayurveda*. *Ayurveda* state that consuming *Gomutra* daily increases the resistance to diseases by up to 104%.*Gomutra* enhances the humoral, cell-mediated immune

response in mice. *Gomutra Arka* was found to augment B- lymphocyte and T-lymphocyte blastogenesis; IgG, IgA and IgM antibody titers in mice. Observation was that *Gomutra* also increases the phagocytic activity of macrophages and thereby helpful in the prevention and control of bacterial infections.The level of both interleukins -1 and - 2 in rats these levels were increased significantly by 14.75% and 33.6%, respectively. And in mice was increased by 30.9% and 11.0%, respectively. *Gomutra Arka* has been reported to be a potent and safe immunomodulator, which increases both humoral, and cell-mediated immunity in mice.

Cell-mediated immune response was evaluated on various parameters in a study by Verma et al. using CU for 30 days.There was a 55% increase in phagocytic index, and a significant increase (16%) in neutrophil adhesion on regular use of whole freeze dried *Gomutra*. *Gomutra* has the potential to boostup the immune functions by increasing the white blood cells counts (WBC) and subsequently reducing the red blood cells count (RBC) to a certain extent[51].

9.Traditional uses of *Gomutra*:

Such as in fever, *Gomutra* along with *pippali* (pepper), *dadhi*(curd) and *ghrita* (ghee) is used; in leprosy, *Gomutra* is used combined with *daruharidra* and in deformities associated with leprosy, it is used with Nimbuchal, whereas in chronic leprosy, *Gomutra* is combined with leaves of Vasaka and kanar, and bark of *kuraila* and *nimba*.

Local traditional healing practices in Mandsaur prescribe *Gomutra* for worm infestations, to develop immunity and to avoid aging. They suggest 10-25 ml of *Gomutra* to be taken on an empty stomach for the same.

CONCLUSION

On analyzing the effect of different preparations of *Gomutra*, Fresh *Gomutra* had better activity than *Gomutra arka*. Activity of fresh *Gomutra* and *Gomutra arka* native cows was similar to streptomycin and tetracycline. *Ayurveda* too mentions that fresh *Gomutra* of indigenous cows' is the best.

More and more well-planned studies in human subjects are required in order to completely assess its potential as an effective antimicrobial agent as that most of the studies quoted are in vitro studies. Comparative studies between *Gomutra* obtained from indigenous breeds and of inbred strains may be undertaken, as *Ayurveda* was written when inbred strains of cows were not present. Future development of newer drugs can involve *Gomutra* in its repository.

REVIEW ARTICLE

REFERENCES

1. Retrieved from: http://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf#page=11 .

2. Retrieved from : http://www.who.int/mediacentre/factsheets/fs194/en/

3. Murray CK. Crit Care Med. [2008]. Infectious disease complications of combat-related injuries;36:S358–64. DOI: 10.1097/CCM.0b013e31817e2ffc

4. Shafer RW, Rhee SY, Bennett DE. Antivir Ther.; [2009].Consensus drug resistance mutations for epidemiological surveillance: Basic principles and potential controversies: 13(Suppl 2),59–68. DOI: 10.1371/journal.pone.0004724

5. Vaidya Jadavji Trikamji. Sushruta Samhita, with Nibandh sangrahavyakhya, Uttarasthana, 45/221, Varanasi: Chaukhamba Orientalia 2002, Pg.no-851

6. Vagbhata, Ashtanga Hridayama in Sutra Sthana. 5/83, Tripathi Brahmananda, Chowkhamba Sanskrit Pratishthan, Delhi, 1st edition, 1992; 84

7. Pandit Shree B. S. Mishra. Bhavaprakasha, Purva khanda mutra varga/4. Varanasi; Chaukhamba Samskrit Samsthana; 9th edition; 2005, Pg.no.315

8. Vaidya Jadavji Trikamji, Charaka Samhita Sutrasthana 1/70 Ayurveda deepikavyakhya Varanasi:. Chaukhambha Orientalia; 2006, Pg.no-41

9. Chauhan RS, Singh BP, Singhal LK.[2001] Immunomodulation with Kamdhenu ark in mice. J Immunol Immunopathol ;3:74–7.

10. Bhadauria H.[2002]. Cow Urine- A Magical Therapy. Vishwa Ayurveda Parishad, 71-74. Int J Cow Sci. 2002;1:32–6.

11. Randhawa GK.[2010] Cow urine distillate as bioenhancer. J Ayurveda Integr Med. ;1:240–1. DOI: 10.4103/0975-9476.74089

12. Jarald E, Edwin S, Tiwari V, Garg R, Toppo E;[2008].Antioxidant and antimicrobial activities of cow urine. Glob J Pharmacol;2:20–2 .

13. Kumar AA. Kanpur (U.P.): [2001].Thesis Submitted to the C.S.A. Univ Agr Techn; Study on Various Biochemical Constituents in the Urine of Cow, Buffalo and Goat; Pg.no-13.

14. Badadani M, SureshBabu SV, Shetty KT. [2007] Optimum conditions of autoclaving for hydrolysis of proteins and urinary peptides of prolyl and hydroxyprolyl residues and HPLC analysis. J Chromatogr B Analyt Technol Biomed Life Sci. ;847:267–74. DOI: 10.1016/j.jchromb.2006.10.02.

15. Upadhyay RK, Dwivedi P, Ahmad S.[2010] Antimicrobial activity of photo-activated cow urine against certain pathogenic bacterial strains. Afr J Biotechnol. ;9:518–22.

16. Naotoshi K, Osamu Y, Yoshihiko S, Fuminobu M, Masahiro Y, Yoshimitsu M.[2007] Clinico-pathological findings in peripartum dairy cows fed anion salts lowering the dietary cation-anion difference: Involvement of serum inorganic phosphorus, chloride and plasma estrogen

concentrations in milk fever. Jpn J Vet Res ;55:3–12.

17. Türi M, Türi E, Kõljalg S, Mikelsaar M.[1997] Influence of aqueous extracts of medicinal plants on surface hydrophobicity of Escherichia coli strains of different origin. APMIS.;105:956–62.

18. Chauhan RS, Singhal L.[2006]. Harmful effects of Pesticides and their control through cowpathy. Int J Cow Sci. ;2:61–70.

19. Singh UP, Maurya S, Singh A, Nath G, Singh M.; [2012]. Antimicrobial efficacy, disease inhibition and phenolic acid-inducing potential of chloroform fraction of cow urine. Arch Phytopathol Plant Protect.; 45:1546–57.

20. Chauhan RS. Panchagavya therapy (cow pathy) [2004]. Current status and future directions. Indian Cow. ;1:3–7.

21. Kumar S.[2013] Analysis of cow's urine for detection of lipase activity and anti-microbial properties. J Pharm Biol Sci. ;7:1–8.

22. Pescheck-Böhmer F, Schreiber G. [1999]. Urine Therapy: Nature's Elixir for Good Health. Rochester: Inner Traditions, Bear & Company; Healing yourself using urine; P-no-. 152.

23. Yadav H, Yadav M, Jain S, Bhardwaj A, Singh V, Parkash O, et al.[2008]. Antimicrobial property of a herbal preparation containing Dalbergia sissoo and Datura tramonium with cow urine against pathogenic bacteria. Int J Immunopathol Pharmacol. ;21:1013–
20. DOI: 10.1177/039463200802100427.

24. Minocheherhomji FP, Vyas BM.[2014]. Study of the antimicrobial activity of cow urine and medicinal plant extracts on pathogenic human microbial strains. Int J Adv Pharm Biol Chem; 3:836–40.

25. Rana R, De S. [2013]. In vitro antimicrobial screening of cow urine- A potential natural anti-microbial agent. Int J Bioassays.;2:436–9.

26. Ahuja A, Kumar P, Verma A, Tanwar R.[2012]. Antimicrobial activities of cow urine against various bacterial strains. Int J Recent Adv Pharm Res.; 2:84–7.

27. Kekuda PT, Nishanth BC, Kumar PS, Kamal D, Sandeep M, Megharaj HK. [2010] Cow urine concentration: A potent agent with antimicrobial and anthelmintic activity. J Pharm Res.; 3:1025–7.

28. Tyagi PK, Tyagi S, Sarsar V, Pannu R. [2013] Cow urine: An antimicrobial activity against pathogens and their possible uses. Int J Pharm Res Sch.;2:427–33.

29. Sarsar V, Selwal KK, Selwal MK, Pannu R, Tyagi PK. [2013].Evaluation of antibacterial activity of photoactivated cow urine against human pathogenic strains. Environ Exp Biol.;11:201–3.

30. Shah CP, Patel DM, Dhami PD, Kakadia J, Bhavsar D, Vachhani UD, et al. [2011]. In vitro screening of antibacterial activity of cow urine against pathogenic human bacterial strains. Int J Curr Pharm Res.;3:91–2.

31. Sathasivam A, Muthuselvam M, Rajendran R.[2010]. Antimicrobial activities of cow urine

distillate against some clinical pathogens. Glob J Pharmacol.;4:41–4.

32. Vats S, Kumar R, Negi S.[2012] Natural food that meet antibiotics resistance challenge: In vitro synergistic antimicrobial activity of Azadirachta indica, Terminalia chebula, Piper nigrum and photoactivated cow urine. Asian J Pharm Biol Res.;2:122–6.

33. Singh S.[2005]. Cow urine has anti-leishmania donovani effect in vitro. Int J Cow Sci.;1(2):72–3.

34. Biddle S, Teale P, Robinson A, Bowman J, Houghton E. [2007]. Gas chromatography-mass spectrometry/mass spectrometry analysis to determine natural and post-administration levels of oestrogens in bovine serum and urine. Anal Chim Acta. ;586:115–21. DOI: 10.1016/j.aca.2006.10.044.

35. Rajapandiyan K, Shanthi S, Murugan AM, Muthu GA, Singh AJ.[2011]. Azadirachta indica - Cow urine extract, a novel controlling agent towards clinically significant multi drug resistant pathogens. J Appl Pharm Sci.;1:107–13.

36. Kumar S.[2013]. Analysis on the natural remedies to cure dandruff/skin disease-causing fungus - Malassezia furfur. Adv Bio Tech.;12:1–5.

37. Vijayalakshmi R, Saranya VT.[2010]. Effect of "Go-Mutra" on plant growth and its antifungal and antibacterial activity. J Herb Sci Technol.;6:6–11.

38. Deshmukh SS, Rajgure SS, Ingole SP.[2012]. Antifungal activity of cow urine. IOSR J Pharm. 2012;2(5):27–30.

39. Sanganal JS, Jayakumar K, Jayaramu GM, Tikare VP, Paniraj K, Swetha R.[2011]. Effect of cow urine on wound healing property in wister albino rats. Vet World.;4:317–21.

40. Maheshwari AK, Gupta AK, Das AK. [2004] Effect of cow urine on wounds. Indian Cow.;1:19–24.

41. Kumar R, Kumar A, Kumar K, Gupta V, Shrivas T, Tripathi K.[2014] Synergistic anthelmintic activity of different compositions of panchagavya and Bauhinia variegate Linn. Int J Phytopharmacol.;5:120–2.

42. Tambekar DH, Kerhalkar SA. [2006] Cow urine: A bioenhancer for antibiotic. Asian J Microbiol Biotechnol Environ Sci. ;8:329–33.

43. Khanuja SP, Kumar S, Shasany AK, Arya JS, Darokar MP.[2007]. Use of bioactive fraction from cow urine distillate ('Go-mutra') as a bioenhancer of anti-infective, anti-cancer agents and nutrients. US Patent US 7235262.

44. Khanuja SPS, Kumar S, Shasany AK, Arya JS, Darokar MP, Singh M, et al.[2002] Pharmaceutical composition containing cow urine distillate and an antibiotic. US Patent US 6410059 B1.

45. Tatiraju DV, Bagade VB, Karambelkar PJ, Jadhav VM, Kadam V.[2013] Natural bioenhancers: An overview. J Pharmacogn Phytochem. ;2:55–60.

46. Chawla PC. [2010]. Resorine a novel CSIR drug curtails TB treatment. CSIR News.;60: 52–4.

47. Poornima G, Abhipsa V, Rekha C, Manasa M, Kekuda PT.[2012] Antibacterial activity of

combination of Polyalthia longifolia thw. extract, cow urine distillate and Streptomycin. Res J Pharm Tech. ;5:927–30.

48. Kumar A, Kumar P, Singh LK, Agrawal DK. [2004] Pathogenic effects of free radicals and their prevention through cowpathy. Indian Cow.;6:27–34.

49. Raja W, Agrawal RC. [2010] Chemopreventive potential of cow urine against 7, 12 dimethyl benz(a) anthracene-induced skin papillomasgenesis in mice. Acad J Cancer Res. ;3(1):7–10.

50. Dutta D, Devi SS, Krishnamurthi K, Chakrabarti T.[2006]. Anticlastogenic effect of redistilled cow's urine distillate in human peripheral lymphocytes challenged with manganese dioxide and hexavalent chromium. Biomed Environ Sci.; 19:487–94.

51. Verma A, Kumar B, Manish KS, Kharya MD. [2011] Immunomodulatory potential of cow.