

ISSN: 2578-0190



# Plant Derivatives as Antimicrobial Agents: A Short Review

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## Opinion

Plants have been used for centuries as a source of natural compounds with antimicrobial activity. Recent use of plant extract has greatly increased as antimicrobial agents due to their vast application and minimal side effects. The antimicrobial effect of different plant extracts is a topic of interest for many researchers and consumers. This is because plant products with medicinal benefits could provide a suitable basis for combating multi-drug resistant microorganisms. Apart from that, our environment is naturally surrounded by microorganisms and therefore these microorganisms have access to food during harvesting, processing, and packaging. Our environment is naturally surrounded by microorganisms and therefore these microorganisms have access to food during harvesting, processing, and packaging. These microorganisms have capability to survive not only under adverse environmental conditions but also can survive in vacuum processing of food and can resist conventional pasteurization [1]. Therefore, there is concern among consumers regarding the risk involved in using synthetic additives for human health as these additives can lead to health-related issues. Hence, some plants extracts have been introduced as natural preservatives to reduce the growth of bacteria and prolong the shelf life of food products. Traditionally, crude extracts of plant roots, stems, flower, fruit, and twigs were widely used for treatment of human diseases.

Plant extracts and essential oils are natural sources of bioactive compounds that can inhibit or kill harmful microorganisms, such as bacteria and fungi. Antimicrobial agents derived from plants can inhibit the growth or kill microorganisms such as bacteria, fungi, viruses, and parasites. Plant extracts can be obtained by various methods, such as maceration, infusion, decoction, percolation, distillation, and extraction with organic solvents. The antimicrobial effect of different plant extracts depends on several factors, such as the type of plant, the part of the plant used, the solvent used, the concentration of the extract, the method of application and the type of microorganism tested. The antimicrobial activities of some plants have been widely researched. For example, ginger, turmeric, thyme, basil, sage, mustard, cinnamon, clove, and tea tree exhibit antimicrobial activities against a wide range of gram positive and gram-negative bacteria [2]. These plants contain various phytochemicals that can act as antimicrobial agents, such as allicin, gingerol, curcumin, thymol, carvacrol, rosmarinic acid, cinnamaldehyde, eugenol and terpinen-4-ol. The mechanisms of action of these compounds are diverse and include interference with cell wall synthesis, membrane permeability, enzyme activity, protein synthesis and DNA replication [3].

Eucalyptus leaves and essential oils have been found beneficial to treat gastrointestinal symptoms (diarrhea), respiratory disease (colds, sore throat), and wound healing due to its antiseptic, anti-inflammatory and antipyretic properties. Rosmarinic acid of the *Lamiaceae* family is a secondary metabolite and possesses anti-staphylococcal activity and has synergic effect with various antibiotics against resistant staphylococcal strains and has synergic

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**Submission:**  November 27, 2023

**Published:**  December 06, 2023

Volume 7 - Issue 1

**How to cite this article:** Quratul Ann Hussain\*. Plant Derivatives as Antimicrobial Agents: A Short Review. Cohesive J Microbiol Infect Dis. 7(1). CJMI. 000654. 2023. DOI: [10.31031/CJMI.2023.07.000654](https://doi.org/10.31031/CJMI.2023.07.000654)

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effect with numerous antibiotics against resistant staphylococcal strains [4]. Flavonoids are the biggest group of natural molecules with antibacterial properties. Fruits, vegetables, nuts, seeds, stems, flowers, and honey are an excellent source of flavonoids and are consumed daily. Flavonoids are secondary metabolites and are known to be effective both against Gram-positive and Gram-negative bacteria. Additionally, they may act in synergy with  $\beta$ -lactams and possibly also block the activity of specific  $\beta$ -lactamases released by bacteria. Modified flavonoids could be used as suitable alternative antimicrobial agent against pathogenic bacteria especially against *Listeria mono cytogens* and *Pseudomonas aeruginosa* [5].

Tannins are a class of exceptional secondary metabolites, are a very valuable group of natural antimicrobial substances. They deter growth and destroy bacteria by various mechanisms, using their astringent properties. Walnuts, cashew nuts, hazelnuts, and fruits such as grapes, blackberries are a great source of tannins [6]. Since tannins are secondary metabolites, they are generally recognized as safety agents against oxidative stress and external insults, such as infections, solar radiation, and dryness. Review of the literature showed that different plant extracts are effective source of cheap and safe antimicrobial agents and may be used as natural alternatives or supplements to conventional antibiotics for

preventing or treating infections caused by these microorganisms. Although much work must still be carried out, especially in *in vivo* conditions to ensure the selection of effective antimicrobial substances with low side and adverse effects.

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