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A comprehensive review on antibacterial activity of Aloe barbadensis and *Ocimum gratissimum* against selected bacterial pathogens of public health concern

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Abstract
Antibiotic resistance is emerging as a significant public health concern globally. The frequent use of antibiotics for growth promotion and prevention in cattle husbandry leads to antibiotic resistance because it promotes commensal and pathogenic microorganism. The consumption of antibiotic-containing animal feed has been associated with antimicrobial resistance, which can render medical treatments inefficient for humans as well as animals. The use of herbal medicine is widespread around the world, and in many nations, it is an essential component of primary health care. 90% of cattle and 80% of human treatment in Ethiopia are provided by traditional medicines, of which 95% percent originate from plants. In underdeveloped countries, traditional medicines remain the primary means of providing healthcare. *Ocimum grattissimum* and *Aloe barbadensis* are utilized to treat a wide range of infectious and non-infectious diseases.

Numerous health advantages of aloe vera have been demonstrated, such as its capacity to heal wounds, protect skin and cosmetics, be anticancer, antitumor, antifungal, and antibacterial, lower blood sugar in diabetics, and boost immunity. One of the species of plant that is used extensively in medicine worldwide is *Ocimum gratissimum*. Traditional medicine makes extensive use of the plant *(Ocimum gratissimum*) to treat a wide range of ailments, such as conjunctivitis, upper respiratory tract infections, diarrhea, headaches, eye diseases, skin concerns, pneumonia, coughing, fever, and skin-related problems. *Aloe barbadensis* and *Ocimum gratissimum* extracts have the potential to be employed in the discovery of an antibacterial agent for the development of novel pharmaceuticals to regulate animal pathogenic bacteria that cause serious health conditions.

Keywords: Antibacterial activity, *Aloe barbadensis,* Bacterial pathogens, *Ocimum gratissimum*

1. Introduction

The development of antimicrobial resistance has made it a serious threat to global health. Antibiotic resistance has frequently been discovered in a number of bacterial illnesses, including *Salmonella*, *Pseudomonas aeruginosa, Escherichia coli,* and *Staphylococcus aureus*. (Pal, 2007; Pal *et al.*, 2021) [41, 42]. Currently, meticulous study aimed at discovering novel and inventive antimicrobials is one approach to improve the predicament. Traditional medicine is the primary source of medical care for up to 80% of the population in Africa (Yineger, 2005) [64]. The frequent use of antibiotics in cattle husbandry to promote and prevent growth leads to antibiotic resistance since it favors commensal and pathogenic microorganisms. For around 80% of the people and over 90% of cattle in Ethiopia, plant treatments continue to be the most significant and occasionally the only source of medical treatments (Mengistu, 2004; Tadesse and Dereje, 2015) [31, 55]. The plant's yellow excretion can be utilized as a laxative, but it could potentially cause cancer in humans, according to monographs published by the WHO and IARC (IARC, 2017; WHO, 1999) [22, 62]. Ever since Linnaeus first identified *Aloe vera* as the genus type, various ailments have been treated with the plant's two medicinal components—yellow exudate and inner leaf mesophyll-together. A variety of animals and birds rely on *Aloe species* as a food resource. Aloes generate an enormous amount of nectar. Their characteristic adaptations to bird pollination are evident in their long, tubular blooms, which are typically red to yellow in color and produce a substantial quantity of nectar. Members of the genus *Aloe* can be discovered in Madagascar, the Arabian Peninsula, East and Southern Africa, as well as a few small Indian Ocean islands, as reported by Grace and associates (2015) [19]. The fragrant, evergreen plant *Ocimum gratissimum* will grow to a height of one to three meters.

With peeling skin often present, its stem is glabrous or pubescent, straight, circular-quadrangular, densely branched, and woody at the base. Despite having the essential oil eugenol like most other *Ocimum* species, *Ocimum gratissimum* is primarily utilized as a spice, vegetable, or medicine (Orafidiya *et al*., 2001; Ijeh, 2005) [39, 21]. Over the course of time, herbal medicine has been used extensively and has become an essential element of primary healthcare in several countries. Plant species have been defined for their therapeutic qualities since antiquity. Their defense against disease-causing microbes is facilitated by a variety of secondary metabolites that they are known to possess (Redda *et al*., 201) [49]. The antibacterial properties of *Ocimum grattissimum* and *Aloe barbadensis* against a few key bacterial diseases that affect public health are discussed in this article.

2.1 Antimicrobial Resistance

2.1.1 The growth of resistance to antibiotics

The first recorded instance of antibiotic resistance in *Bacillus coli*, presently known as *Escherichia coli*, was documented by Abraham and Chain in 1940. This happened right before penicillin was first introduced to treat infectious infections in people, not long after Fleming (1929) [18]. Discovered antimicrobial resistance. The source of many resistance genes currently found in clinically pertinent bacteria has been demonstrated over 40 years ago: soil microorganisms. These microbes naturally produce the majority of antimicrobials utilized in medical applications. Further phylogenetic research reveals that bacteria evolved AMR genes well before the invention of antibiotics, shedding some clarification on the evolutionary roots of resistance (Finley *et al.*, 2013; Wellington *et al.*, 2013) [17, 60]. They even developed defense mechanisms to withstand synthetic substances (D'Costa *et al.*, 2011) [11].

2.1.2 Transmission mechanisms of antimicrobial resistance from animals to humans

Pathogenic and non-pathogenic bacteria resistant to antibiotics are said to spread through direct human-animal contact and environmental exposure to animal feces, according to Marshall and Levy (2011) [28]. Transmission via ingestion of food is another substantial mechanism. Contaminated surfaces can have an imperative impact on the local and global transmission of resistant microorganisms. Any mechanism that stimulates the proliferation of bacteria drives the danger that resistant strains may spread. Additionally, resistance can be conferred by the exchange of genetic components between bacteria pertaining to distinct species or strains. Slurry-treated agricultural soil, aquatic ecosystems, the digestive tracts of humans and animals, and numerous other diverse ecosystems can all host such transfer events where vulnerable colonies of bacteria come into proximity to resistant counterparts (Wooldridge, 2012) [61].

2.1.3 The formidable challenge posed by antibiotic resistance

The prolonged application of antibiotics in livestock husbandry, mainly for the purposes of growth stimulation and disease prevention, has led to the emergence of antibiotic resistance since it fosters the growth of both commensal and pathogenic organisms. This occurrence has ecological implications since the inadequate digestion of these medications releases residual waste into the environment. Even at low concentrations, these waste products can still have an impact on bacterial populations that encourage resistance to antibiotics. The modest concentrations of antibiotics in the environment results in mutational events to happen sporadically and unpredictably, as reported by Cogliani and co-workers (2011) [42]. Consequently, it is postulated that both antibiotic resistance genes and the bacteria harboring them are likely to be widespread in environmental settings. The capability of bacteria to transfer resistance genes between strains of the same species as well as between distinct species is a matter of tremendous concern to the global health communities and public health centers (Marti *et al.*, 2013) [29].

2.1.4. The genesis of drug resistance

Antibiotics in animal feed have been linked to antimicrobial resistance, which could make medical treatments ineffective for both human and animal populations. There are known cases in which drugs show no effect at all. According to Baynes (2016) [4]. The transfer of microbial resistance from animals to humans means that these resistant germs can enter human hosts directly through contact or indirectly by ingestion of animal-derived foods like milk and eggs. In addition, food products tainted with bacteria resistant to antibiotics (Angulo *et al.* 2004; Phillips *et al.* 2004) [3, 442], act as carriers of resistant strains. As a result, food plays an indispensable part in the effective transfer of elements that constitute antimicrobial resistance to consumers' gastrointestinal systems (Spanu *et al.*, 2012) [54].

2.1.5 The ramifications of antibiotic resistance and preventive measures

Antibiotic resistance must be prevented if global public health is to be preserved. In order to deal with antibiotic resistance, the World Health Organization published a global action plan in 2015 and urged nations worldwide to develop national plans. To maintain the effectiveness of antibiotics as a vital medicine, we must address the severe issue of antibiotic resistance. Prolonged hospital admissions, an extensive application of expensive second-line medications, and increased research efforts are linked to the control of resistant infections (Coast *et al.*, 1998) [8]. In addition, the economic impact of antimicrobial resistance (AMR) is further emphasized by indirect costs ensuing from lower production as a result of higher rates of illness and mortality (Coast *et al.*, 1998; Kaier and Frank, 2010) [8, 21]. Eliminating the amount of antibiotics present in animal feed is an easy and effective approach to eradicate the emerging issue of antibiotic resistance.

2.2 Aloe barbadensis

2.2.1 Description of *Aloe barbadensis*

Originally from South Africa, *Aloe barbadensis*, also referred to as Aloe vera, is a member of the Liliaceae family of aloe plants, which consists of approximately 400 species that are prevalent to tropical and subtropical countries (Reynolds *et al.*, 2004) [50]. With storage tissues that can hold up to 99.5% more water than other plant materials, *Aloe vera* demonstrates the succulent properties typical of xerophyte plants (Hamman *et al.*, 2008) [20]. About 75 different potentially active chemicals, including minerals, enzymes, fat and water-soluble vitamins, simple and complex polysaccharides, and phenolic compounds, are found in its solid substance, which makes about 0.5% to 1.0% of the plant. *Aloe* Miller (A. Vera), *Aloe arborescens*, and *Aloe Chinensis* represent a few of the most frequently observed species in the genus Aloe, which has over 400 species. *Aloe barbadensis* Miller has been identified to be most significantly biologically active plant, according to (Bozzi A. *et al.* 2007) [6].

2.2.2 Plant Anatomy and cell walls

The immobility of the majority of vegetation has prompted rapid evolutionary adaptations to deal with changing climates. The adaptability of plant cell walls plays an integral role for their survival (Albersheim, 2011) [2]. The layers are laid down, commencing with the middle lamella, at multiple stages of expansion. The role of the corresponding cell and tissue strictly stipulates the polysaccharide and protein composition of each layer (Carpita and Gibeaut, 1993) [7]. The middle lamella develops during cytokinesis, strengthening individual cell integrity, interconnecting contiguous cell walls, and facilitating material exchange through plasmodesmata. The polysaccharides in the middle lamella comprise primarily of pectins (Albersheim, 2011; Knox, 2008) [2]. The primary cell wall, which contains water, structural proteins, glycoproteins, proteoglycans, and enzymes in addition to polysaccharides, is predicted to undergo transformation during subsequent layer deposition (Albersheim, 2011; Cosgrove, 2005; Raven *et al*., 2005) [2,48,10]. Additionally, the efficiency of water transport is further strengthened by the prevalence of hydrophobic lignin in the xylem (Raven *et al.,* 2005) [48].

2.2.3 Succulence

The succulent features, found in certain plant species, refers to their ability to hold massive quantities of water in specialized tissues; this is a phenomenal instance of evolutionary convergence. An adaptation to deal with various degrees of precipitation and protracted dry conditions is succulence, a physiological characteristic that has independently evolved throughout several plant lineages globally (Males, 2017) [27]. Typically, tissues like leaves, stems, roots, or pseudobulbs retain water (Raven *et al.*, 2005) [48]. A prime instance of a plant that falls into this latter group is aloes that preserve water in the mesophyll of their inner leaves and utilize the epidermis for photosynthesis (Kluge *et al.*, 1978). [24]. The ecological significance of succulence has drawn more attention recently owing to speculation that climate change would result in more droughts (Males, 2017) [22].

2.2.4 Geographical distribution of aloe barbadensis

Perennial plants, comprising shrubs, trees, and herbs, are referred to as aloes by Newton (2001) [34]. They can be readily recognized by their thick, densely cuticularized leaves, which are usually studded with spiky borders (Smith and Steyn, 2004) [53]. Apart from a few isolated species found on small islands in insular Africa and the Arabian Peninsula, aloes predominantly grow in Africa, especially in the southern regions of the continent. Thus, the majority of the 450 taxa (species, subspecies, or variants) that collectively make up the Aloe genus originate in Sub-Saharan Africa, and that includes the island of Madagascar. The genus's epicenter of origin is thought to be in the southeast African highlands, where ancestral aloes have been hypothesized to have proliferated throughout the Tertiary period, citing to research by Newton (2001) [34], and Newton and Vaughan (1996) [33]. Perennial plants, comprising shrubs, trees, and herbs, are referred to as aloes by Newton (2001) [34]. They can be readily recognized by their thick, densely cuticularized leaves, which are usually studded with spiky borders (Smith and Steyn, 2004) [53] Apart from a few isolated species found on small islands in insular Africa and the Arabian Peninsula, aloes predominantly grow in Africa, especially in the southern regions of the continent. Thus, the majority of the 450 taxa (species, subspecies, or variants) that collectively make up the Aloe genus originate in Sub-Saharan Africa, and that includes the island of Madagascar. The genus's epicenter of origin is thought to be in the southeast African highlands, where ancestral aloes have been hypothesized to have proliferated throughout the Tertiary period, according to research by Newton (2001) [34] and Newton and Vaughan (1996) [33].

Aloe species exhibit adaptations that promote growth in severely perturbed habitats and surroundings with extreme circumstances, and are often found in soil that lacks nutrients. Although they can be found in more fertile soil among grasses, on sandy substrates, or poking out of rock crevices, aloes usually grow best on rocky or gravelly soils. When grown in shaded conditions, aloe plants are more resilient than when they are grown in direct sunshine. However, as proven by their successful growth in a variety of soil blends, aloes exhibit exceptional tolerance to a wide range of soil compositions (Wabuyele and Keyalo, 2008) [59].

2.2.4.1 Distributions of Aloes in Ethiopia

There are forty-six species of the *Aloaceae* family of plants discovered in Ethiopia (Sebsebe and Nordal, 2010) [53]. The range of these plants is widespread across Ethiopia's floristic regions; these include Afar, Arsi, Bale, Gamo Gofa, Gojam, Gonder, Harerge, Kefa, Shewa, Sidamo, Tigray, Wellega, and Welo. Two main vegetation categories are habitat to the vast majority of endemic and near-endemic species of *Aloes*, according to a study done by Demissew and co-investigators (2001) [15] on the distribution of *Aloes* in Ethiopia. These consist of *Acacia-commiphora* woodland and bushland, as well as the dry montane evergreen forests and the related montane evergreen scrub or montane grassland. *Aloe*s *A. debrand A. adigratana*, *A. percrassa*, *A. pulcherrima*, *A. elegans*, *A. camperi*, and *A. Javellana.* Acacia Commiphora woodland and bushland also host *Aloe species* like *A. calidophila*, *A. ellenbeckii*, *A. gilbertii*, *A. friisii*, *A. retrospiciens*, *A. mcloughlinii*, *A. pirottae*, *A. otallensis*, and *A. trichosantha* and others are notable taxa present in the dry highland evergreen forest. Furthermore, Aloe bertemariae and A. citrine have been reported from semi-desert shrublands and deserts, and Aloe ankoberensis has been found in Ethiopia's Afro-alpine vegetation (Sebsebe and Nordal, 2010) [52]. Remarkably, from an ecological and phytogeographical standpoint, *A. benishangulana* and *A. ghibensis* stand out, seemingly corresponding to a yet unidentified western group predominantly associated with fire-prone Combretum-Terminalia forests (Demissew *et al.*, 2011) [11].

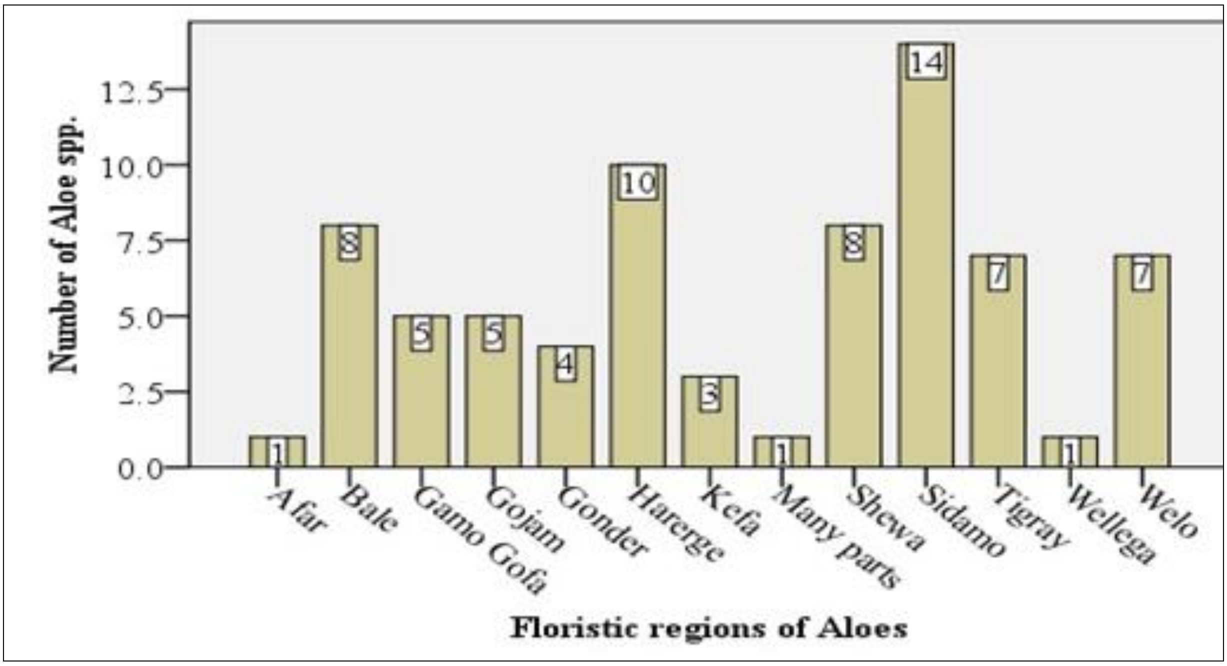


Fig 1: Distribution of Aloes in various floristic regions of Ethiopia

2.2.4.2 Endemicity of Aloes in Ethiopia

With 89% of Ethiopia's flora corresponding to the genus *Aloe*, it exemplifies an exceptionally high degree of endemism. Even with comparable species richness, this genus's level of endemism surpasses any other in the vicinity (Demissew *et al.*, 2011) [14]. Of all the species and subspecies of Aloe vera discovered in Ethiopia, about 66% are endemic or nearly endemic, with the remaining 34% not endemic. So as to ensure their sustainable utilization in the future, immediately apparent conservation initiatives are recommended. The distribution ranges of many indigenous *Aloe species* are critically limited. Within the flora region, Sebsebe Demissew and Nordal (2010) [52]. Found four hotspots of endemism: 1) There are sixteen endemic species in the northern and central highlands, which are located north and west of the Rift Valley. (e.g. *A. adigratana, A. camperi, A. sinana, A. pulcherima,* and *A. debrana*); 2) 9 spices are exclusive to the eastern highlands and southeast lowlands. (e.g. *A. elkerriana*, *A. harlana*, *A. mcloughlinii* and *A. welmelensis);* 3) Southern Ethiopia, home to six native breeds (e.g. *A. gilbertii*, *A. otallensis*, and *A. friisii*); and 4) 4 species (*A. clarkei* and *A. kefaensis*, and the newly described *A. benishangulana* and *A. ghibensis*) are found in the western regions of Ethiopia.

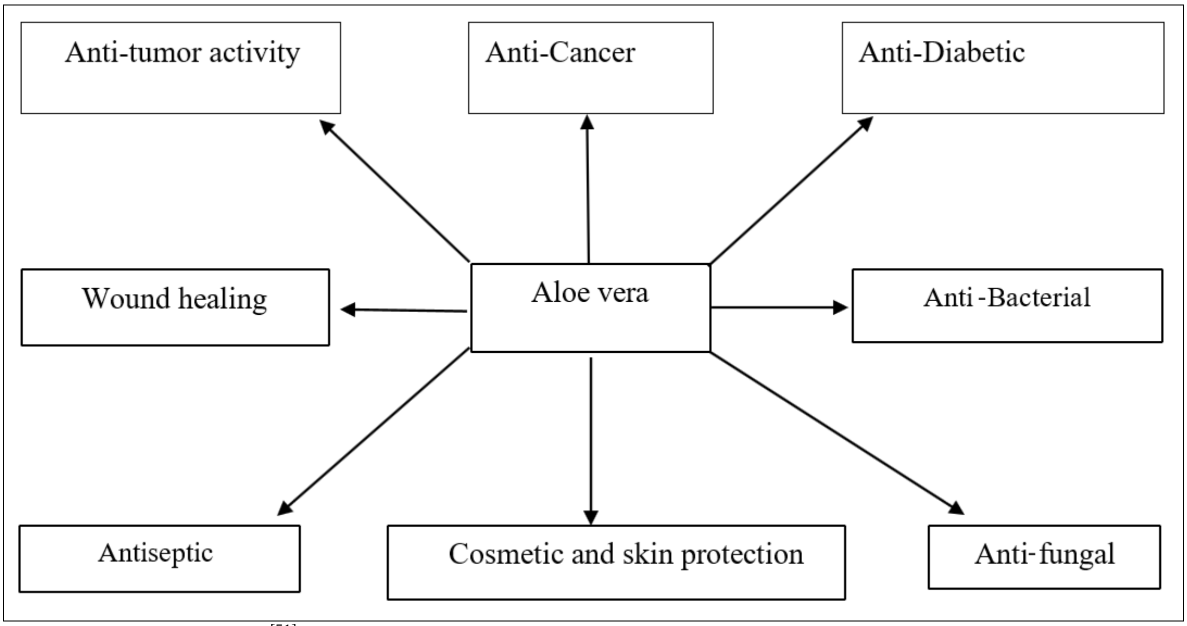
2.2.5 Applications of *Aloe barbadensis* a plant in Ethiopia

2.2.5.1 Aloe as a food for animals

Several species of birds and mammals rely on *Aloe species* as a key source of food. Aloes are particularly tempting to birds precisely due to their abundant nectar production. Their long, tubular blossoms, which are typically red to yellow in color, yield an adequate quantity of nectar, implying that they have evolved to be pollinated by birds. While the flowering times of different sorts of aloe differ, some flower continually, offering nectar-feeding birds a reliable source of food. Aloes are important as foraging plants for bees as a result of their good properties that impact the quantity and quality of honey produced by honeybees during the seasons when they happen to be in blooming (Wabuyele and Keyalo, 2008) [59].

2.2.5.2 Medicinal properties of *Aloe species* in Ethiopia

For extended periods of time, humans have been utilizing the bitter ingredient which most aloes discharge just below the leaf surface for medicinal reasons (UCDAVIS, 2009). The horticultural, medicinal, and commercial utility of plants in the genus Aloe has long been acknowledged. *Aloe species* have been used extensively in traditional medicine to treat plenty of different diseases, like burns, dermatitis, constipation, gastrointestinal issues, wounds, and skin conditions (Grace, 2015; Rajeswari *et al.*, 2012) [19, 47]. *Aloe species* are believed to be therapeutically effective due to the synergistic properties of their varied chemical contents. These ingredients consist of approximately twenty amino acids, vitamins B1, B2, B6, B12, and C, as well as enzymes including lipase, amylase, and folic acid. They additionally incorporate important inorganic minerals such as ions of calcium, magnesium, zinc, iron, and copper (Dagne *et al.*, 2000) [12]. *Aloe species* contain the following saccharides: mannose, xylose, arabinose, galactose, and glucose. *Aloe species* are commonly used as main ingredients in tonics and health drinks, along with skin and hair care products, in Ethiopia (Demissew *et al*., 2003) [13]. In rural parts of the nation, aloe plant-derived mucilaginous fluid is applied to cuts and wounds to aid in healing and protect against infections (Tadesse, 2010) [56]. Particularly, *Aloe vera* has been scientifically demonstrated to provide a host of health benefits, such as the capacity to heal wounds, possess anticancer and antitumor effects, have antifungal and antibacterial activities, protect the skin, help patients with diabetes regulate their blood sugar levels, and fortify their immune systems (Sahu *et al*., 2013) [51].



Source: Sahu *et al.,* 2013) [51].

Fig 2: Medicinal utilities of *Aloe vera*

2.2.6 Phyto-chemistry of Aloe vera

There are about 200 different kinds of chemicals found in aloe vera. Luta and McAnalley's research from 2005 states that aloe gel is composed of polysaccharides (55%), sugars (17%), minerals (16%), proteins (7%), lipids (4%), and phenolic chemicals (1%), on a dry matter basis. Among several vitamins found within aloe vera gel are essential vitamins like A, C, and E.

A significant quantity of niacin, choline, folic acid, vitamins B1 (thiamine), B2 (riboflavin), and niacin is also present. The mucilage layer on the outside of the plant that surrounds its inner parenchyma, or gel, is the source of polysaccharides.

2.3 *Ocimum gratissimum*

The perennial herb *Ocimum gratissimum* normally blooms to a height of 1 to 3 meters. It is recognized by its fragrant nature and might have pubescent or glabrous branches. The stem is tall, rounded to quadrangular in shape, extensively branched, and it often has peeling epidermis at the woody base (Bhat, 2003) [5]. *Ocimum gratissimum* primarily serves as a spice, vegetable, or medicinal plant, despite the fact it also contains the essential oil eugenol, which is ubiquitous among *Ocimum* species (Orafidiya *et al.*, 2001; Ijeh, 2005) [38, 21]. Its most evident nutritional advantage stems from its delectable flavor, which serves as a condiment (Pino, 1996) [45]. *Ocimum gratissimum* is widely used in West African traditional medicine as a remedy for convulsions, fevers, coughing, and malaria (Ndounga, 1997) [32].

2.3.1 Applications of *Ocimum gratissimum*

2.3.1.1 Medicinal applications of *Ocimum gratissimum*

Ocimum gratissimum is a spice, culinary element, and medical cure that has been used broadly in traditional medicine in diverse nations. The plant's abundant, thoroughly oil-rich blooms and leaves are utilized to make teas and infusions in Northeastern Brazil (Rabelo *et al.*, 2003) [46]. It is commonly utilized in coastal regions of Nigeria to treat epilepsy, diarrhea, and high fever (Effraim *et al.*, 2003) [16]. It has been traditionally utilized for the treatment of a variety of ailments in Kenya and Sub-Saharan Africa, such as irregular menstruation, infections, coughs, fever, convulsions, stomach pain, sore eyes, coughing, and rectal prolapse (Matasyoh *et al.*, 2007) [30]. The entire plant has been used in India for treating sunstroke, headaches, and influenza as a diaphoretic, antipyretic, and anti-inflammatory (Ueda-Nakamura *et al.*, 2006) [57]. Hemorrhoids and gastrointestinal disorders are treated with cold leaf infusions, while diarrhea is treated with *O. gratissimum* leaf extract. Furthermore, the plant's efficacy in treating conjunctivitis, upper respiratory tract infections, headaches, eye diseases, skin conditions, pneumonia, fever, coughs, and multiple kinds of skin problems is well known in traditional medicine (Adebolu and Oladimeji, 2005) [1]. As pulmonary antiseptics and antispasmodics, infusions derived from *O. gratissimum* leaves are used (Ngassoum *et al.*, 2003) [35].

2.3.1.2 Alternative and complementary medicinal applications

One species that is commonly employed in medicine across the world is *Ocimum gratissimum*. *Ocimum* oil, or O. *gratissimum* leaf essential oil, is found in a number of formulations that are intended to be administered as a topical antiseptic for minor wounds, boils, and zits (Orafidiya *et al.*, 2004) [37]. In addition, *Xylopiathiopica* and *O. gratissimum* are combined in order for creating teas and concoctions for girls going through adolescence (Ijeh *et al.*, 2005) [21].

2.3.1.3 Antimicrobial activity

A research study of the effects of detergents and honey on the antibacterial properties of *Ocimum gratissimum* essential oil had been carried out. The cup plate method was applied to assess the antibacterial capacity of dispersions containing *Ocimum* oil (2%) in methanol, honey, a macrogol blend, and nonionic and ionic emulsifiers against both prevalent bacterial strains and wound isolates. When compared to the macrogol blend, it was discovered that honey substantially improved the antibacterial properties of *Ocimum* oil (Orafidiya *et al.*, 2005) [38]. In addition, different extracts from *O. gratissimum* leaves have been investigated for their ability to inhibit the growth of pathogenic microbes, such as *Salmonella typhi, Salmonella typhimurium, Escherichia coli*, and *Staphylococcus aureus*, which are known to cause diarrhea. Steam distillation, hot water, and cold-water extracts were among the extracts examined. The minimal inhibitory concentrations for the different bacteria varied from 0.1% for *S. aureus* to 0.01% for *E. coli* and *S. typhimurium*, and 0.001% for *S. typhi* (Adebolu & Oladimeji, 2005) [1]. Only the steam distillation extract exhibited inhibitory effects on the tested bacteria.

2.3.2 Phytochemistry
The primary purpose that *Ocimum gratissimum* is cultivated is for its essential oil-containing leaves and stems. Clove oil and thyme oil can both be partially substituted with the oil's byproducts, eugenol and thymol, respectively. *Ocimum gratissimum* fresh above-ground sections have an essential oil content of 0.8-1.2%. The main ingredients of the oil consist of eugenol, thymol, citral, ethyl cinnamate, geraniol, and linalool, however its chemical composition varies. At least six chemotypes have been discovered. The eugenol-type oil has a strong, warm, spicy, and aromatic scent. It is colored brownish-yellow to pale yellow. When compared to clove oil, its flavor is bitterer. Conversely, the thymol-type oil has a dark yellow to orange-yellow or brownish color with a warm, medicinal-spicy, slightly herbaceous fragrance. A pleasing medicinal aftertaste left afterwards. It imparts a hot, searing sensation and tastes slightly astringent. The concrete that was obtained through a solvent has a notably higher thymol concentration than the distilled oil. A geraniol-rich form of *O. gratissimum* has been discovered in the US, containing 84-88% geraniol along with sporadic quantities of limonene, neral, beta-caryophyllene, and gamma-microlens. In the interim, findings from Iran, Pakistan, and India have revealed the presence of a citral type that is high in geraniol (26%) and citral (67%) (Orwa *et al.*, 2009) [40].

3. Conclusion and Recommendations
It is implied that human populations could get infected with resistant microbes either directly through contact or indirectly through the consumption of animal-derived goods (such as milk, eggs, and other dairy products). Fighting antibiotic resistance is crucial to preserving public health globally. Growing interest has been apparent for utilizing plants as sources of novel compounds to combat microbial diseases in recent years. Since conventional antibiotics are becoming more and more costly with reduced efficacy, there is surging demand for plant-based antibiotics. Certain discoveries propose a novel approach for identifying potent antibacterial agents from *Aloe barbadensis* and *Ocimum gratissimum*. Nevertheless, the extract's efficiency to impede bacterial growth is contingent on the antibiogram results of the experiments. The review's findings demonstrated that, to varied degrees, each extract exhibited antibacterial activity against the examined pathogens. Thus, in accordance with the aforementioned concluding assessments, the ensuing recommendations are put forward:

- Educating people about the historical use of these plants in the vicinity as remedies for a broad spectrum of diseases is indispensable.
- Potential cultivation techniques for the cultivation of these plants should be divulged to the public.
- It is anticipated that the antibacterial effects of these plants will differ drastically due to the inherent variety in chemical substance's quantity and composition throughout distinct regions of the plant.
- It is crucial to conduct research to determine the prospective variables affecting plant extracts' antibacterial potency.

4. Authors' Contributions
All authors contributed substantially directly, and cognitively to the manuscript's preparation.

5. Conflict of interest:
The authors declare that they have no conflict of interest.

6. Financial support:
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