

ANTIMICROBIAL RESISTANCE - AN AYURVEDIC PERSPECTIVE

Airi kshitiza¹, Pathak Akshay²

1. Lecturer, Department of rog Nidan evam Vikriti Vigyan, Govt. Ayurvedic College Patiala.
2. Lecturer, Department of Kriya Sharir, Govt. Ayurvedic College Patiala.

Corresponding Author: akshaypathak745@gmail.com

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ABSTRACT

Antibiotics have significantly helped treat various infectious diseases and thus reduced mortality rates around the globe. But over time, these pathogens have become resistant to these antimicrobial agents, worsening the scenario in life-threatening infectious diseases. Antimicrobial resistance happens when microorganisms (such as bacteria, fungi, viruses, and parasites) change when exposed to antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarials, and anthelmintic agents). The present review study explored various Ayurvedic methods, modalities, and medicines to develop a sustainable and innovative mechanism to combat the current problem of AMR. The Ayurvedic approach to the prevention and treatment of microbial infection recognises the emergency use of modern drugs but recommends traditional herbal combinations and extracts known to balance the individual and improve health, as well as herbs that help to combat or prevent microbial infections. Some solutions can be to increase the host's immunity through therapy, and proper use of Dhatupachaka Kashaya prescribed in Ayurveda in combination with antibiotics. There is a scope for further exploration and research in this area.

Key words: Anti-microbial resistance, *Rasayana*, anti-microbial agents, *Dhatupachaka Kashaya*

INTRODUCTION

The Invention or discovery of antibiotics has enormously aided the effective treatment of various infectious diseases. The discovery of antibiotic or anti-infective agents and their administration in medical

practice to treat infections transformed modern medicine and reduced the mortality rate to remarkable levels worldwide. Anti-infective is an agent that is capable of acting against infection, either by inhibiting the

spread of an infectious agent or by killing the contagious agent.¹

Unfortunately, a marked increase in antimicrobial resistance among common bacterial pathogens is now threatening this therapeutic success. AMR (antimicrobial resistance) is the ability of microorganisms to prevent antimicrobials from working against it. Microorganisms may resist anti-infective agents through various mechanisms such as mutation, transduction, and transfer of genetic material or gene induction.² Antimicrobial resistance happens when microorganisms (bacteria, fungi, viruses, and parasites) change when exposed to antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarials, and anthelmintic agents). Microorganisms that develop antimicrobial resistance are sometimes referred to as “superbugs”. As a result, the medicines become ineffective, and infections persist in the body, increasing the risk of spreading them to others.³

The cost of health care for patients with resistant infections is higher than care for patients with non-resistant infections due to longer duration of illness, additional tests and use of more expensive drugs. In 2016, 490,000 people developed multi-drug-resistant TB globally, and drug resistance is starting to complicate the fight against HIV and malaria, as well.³

Excessive, repetitive and unsolicited use of antimicrobial agents exerts a powerful selective pressure, leading to the emergence of pathogens that are resistant to almost all antimicrobial agents.⁴

New anti-infective agents and strategies to combat AMR are required to be discovered. Developing new leads Ayurveda can diminish this hazard of antimicrobial resistance. Antimicrobial resistance is a complex problem with many diverse contributing factors. It is a significant cause of health concerns, adding cost to oneself and the community, directly or indirectly. Prevention is still the best tool to reduce the spread of infection and, thereby, AMR. New effective compounds, diagnostic technology, and the rational use of existing antimicrobial drugs are needed.

Various Ayurvedic methods, modalities and medicines available in Ayurveda can be explored to de-

velop a sustainable and innovative mechanism to combat the current problem of AMR.^(5, 6,7,8)

- **Methods:**

Modern texts and updates on websites about antimicrobial resistance (AMR) have been reviewed and documented. For the present study, Ayurvedic texts with major commentaries regarding strategies and treatment modalities to attenuate the threat of AMR were also reviewed and documented.

- **Conceptual Study:**

Ayurveda categorises infectious diseases under the Agantuja as “Exogenous diseases” caused by close physical contact, nail cuts, teeth infections, falls, spells, and natural calamities. Further, it says that these may cause disturbance in the equilibrium of three *Doshas*.^{9,10}

According to Ayurveda, the *Doshas* get aggravated by exogenous or endogenous causes, which further spread in the body by the using improper foods and activities. It vitiates *Kosthagni* (Metabolic enzymes), which leads to improper digestion and production of Ama (toxin) and their minute Srotas (body channels). This is called *Srotodushti* (Disequilibrium in channels). When the *Rasadhatu* (plasma and lymph) containing Ama (toxin) and aggravated *Doshas* reaches the place where *Kha-Vaigunya* (movement tendency towards space) has taken place, it being unable to get into the minute channels gets obstructed, stagnates/accumulates there and gives rise to such diseases caused by exogenous causes.¹¹ If the “Exogenous – diseases” get ignored, they may become Nija Vyadhi and affect the immune system. Diminution of natural immunity makes the person susceptible to all infections. Therefore, Ayurveda advocates enhancing the immunity against the diseases.

Strategies to deal with AMR – An Ayurvedic Perspective:

The Ayurvedic approach to the prevention and treatment of microbial infection recognises the emergency use of modern drugs but recommends traditional herbal combinations and extracts known to balance the individual and improve health, as well as herbs that help to combat or prevent microbial infections. As per Ayurveda, all diseases emerge from impaired

Agni, ‘*Rogah Sarveapi mandeagnu*.’¹² In Ayurveda, the term “*Agni*” is used to digest food and metabolic products. *Agni* converts food into energy, which is responsible for all the vital functions of our body. Therefore, Ayurveda considers that *Dehagni* is the cause of life, complexion, strength, health, nourishment, lustre, *Oja*, *Teja* (energy) and *Prana* (life energy).¹³

Agni has been divided into 13 types according to the function and site of action. These are:

1. ***Jatharagni*** is considered the most important because every nutrient one ingests first comes to the *Jathara* and is subjected to the action of *Jatharagni*. *Jatharagni* digests the food materials that consist of the five essential elements and transforms them for utilisation by the respective *Dhatu-paramanus* (tissues).¹⁴
2. ***Bhutagni*** is the one that is present in an essential element (*Bhutas*). There are five *Agnis* in each of the five essential elements, namely –*Parthiva* (earth), *Apya* (water), *Tejas* (*Agni*), *Vayavya* (*Vayu*) and *Nabhasa* (*Akash*).¹⁵ These *Bhutagnis* act after the *Jatharagni* present in the stomach and duodenum, acting on the food and causing their disintegration. From the modern physiological perspective, the action of the *Jatharagni* can be equated with the digestion in the stomach and duodenum, and the action of the *Bhutagni* can be equated with the conversion of digested materials in the liver.
3. ***Dhatvagni***: All the seven *Dhatu* (seven element tissues of the body) contain their own *Agni* to metabolise the nutrient materials supplied to them through their own *Srotas*.¹⁶ Each *Dhatvagni* or the bioenergy in each *Dhatu* synthesises and transforms the essential *Rasa Dhatu* required for that particular *Dhatu* or cell from the vital nutrients present in the *Anna Rasa* or essence of our diet. Each *Dhatvagni* specialises in synthesising and transforming the constituents suitable to its particular *Dhatu*. This action is selective. Acharya Charaka has mentioned that the seven dhatus that support the body contain their own *Agni*. By their own *Agni*, they digest

and transform the materials supplied to them to make similar substances for assimilation and nourishment.¹⁷ Impaired *Agni* leads to improper digestion. Thus, toxins or free radicals are formed, called *Ama*. This *Ama* leads to diseases.¹⁸ Therefore, the treatment for many diseases begins with *Langhana* along with *Deepana Paachana*.¹⁹ *Langhana* is fasting and, therefore, can digest *Ama* (toxins). *Deepana* drugs help improve digestive fire, and *Paachana* drugs help enhance digestion.

Dhatu-Pachaka Yogas are the polyherbal formulations mentioned in the *Charak Samhita* and *Ashtanga Hridaya* in the *Jvara Adhikara*. However, the importance of the five *Dhatupachaka Yoga* is not only confined to *Vishama Jvara* but is used widely by physicians all over in the form of *Churna-Vati-Kwath* to treat various other diseases.^{20, 21}

Dhatupachaka Yogas improve *Dhatvagni*, thus improving the quality of *Dhatu*. Qualitative improvement in *Dhatu* strengthens the body and enhances the host’s immune mechanism.

1. *Indrayava* (*Holarrhena antidysenterica* Seed), *Patola-Patra* (*Trichosanthes dioica*) and *Kutaki* (*Picrorhiza Kurroa*) constitute the *Santata Jvara* treatment and is commonly known as *Rasapachaka Yoga*.
2. *Patola-Patra* (*Trichosanthes dioica*), *Sariva* (*Hemidesmus indicus*), *Musta* (*Cyperus rotundus* Linn.), *Patha* (*Cyclea peltate*), and *Kutaki* (*Picrorhiza Kurroa*) constitute the *Satata Jvara* treatment, which is commonly known as *Raktapachaka Yoga*.
3. *Nimba Patra* (*Azadirachta indica*), *Patol Patra* (*Trichosanthes dioica*), *Triphala* (*Emblica officinalis* (*Amalaki*), *Terminalia bellerica* (*Bibhitaki*), and *Terminalia chebula* (*Haritaki*), *Mridvika* (*Vitis vinifera*), *Musta* (*Cyperus rotundus* Linn.) and *Kutaja* (*Holarrhena antidysenterica*) constitute the treatment of *Anyedyushka Jvara* commonly known as *Mamsapachaka Yoga*.
4. *Kiratiktika* (*Swertia chirata*), *Guduchi* (*Tinospora cordifolia*), *Chandana* (*Santalum album*) and

Shunthi (Zingiber officinale), constitute the treatment of *Tritiyaka Jvara*, commonly known as *Medopachaka Yoga*.

5. *Guduchi (Tinospora cordifolia)*, *Amlaki (Embllica officinalis)* and *Musta (Cyperus rotundus Linn.)* constitute the treatment of *Chaturthaka Jvara*, commonly known as *Ashtimajjapachaka Yoga*.

Dhatupachaka Yogas improve *Dhatvagni*, thus improving the quality of *Dhatu*. *Qualitative improvement in Dhatus strengthens the body and enhances the host's immune mechanism*.

Rasayana Tantra is one of the eight clinical specialties of Ayurveda.²² *Rasayana* is the way to attain excellent qualities of *Rasadi Dhatus* (the seven tissues mentioned in Ayurveda).²³ It is also called *Jarachikitsa* as it can be used as a palliation in old age. *Rasayana* means an improved state of nourishment, which in turn upholds increased immunity and youthfulness. *Rasayana* therapy helps to strengthen *Oja* and *Bala*, i.e., *vitality and natural resistance against ageing and disease*. Ayurveda attributes *Rasayana* to contribute to the integrity of body tissues and thus increases longevity. The other benefits of this therapy are the promotion of memory and intelligence and the preservation of youth, lustre, complexion, and voice.²⁴ *Rasayana* includes medicines and specific procedures that can be used in clinical practice.

Vyadhi-kshmatva, as understood in Ayurveda, has much broader implications than the term "Immunity" used in modern medicine. *Chakrapanidatta* has interpreted the term *Vyadhi-kshmatva* as *Vyadhibala Virodhitva*, i.e., *antagonistic to the strength and virulence of the disease and Vyadhyutpada, Pratibandhatva*, i.e., the capacity to inhibit and bind the causes and factors of the disease.²⁵

Immunomodulators are considered one of the most potent tools in modern medicine for managing health and disease. The role of immunomodulators in contemporary medicine is yet to be fully appreciated or perceived as our understanding of the immune system is changing rapidly. It is now recognised that modulation of immunological response could provide an alternative to conventional chemotherapy for various diseased conditions. *Rasayana* therapy can be corre-

lated with immunomodulators. *Rasayana* drugs are rich in antioxidants and are good hepatoprotective, nephroprotective, and immunomodulating agents.²⁶

CONCLUSION

Increasing antibiotic resistance is a significant hazard, leading to a bad prognosis of fatal infections. It is vital to develop interventions to combat AMR. If the "Exogenous – diseases" get ignored, they may become *Nija Vyadhi* and affect the immune system. Diminution of natural immunity makes the person susceptible to all infections. Therefore, Ayurveda advocates enhancing the immunity against the diseases. The Ayurvedic approach to the prevention and treatment of microbial infection recognises the emergency use of modern drugs but recommends traditional herbal combinations and extracts known to balance the individual and improve health, as well as herbs that help to combat or prevent microbial infections.

Increasing the host's immunity through *Rasyana* therapy and *Dhatupachaka Kashaya*, prescribed in Ayurveda in combination with antibiotics, can be one solution. Further exploration and research in this area are desirable to combat antimicrobial resistance.

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