Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(6), 1375-1383 | ISSN:2251-6727

Review on Antibacterial efficacy of Tribal Acquaintance Medicinal Plants of Jaipur, (Rajasthan) Against Multidrug-Resistant Bacterial Uropathogens

Teena Gulia[1]*, Divya Shrivastava[2], Juhi Sharma[3]

[1.] Research Scholar, School of Life & Basic Sciences, Jaipur National University, Jaipur
[2.] Professor, School of Life & Basic Sciences, Jaipur National University, Jaipur
[3.] Assistant Professor, School of Life & Basic Sciences, Jaipur National University, Jaipur

(Received: 07 October 2023 Revised: 12 November Accepted: 06 December)

KEYWORDS
Urinary Tract Infections, Antibiotic resistance, Medicinal Plants, Achyranthus aspera, Prosopis cineraria.

ABSTRACT:
A more frequent and perhaps hazardous illness is a UTI. Prolonged antibiotic therapy eventually results in diseases that are resistant to drugs. The search for novel antimicrobial compounds in nature has quickened due to the growing anxiety over antibiotic resistance in public health. Many human diseases have unavoidably evolved to become resistant to a variety of currently accessible medications, leading to significant global death and morbidity rates. The fight against these deadly infections requires the urgent need for innovative antibiotics. There is an urgent need to use standardised modern analytical approaches due to the rising occurrence of anti-drug diseases for the isolation of new bioactive compounds from therapeutic plants. Complexes obtained from therapeutic flora may offer new, simple strategies for combating harmful bacteria. The primary objective is to create effective antibiotics for patients with urinary tract infections by utilising bioactive compounds derived from plants that possess antibacterial properties. This review aims to record and distillate plant-derived chemicals and extracts against multidrug-resistant infections (MDR). Since antimicrobial drug use is unpredictable and the conditions leading to microbial resistance are expanding quickly, it is critical to implement stringent measures to lessen the impact of this issue. To identify medicinal plant extracts as possible antimicrobial agents, research on their modes of action, interactions with other compounds, and pharmacokinetic and/or pharmacodynamic characteristics should be prioritised. The antibacterial activity of components originating from plants is examined in this review. The emphasis is on the present difficulties and potential developments in antibacterial medicinal herbs.

INTRODUCTION

Highest prevalent categories of infections seen in scientific attempt, urinary tract infections (UTIs) account for about 25% of all illnesses and impact women (60%) at some point in their generation. Inappropriately, most of the women have recurring UTI experiences; 27% were found positive symptoms of UTI in less than half a year, and 12.4% had a third occurrence in less than365 days. [1] The likelihood of getting a urinary tract infection rises with age and influences deteriorating health, an increase in diseases, where you live (a nursing home), and your medical history, including any catheterizations and antibiotic use. UTIs occur more frequently in post-menopausal women, perhaps because of declining estrogen and accompanying changes in the pH of the vagina. [2]

Klebsiella species, Proteus species Escherichia coli, Pseudomonas aeruginosa, Acinetobacter species, and *Morganella margani* are the main culprits in UTIs which are gram-negative bacteria. UTIs are frequently caused by *Enterococcus, Staphylococci,* and *Streptococcus agalactiae,* all of which are gram-positive bacteria and coagulase negative. [3]

Regional studies have examined the frequency of healthcare related UTIs, which ranges from 12.9% in the US, 19.6% in Europe, and up to 24% in poor nations. *E. coli* was the most common uropathogen detected in the

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JCHR (2023) 13(6), 1375-1383 | ISSN:2251-6727

universal prevalence study of infections in urology, accounting for 38.7% of all cases. It was followed in frequency by *Acinetobacter spp.,* 3.6% of *Proteus spp.*, 10.4% of *Pseudomonas spp.,* 12.7% of *Enterococcus spp.* and 14.1% of *Klebsiella spp*. [4]

If the infection is not treated, it can lead to intrauterine fetal death premature babies, growth retardation, preterm labor, low birth weight, intrauterine, increased prenatal mortality, plus complications for mom, such as, preeclampsia, adult respiratory syndrome, renal failure, anemia, and septicemia. Contrary to affluent nations, its incidence is increasing in poorer nations due to hunger, low socioeconomic position, and improper antibiotic usage. According to several research conducted in Ethiopia; the incidence of UTI ranged from 9 to 14% during prenatal period. [5]

Antibiotic treatment, based on knowledge of the resistance pattern of antimicrobial presented by the gram-negative bacteria of urinary tract infection, is frequently used to begin the treatment of UTI. Thus, urinary pathogens are reported to have higher rates of global antibiotic resistance. Learning about the patterns of resistance and gathering data on the susceptibility of urinary infections to various antibiotics depends on where they are distributed. Therefore, understanding the spreading of these organisms plus sensitivity repetition to various drugs in a specific context using the right conditions. [6]

There is no denying that research over the past several decades has demonstrated the promise of plants as a source for novel antibacterial medications. As a result, there is a bright future for antibacterial medicinal plants given the enormous and diverse variety of plants present on Earth, the majority of which have not yet received enough research. Additionally, herbal medicine is becoming more and more well-liked daily, therefore the introduction of new all-natural antibacterial medications into the pharmaceutical markets will be well-received. To assure the selection of bioactive and non-toxic or potential side effects of the nominated antibacterial phytochemicals, more thorough research relating to the isolation of antibacterial phytochemical components from medicinal plants still need to be conducted. On the other hand, financial backing is essential to advance scientific initiatives that depend on pharmaceutical firms' interest in making investments in that promising subject.

UROPATHOGENS - MDR

Bacteria known as multidrug-resistant organisms (MDRO) display acquired resistance to a number of drugs, decreasing the effectiveness of antimicrobial therapy. One of the largest risks to municipal health at the moment is spread of MDRO, which has a significant impact on antibiotic use, healthcare expenditures, morbidity, and death. Both at the human and animal levels, the widespread and, in the majority of cases, improper use of antibiotics adds to the selection pressure that underlies MDRO dissemination. Poorly cooked food, close closeness, and insufficient cleanliness are a few of the factors that lead to the increase of resistant germs on the way to people and animals. Through tainted wastewater or through animals, resistant bacteria can get into the ecosystem and food supply. [7]

Implementing a One Health strategy, incorporates the cooperation of all divisions to promote people condition effects as outlined by the WHO, is the greatest way to counter the development of MDRO. Ten exploration pieces, reviews and letters focusing on the pathogenicity and epidemiology of MDRO are included in this Special Issue. [8]

The deployment of effective disinfection methods using various biocides should be linked with surveillance program implementation to lessen the spread of MDRO. Effective antibacterial activity was demonstrated by a new biocide against isolates of several bacterial classes from the Biological Isolation and Containment Unit. A modest alteration in susceptibility of antimicrobial was seen in four Enterococcus, which is likely connected to a conventional stress-induced response aided by the mid-lethal levels, and organic materials might interfere with its antibacterial action.[9] A biofilm's capacity to form and its relationship to antibiotic resistance. To aid in treatment and control of related infections and to prevent their selection in the hospital surroundings, it is important to describe the inherited diversity and biofilm modeling capabilities clinical isolates of Klebsiella pneumoniae. Additionally, the identification of the new risky clones can help with the application of preventative measures and infection limit protocols.[10] Classifying drug resistance to multiple drugs, the survival of various microbial strains after receiving the right dosages of medications for a certain amount of time shows that significant degrees of resistance have been generated in

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JCHR (2023) 13(6), 1375-1383 | ISSN:2251-6727

them. Along with antimicrobial resistance, other factors contributing to this clinical failure include immune system suppression, a lack of or inadequate medication bioavailability, or an accelerated rate of drug metabolism. Primary or secondary resistance can be used to classify multiple medication resistance.[11]

Primary resistance: is a drug resistance that develops in a patient who has not previously undergone antitubercular therapy and arises when the organism has never encountered the medication of interest in that host. For instance, people who have never undergone TB therapy before may develop primary medication resistance. The distribution of drug-resistant strains is believed to be the primary source of drug resistance. [12].

Secondary resistance: This is sometimes referred to as "acquired resistance," which refers to resistance that develops in an organism only after exposure to a medication.[13]. The development of resistance in a patient who has already had chemotherapy is another way to describe this. For instance, acquired drug resistance expresses TB isolated from patients who are presently receiving or who have previously undergone at least one month of anti-tuberculosis medication therapy [14]

THERAPEUTIC VALUE OF MEDICINAL PLANTS IN RAJASTHAN

Rajasthan being the largest state in India, is home to a wide selection of therapeutic plants and is located between 69o30' and 78o17'S latitude and 23o3' to 30o12'N longitude1. Many works of literature demonstrate the therapeutic benefits of many plants dating back to the Vedic era. The ethnomedicinal herbs employed by various tribal people and scholars in Rajasthan have also been the subject of much investigation. This article covers some significant Rajasthani medicinal plants and their practical use for healing.[15]

Since the beginning of civilization, medicinal plants have enacted a significant position in the provision of healthcare to humans. Indian people are extremely passionate about medicinal herbs and utilize them for a variety of purposes relating to health. Both emerging and developed nations are seeing an increase in the requirement for therapeutic plants, and most of material commerce still comes from plants that have been taken from the wild. Folk remedies, which are mostly based on plants, are respected today, especially in underdeveloped nations where access to modern healthcare is scarce. Indigenous treatments that are secure, efficient, and affordable are becoming more and more popular worldwide, particularly in India and China. The identification of innovative plant-based products as chemotherapeutic drugs has been significantly facilitated by knowledge from indigenous clusters or indigenous conventional medicine.[16]

The upfront contact that preserves be created with the accurate knowledge on the usage of plants, both cultivated and wild, makes the field approach to ethnobotany study so important. In Indian mythology, wild plants are employed to help impoverished and tribal people with a variability of needs. These plants are used for a type of things, plus food, fodder, narcotics, poison, gums, dyes, pesticides, clothes, agricultural equipment, and other things.[18]

Worldwide interest in traditional treatments, particularly folk herbal remedies, has lately increased. Such ancient healthcare systems were created in many regions of the world where people lived near nature. The development of new chemotherapeutic drugs from plants has historically relied heavily on information from ethnic groups about their traditional herbal treatments. Lack of facilities, competent workers, and medicine characterizes modern healthcare in Rajasthan's tribal and rural areas. Moving to a faraway location to take advantage of current medical treatments is challenging during some times of the year since access to and within the region is particularly tough. The rural population relies nearly exclusively on traditional herbal treatments because of these severe illnesses.[19]

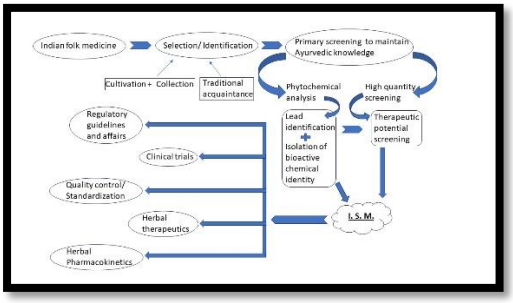

Figure 1 : Indian System of Medicine [17]

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JCHR (2023) 13(6), 1375-1383 | ISSN:2251-6727

Precursors and finished goods from plants have been a significant source for a few sectors, including food, agrochemicals, medicines, and cosmetics. Scientists have been examining the natural humanity for approaching pharmaceuticals as the hunt for novel drugs continues. Alternatively, conventional medicines are developing more and more widespread due to their little or comprehensive lack of enduring toxicity. Originally the primary factor of folk treatments was plants. Folk treatments gradually surfaced the way for the advancement of traditional remedial practices like Ayurveda in Republic of India. It is crucial to prompt interest in folk herbal medicines and medical practices, which are thought to be relatively protected, have no known negative effects, and should be affordable, accessible, and simple to use. People who live in inner and inhospitable distant rural locations are quite knowledgeable about the therapeutic value of the regional flora. For generations, locals in these districts have relied on homegrown folk treatments to treat urolithiasis.[20]

Flora or other living things have significant potential to heal human ailments and tribal intelligence on the usage of plant variety for diverse objectives depends on the contiguous plants. To successfully address his predicament, time needs an integrated and diversified approach to health care. [21]

Indian folklore uses the wild plant to help impoverished and tribal people with a variety of problems. Scientific supervision over the growing of therapeutic plants will be exercised through the establishment of herbal forms in carefully chosen locales. Every ethnic group has a well-established, community-supported traditional healthcare system. The identification of innovative plant-based products as chemotherapeutic drugs has been greatly facilitated by knowledge from indigenous groups or indigenous conventional medicine.[22]

The findings of the research that have been done so far have completely revealed the huge potential of underutilizing the plants that are employed in these civilizations, especially in relation to the problems of hunger and health that face humanity. Our top concerns are undoubtedly the protection and preservation of therapeutic plants from overexploitation by local and international economic interests with no values to the country.[23]

Achyranthus aspera

In Ayurvedic medicine, apamarg (Achyranthes aspera) has been used as a diuretic to treat dropsy. [24] According to Jayaweera [25], the leaves are utilised for dermatological conditions. The ethnic people utilise the herb to treat gynaecological diseases. [26,27]
To cause labour pains, the paste made from the roots is used on to the outer genitalia. [28] According to Selvanayagam [29], it can also be used to treat renal dropsy, cough, fistula, skin rash, scrofula, nasal infection, impotence, chronic malaria, fever, piles, snake bites and asthma. According to reports, the root can be used to treat colds and infantile diarrhoea[30], and dry leaves can be used to treat asthma[31]. Menstrual disorders were advised to use it [32] Roots have an astringent purpose. According to Ghani [33], roots are used as astringents for wounds, stomach-ache, and abdominal tumours. Different plant parts are castoff as a medicine for renal dropsy, piles, cough, pneumonia, skin eruptions, kidney stone, gonorrhoea, snake bite, dysentery by Yunani clinicians and confined kabiraj [34] The herb is used to treat cardiac, renal, and diabetic mellitus [35]. The mixture of the entire herb is diuretic, ecbolic, and helpful in the treatment of renal dropsy. The herb's juice is applied to treat dysentery and ophthalmia. Internal use of the buttermilk-based root paste is as a contraceptive medication. The external genitalia are injected with a paste made from ground flowers mixed with water to cause abortion. To conceive, the mixture of the clean roots is infused into the vagina to end the pregnancy [28]. To cause sterility in women, cooked root decoction is administered post-menstrually [36]. The herb is used to treat snakebite, scorpion, haemorrhage, and kidney problems [37]. According to Londonkar [38], the plant's juice is used to cure a variety of conditions, including toothache, diarrhoea, rheumatic pains, skin eruptions, pyorrhoea, haemorrhoids, snake bites. rabies, boils neurological disorders, dysentery, hysteria, itches, and bug bites.

Prosopis cineraria

Prosopis cineraria are locally known as Khejri, is a multipurpose native tree mounting wild in dry regions of Pakistan [39,40] It is used by native doctors to control multiple illnesses including cardiovascular disorders, respiratory, and gastrointestinal. The stem bark has

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folkloric reputation to possess antirheumatic, anti-inflammatory properties used in the treatment of fever, dysentery, asthma, leprosy, bronchitis, piles, anxiety, dyspepsia. Furthermore, it is declared to have laxative and abortifacient properties [41]. The smoky leaves are used to treat eye infections. Leaf paste is useful for mouth ulcers, blisters and boils and leaf brew on open wounds for the skin [42]. Flowers are used to prevent abortion as an antidiabetic agent. The plant substances are herbal remedies for scorpion sting and snake bite [43]. The wood ash used as source of potash and to remove hair, ashes are patted over the skin. The leaves and pods are great food for donkeys, goats, and camels [44].

Table 1: Botanical description of medicinal plants.

Languages	*Achyranthes aspera*	*Prosopis cineraria*
Arabian	Atkumah,	Ghaf
Gujrati	Safad Aghedo	Sami, Sumri, Khijado
Hindi	Latjira	Sangria, Khejri, Banni
Sanskrit	Aghata	Jhand
Tamil	Shiru-kadaladi	Jambu, Perumbay

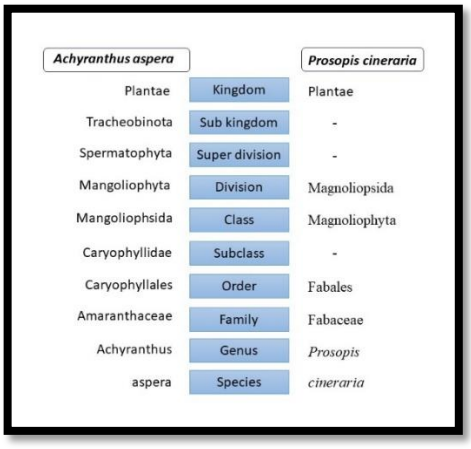

Figure 2: Taxonomic classification of medicinal plants.

FUTURE PROSPECTIVES

To stop the spread of microorganisms that are multidrug resistant, there are also practical considerations. One natural conclusion is to reduce antibiotic usage since the usage of antibiotics is conducted to the choice of these bacteria. Throughout fact, there is a clear link between the use of beta-lactam drugs and the occurrence of penicillin resilient pneumococci in the European Union's member states. Multiple agents may be administered simultaneously. For instance, a multidrug efflux pump inhibitor significantly decreases the MICs of several medications in gram-negative bacteria and may stop the evolution of resistance species. [45]

Third-generation cephalosporin resistance in Escherichia coli has also dramatically increased between 2011 and 2014, rising from 9.6% to 12.0% There is a lot of variation in the resistance rates of Acinetobacter species, although isolates with high percentages (> 50%) of combined fluoroquinolone, aminoglycoside, and carbapenem resistance have been recorded from southern Europe. MRSA prevalence fell between 2011-2014, however this decline was not as sharp as it had been during the preceding four years. Seven out of the 29 reporting nations had MRSA percentages above 25% in 2014, maintaining the high population-weighted mean MRSA percentage for the EU/EEA. [46]

Drugs can affect resistance to antibiotic through numerous different ways, including variations in efflux and cell permeability, variations in the antibiotic objective, and horizontal transmission of confrontation genes, in calculation to the selection compression they apply to susceptible microorganisms. Many antibiotics grounds the production of reactive oxygen species which can harm microbial DNA and increase genomic diversity, even at extremely low quantities that cannot kill sensitive cells. A further unfavorable result that might promote the development of resistance is the selection of hypermutable clones. [47]

Recent experiments have mostly concentrated on subjects like the logic of experimental drugs and resistance to drug gene alterations. Based on patient role features, comorbidities, and treatment histories, several studies have identified risk influences for drug resistant infections. In spite of the high caliber of many of these educations, they frequently dearth real-world datasets

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JCHR (2023) 13(6), 1375-1383 | ISSN:2251-6727

and hospital-level forecast models, are controlled to a single individual, focus only on patient role medical histories, and fail to reflect the distribution characters and potential danger of antimicrobial resistance to hospital infections. [48]

The interaction between plants and humans is ethnobotany. The third-main state in India, Rajasthan, is renowned for its rich ethnic legacy. In connection with nature, around 80% of the population lives in villages. Tribes including the Seharia, Kokna, Dhanka, Bhil, Garasia, Meena, Kolidhor, Damor, Kathodi, Naikara, and Patelia make up about 12.44% of the population and live in isolated locations without access to basic infrastructure. These tribal groups have amassed a wealth of information about wildlife and its conservation. [49]

Vegetations are used by ancestral tribes for food, medicine, beverages, narcotics, insect sprays, lumber, gums, and colours. [50]

Studies on the interactions between communities and plants show that plants are used extensively in everyday life, particularly for food and health considerations. Conventional medicine says crucial in the development of cutting-edge plant-based health solutions. [51]

Over the past three decades, research on ethno-medicinal plants has advanced phenomenally; the global drift concerning the use of environmental plant medicines has generated a huge necessity for knowledge on the characteristics and applications of medicinal plants. India is renowned for its abundance of medicinal plants, which may be found there in its varied physiographic and climatic conditions. [52]

Due to the progressive extinction of traditional culture, a large portion of this treasure of information is being lost. All around the world, tribal humans and indigenous races have created their specific unique backgrounds, religious, traditions, cults, ceremonies, mythologies, folktales, music, meals, and medical practices. These societies depend heavily on a variety of wild and domesticated plants, and their connection has developed through many generations of experience and customs. [53]

The Ayurvedic method developed in India over 5,000 years ago and is being used today. Over 700 medical prescriptions are contained in the Rigveda and Atharva veda3. About 12.44% of the population of Rajasthan, one of India's chief states, is made up of communities like the Seharia, Kokna, Dhanka, Bhil, Garasia, Meena, Kolidhor, Damor, Kathodi, Naikara, and Patelia, who live in isolated areas without admittance to basic amenities. The wandering Sikligar, Bagri, Gadolia-Lohar, Banjara, Sansi, Kalbalia, and Kanjar tribes to Rajasthan's exclusive tribal diversity. These ethnic clusters are dispersed extensively across the federation. There have been several reports of Rajasthani ethnobotanical studies. [54]

CONCLUSION

Although the usage of herbal products has become increasingly accepted in our contemporary lifestyle, an estimated 80% of people worldwide still receive their primary medical treatment from traditional practitioners. A fresh hope for addressing the grave risks posed by mounting evidence of antibiotic resistance is medicinal plant antibacterial activity. It's interesting to note that plant-derived secondary metabolites have antibacterial activity without causing antibiotic resistance, scientists and medical professionals are quite interested in them. For this reason, plant-based antimicrobials have been utilised extensively as both therapeutic and preventive measures against MDR infections. Emerging MDR pathogens on a global scale are a major issue. Consequently, the identification and seclusion of novel bioactive compounds from medicinal plants have not yet received enough research—is urgently needed. However, many chemically synthesised antibiotics come with a high price tag and have unfavourable side effects. The usage of alternative medicine sources, especially medicinal plants, is becoming more and more popular these days. It remains difficult to utilise novel bioactive chemicals to their full potential. Numerous plant species have already been thoroughly shown to provide possible therapeutic benefits. Nonetheless, the rapid evolution of pathogens, the emergence of new illnesses, and diseases push scientists to go further into nature in quest of new natural products. It is crucial to stress that to ensure the selection of potent and safe antibacterial plant-derived compounds, comprehensive in vitro and in vivo testing must be carried out. Undoubtedly, plants are actively preventing bacterial illnesses that are resistant to antibiotics. To turn this understanding into potentially curative medications, more study on these plant-derived

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JCHR (2023) 13(6), 1375-1383 | ISSN:2251-6727

active ingredients should be conducted. Exploiting the possible antagonistic or synergistic effects of chemicals within and amongst medicinal plant extracts is another significant problem.

AUTHOR CONTRIBUTIONS: TG designed and collected the data, wrote the first version of manuscript. JS analysis and report writing. DS revised and approved manuscript for publication.

AVAILABILITY OF REPORT: Those who are interested, this study could only be accessed by the reasonable request of corresponding author.

CONSENT TO PUBLISH: The authors declare that study findings are submitting for publication and have no competing interest. Funding is not applicable.

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