

Potential usage of medicinal plants against various infectious diseases: A mini-review**Ahmed Olatunde^{1*}, Habibu Tijjani², Basiru Olaitan Ajiboye³**

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Abstract

Despite advancements in the development of synthetic antimicrobial medicines, infectious diseases continue to pose a significant burden on world health. This is due to the setbacks linked to the use of these synthetic antimicrobial agents, which include drug resistance and toxicity. Therefore, the search for alternative therapeutic strategies is necessitated. Based on this, research has focused on the exploitation of medicinal plants, as they serve as reservoirs of various phytochemicals with a wide range of antimicrobial actions, in addition to their less or no detrimental effects. These include plants such as *Moringa oleifera*, *Azadirachta indica*, *Psidium guajava*, *Zingiber officinale*, among others. Thus, the present mini-review provides some medicinal plants and their use in the management of infectious diseases as well as their antimicrobial mechanistic actions.

Keywords: Microbial activity, bacteria, viruses, phytochemicals, drug resistance

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1. Introduction

Infectious diseases are among the most vital challenges in human health as a result of their high occurrence and rate of outbreak [1]. In 2013, the World Health Organisation (WHO) documented that infectious diseases are responsible for 61.7% of the 9.6 million deaths in the sub-Saharan region of Africa [2]. Infectious diseases are caused by bacteria, fungi, viruses and parasites. Several synthetic agents are used for their management.

Medicinal plants have been found to be vital in healthcare. There are several research-based studies to confirm the efficacy of these plants. Also, these studies have shown insights into the synthesis of compounds from plants with therapeutic uses [3]. It was reported that medicinal plants' market value surpasses annual 100 billion US dollars worldwide [4]. The herbal or traditional medicines are those obtained from sources of plants that are classified as generally regarded as safe (GRAS) at the dosage that is based on their historical application in different traditions [5]. The use of ethnomedical knowledge in the area of biosciences for the determination of new biologically active molecules as well as pharmacological formulation of extracts from plants for application in primary healthcare has been the major interest in the research [6]. Screening of phytochemicals is carried out against a wide spectrum of microorganisms to discover their antimicrobial properties, based on the bioactive compounds present in plants. The existence of antimicrobial drug resistance induced by microorganisms such as bacteria has presented a huge problem and led to the search for more efficacious and safe medicinal agents [7, 2]. Therefore, this mini-review provides information on infectious diseases and the role of medicinal plants in combating them. The mechanisms by which these medicinal plants exhibit their antimicrobial actions is also highlighted.

2. Plants with medicinal properties used against infectious diseases

In spite of the progress in the use of antibiotics, infectious diseases are documented as the second cause of mortality globally [8]. The search for novel agents that are less detrimental and have therapeutic action against infectious diseases rely majorly on natural products such as plants, as they are seen as a reservoir of therapeutic agents. Also, the challenges of microbial resistance to synthetic antimicrobial agents such as antibiotics have led to the continuous pursuit of safer and more potent drug molecules [9].

3. Antibacterial property

Medicinal plants have been reported to be effective against several bacterial infections. Studies indicated that the leaf and root of *Terminalia glaucescens* extracts displayed antibacterial action against *Salmonella typhi* and *Escherichia coli* [10]. In another study, ethanol and acetone extracts of *Azadirachta indica* bark (25-400 mg/ml) displayed potent antibacterial action against fourteen strains of multiple drug-resistant *S. typhi* [11]. The ethanol and aqueous extracts of *Allium sativum* and *Zingiber officinale* extracts inhibited the activities of *Salmonella* species, *E. coli*, *S. aureus* and *Bacillus cereus* [12]. Other plants such as *Senna alata*, *Psidium guajava*, *Vernonia amygdalina* and others were reported to possess antibacterial properties [13, 14].

4. Antifungal property

Fungal infections have been documented to be a serious health issue in recent years, particularly in immunodeficient individuals [15, 16,]. Fungal infections include esophageal candidiasis, *Pneumocystis pneumonia*, invasive aspergillosis, cryptococcal meningitis, tinea capitis and others. In a study, *Calotropis procera* inhibited the action of *Trichophyton* and *Microsporum* species [17]. In another work, *Spondia mombin* leaf and bark showed anticandidal action. Antifungal activity is also displayed by plants such as *Psidium guajava*, and *Alchornea laxiflora* [18, 19].

5. Antiviral property

Viral infections are caused by viruses and they result in a huge health burden globally. It was documented that extracts of 27 medicinal plants showed antiviral action against echovirus 19, 13 and 7 serotypes, that is, E19, E13 and E7 respectively. In this study, *Macaranga barteri* leaves methanol extracts displayed the highest activity against the E9 and E7 serotypes [20]. In another work, *Rheum officinale* and *Rheum palmatum* extracts together with their major isolated constituents (anthraquinone derivatives) abrogated the activities of both ribonuclease H and HIV-1 reverse transcriptase-associated DNA polymerase [21].

6. Antimalarial property

Malaria which is caused by *Plasmodium*, is a huge threat to world health. In an in vitro study, *Morinda lucida* and *Diospyros monbuttensis* displayed antiplasmodial activity against *P. falciparum* with an IC₅₀ value of 25 nM and 3.2 nM respectively. Secondary metabolites such

as phytosterols and triterpenes obtained from *M. lucida* expressed strong binding affinity on some selected histone deacetylases of class 1 HDAC7 and HDAC [22]. Other medicinal plants such as *Moringa oleifera*, *Landolphia owariensis*, *Bixa orellana*, *Allamanda cathartica*, *Enantia chlorantha* and others have been evidenced to display antimalarial action [23, 24, 25, 26].

7. Medicinal plants and their antimicrobial mechanistic actions

Various mechanistic actions through which secondary metabolites found in medicinal plants exert their antimicrobial properties include bacterial membrane damage, toxins and enzyme activity inhibition, quorum quenching virulence factors suppression, protein synthesis inhibition, and biofilm formation [27]. Medicinal plants can also exhibit synergistic action with antibiotics [28, 29].

8. Conclusion

The present mini-review has shown some infectious diseases and the efficacy of medicinal plants for their management. Many synthetic antimicrobial agents show limitations such as toxicity and resistance. However, medicinal plants have proven to be safe at studied doses and are efficacious in overcoming the challenges of drug resistance.

Conflict of interest

Authors declared no conflict of interest.

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