NUTRA-CEUTICAL AND PHYTOCHEMICAL ATTRIBUTES OF MENTHA

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ABSTRACT: Plants include a variety of phytochemicals that can be utilized as dietary supplements to treat a wide range of illnesses and issues. Mint (Mentha species), a type of medicinal plant, has a number of health-promoting qualities. These include the ability to prevent the development of cancer as well as having anti-obesity, antimicrobial, anti-inflammatory, anti-diabetic, and cardioprotective effects. Mint essential oils have also been discovered to have antimicrobial effects. A person can add taste to their food while consuming less sodium and sugar by using fresh mint and other herbs and spices in cooking.

KEYWORD: Mentha, Anti-Microbial, Essential oil, Anti-diabetic.

INTRODUCTION:
Perennial, aromatic, and therapeutic herb known as mentha is widely used around the world. The Lamiaceae family has 25–30 species under the genus Mentha. Mentha can grow in a variety of environmental situations and does so energetically at low temperatures. It can typically grow to a height of at least 10 to 20 cm. This genus originated in the Middle Eastern countries and gradually spread throughout the entire planet by artificial or natural origins [1]. These days, Eurasia, Australia, South Africa, and North America are where you can mostly find them. Mentha plants exhibit an abundance of phenolic chemicals, specifically phenols, flavonoids, terpenes, quinines, and polysaccharides, according to several studies [2, 3]. These phytochemicals cleared the path for their significant use in the food, beverage, and pharmaceutical industries [1,4,5]. Several Mentha species are utilized in spices and herbal teas. The leaves, stems, and roots of Mentha, for example, have all been utilized in traditional and tribal medicine [6, 7]. Mentha aquatica L. (M. aquatica), Mentha longifolia L. (M. longifolia), Mentha piperita L. (M. piperita), Mentha spicata L. (M. spicata), and Mentha arvensis L. (M. arvensis) are highly significant species in terms of the economy. All of these species have the potential to produce phytochemicals that are useful in the pharmaceutical, food, flavor, ointment, and related sectors [1,8,9,10], such as iso-menthol, iso-menthone, cineol, limonine, pipertone, carvacrol, dipentene, linalool, and thujone. Tea made from mentha leaves has long been used to heal minor ailments like headaches, fever, digestive problems, and other aches and pains [11]. Additionally, postherpetic neuralgia, headache syndromes, and moderate bacterial and fungal infections of the human skin have all been successfully treated with mint essential oils [12]. Mentha species are frequently utilized to treat digestive system issues in contemporary medicine. For instance, a methanolic extract of Mentha longifolia (L.), which is high in eucalyptol, had antifulcer efficacy against acetic acid-induced colitis in rats. This effect may have been due to the plant’s antioxidant and anti-inflammatory properties, even if it was not dose-dependent [13]. Clinical research have shown the anti-inflammatory properties of mint essential oils. For instance, M. spicata essential oil can help osteoarthritis sufferers feel less pain. There are dozens of bioactive chemicals found in plants that are nontoxic, largely effective replacements with very little negative side effect. These bioactive compounds have been shown to have a wide range of physiologically advantageous effects, including antibacterial, antineoplastic, antioxidant, hypoglycemic, analgesic, antidiarrheal, and wound care capabilities. These plants have natural compounds that can be extracted and are available in both their pure and mixed forms. Such plants provide countless potential because of their unmatched chemical diversity. Global knowledge of eatable floras has grown as a result of growing desire for chemical variety in the selection process, in quest of natural product. A variety of bioactive substances have led to an upsurge in the medicinal uses of herbal plants. Since ancient times, medicinal plants and the molecules that they produce (phytochemicals) have been thought to have pharmacological value. Prior to the emergence of civilization, 60,000 years ago, people began using plants as medicine [14]. Today, more than 30% of all pharmaceuticals (and their analogs and derivatives) come from plants and other natural sources. Products will keep having a significant impact on human medicine. Most artificial Similar in structure to the phytochemicals derived from plants, bioactive medicines Initially segregated [15,16]. Plant-derived materials play a significant role in many developing nations. Function in the treatment of diseases or primary care. Additionally, due to warnings in the Rather than using chemical medications, there is increasing interest in using plant-derived Pharmaceuticals [17].

TAXONOMY:
The Lamiaceae family includes the Mentheae tribe of the Nepetoideae subfamily. More than 3000 names of the genus Mentha from the 65 genera of the tribe Mentheae have been recorded, the majority of which are false names. They have a difficult taxonomy because the genus is easily hybridized. Hybrid seeds can reproduce vegetatively and produce a range of progeny. With the eruption of new species and subspecific taxa has emerged this variability. One taxonomist published 434 new mint taxa in Central Europe between 1911 and 1916 [63]. Between 18 and 25 species are identified by recent sources. As of July 2019, the Plants of the World Online recognized the following species.
**GENUS MENTHA: MORPHOLOGY & SYSTEMATICS**

**Morphology**
A perennial herb, Mentha L., spreads via long, slender rhizomes. Since the rhizomes of this species spread quickly, different populations of it are made up of successive clones. Rhizome segments proliferate particularly around marshes and riverbanks, causing vegetative growth and dissemination [19]. The plant has thickly veined leaves with pubescence and large, ovate leaflets that are rounded or occasionally lanceolate at the base. Anthers protrude from the corolla and the flowers are grouped in a broad whorl with triangular teeth on the calyx. The majority of the blooms are protandrous, and self-pollination typically takes place [18,19].

**Systematics**
Using a plant specimen brought back from Sweden and given the name M. canadensis, Carl Linnaeus created a drawing of mentha. In retaining M. canadensis L. as a subglabrous variety (var. glubrata Benth.) and a villose one (var. villosa Benth.), L. Bentham followed Linnaeous [20]. Recent research, however, has shown that Mentha can be divided into 42 species, hundreds of subspecies, variations, and cultivars, as well as 15 hybrids, based on physiological, anatomical, and molecular characteristics [21]. There is no agreement over the classification of mentha in science, which makes it extremely unpredictable. Eriodontes, Mentha, Preslia, Audibertia, and Pulegium are the five divisions into which Mentha is typically divided [22]. Recently, [23]. Demonstrated that utilizing matK sequencing, phylogenetically, M. arvensis, M. spicata, and M. piperita show 98% identity.

**PHYTOCHEMICAL COMPOSITION OF MENTHA:**
Biologically active substances are referred to as having a “phytochemical composition” in plants. The phytochemicals add flavor and color. As well as the plants’ scent. In addition, helping to spread a protective mechanism to protect plants against illnesses[24]. Several investigations have Solid-phase microextraction combined with gas chromatography/mass spectrometry (mass spectrometry/chromatography), to verify and affirm that there is floral monoterpene compounds and the piperita leaves. It was discovered Peppermint is abundant in substances like Neomenthol, asmenthyl acetate, and components of the menthol elder plant (basipetal) as opposed to younger plant components. (in the acropetal direction) Awarded isomenthone and menthone. Mentho furan is more concentrated in the flowers than it is in the leaves[25]. Study of peppermint’s volatile oil GC/FID analysis of (Mentha x piperita L.) GC-MS reveals the existence of Menthol and menthone (23.4% each) (40.7%). 1,8-cineole, limonene, menthyl acetate, -caryophyllene, and -pinene are also present. A peppermint plant has been reported [26]. the closest examination of spearmint leaves. About 300 various compounds have been identified in peppermint leaves that contain volatile oil. The terpenic category has the foremost outstanding features and is comprised of 9% of sesquiterpenes and 52% of monoterpenes, whereas other groups like lactones (7%), aldehydes (9%), aromatic hydrocarbons (9%), alcohols (6%) and a smaller proportion of miscellaneous components (8%) have also been reported. Among monoterpenes, menthol is a chief component (35-60%) followed by menthyl acetate (0.7-23%), menthone (2-44%), menthofuran (0.3-14%), 1,8-cineole (eucalyptol) (1-13%), isomenthone (2-5%), limonene (0.1-
6%) neomenthol (3-4%), whereas β-caryophyllene is the major sesquiterpene (1.6-1.8%). The volatile oil-containing peppermint leaves contains almost 300 different chemicals. The terpenic class is the most important exceptional qualities and includes 52% of terpenes and 9% of sesquiterpenes monoterpenes contrasted with other groups. Such as alcohols (9%), lactones (7%), aldehydes (9%), and aromatic hydrocarbons (9%). (6%) and a lesser extent of components of other types (8%) have been reported as well. Among Menthol is a major monoterpen. Part (35–60%) is followed by (0.7-23%), menthol acetate, and menthone (2-44%), menthofuran (0.3-14%), 1,8-cineole (eucalyptol) (1-13%), isomenthone (2-5%), limonene (0.1-6%), and neomenthol (3-4%), with the majority of sesquiterpenes being -caryophyllene (1.6-1.8%).

SPECIES AND HYBRID
Mentha piperita, well known as peppermint, and M. spicata, also known as spearmint, are two of the most well-known and commonly accessible species. Peppermint is more potent than spearmint and has brilliant green leaves and stems with purple undertones Green or gray-green leaves, a lack of a leafstalk, and a milder flavor and aroma are all characteristics of spearmint. These plants’ essential oils are used as flavoring in products like chewing gum and to mask the tastes of pharmaceuticals. The most significant commercial species of mint are peppermint and spearmint, which are grown in Europe, Asia, and the United States. Below is a selection of what are considered to be pure species of mints.

- Water mint (Mentha aquatica), often known as marsh mint
- Mentha arvensis, also known as field mint, corn mint, wild mint, and Japanese Asian mint, Mentha asiatica
- The Australian mint, Mentha australis
- Mentha xanthophylla
- Hart’s Pennyroyal, Mentha cervina
- Bergamot mint, Mentha citrata
- Wrinkled-leaf mint, Mentha crispata The IA Mentha Cunningham
- Dahurian Thyme, Mentha dahurica
- Slender mint, Mentha diemenica
- Mentha gattefii
- Menthol (haplocalyx)
- Menthol from Japan
- Menthol from Japan The herb Mentha kopetdaghensis
- Forest mint, Mentha laxiflora Horse mint, Mentha longifolia
- Mentha nemorosa, also known as Cuban mint, hairy mint, foxtail mint, and giant apple mint
- Pennyroyal (Mentha pulegium)
- Corsican mint, Mentha requienii Garden mint, Mentha sachalinensis
- Native Pennyroyal, Mentha satureioides
- Mentha spicata – Curly mint and spearmint
- Apple mint and Pineapple mint are both varieties of Mentha suaveolens.
- Mentha grandiflora and Gray mint, Mentha vagans

SELECTED HYBRID:
There are many known hybrids in the mint family.
- Mentha gracilis, sometimes known as ginger mint
- Peppermint, Mentha piperita
- Mentha rotundifolia, also known as false apple-mint (Mentha longifolia and Mentha suaveolens).
- Red Raripila Mint (Mentha smithiana, M. aquatica, M. arvensis, and M. spicata)
- Mentha villosa, sometimes known as apple-mint (Mentha spicata, Mentha suaveolens, or M. cordifspicata
- Sharp-toothed Mint (Mentha villosonervata, M. longifolia, M. spicata)
**BIOLOGICAL ACTIVITIES OF MENTHA:**

A detailed survey of the biological activities of Mentha is a prerequisite to explore its potential for the treatment of diseases.

**Antimicrobial Activity of Mentha**

One of the major medical concerns around the world is infectious disorders brought on by bacteria, viruses, and fungi [50]. In spite of the availability and use of powerful antibiotics, bacteria have the potential to endure unfavorable environmental conditions and develop multi-drug resistance [51]. Additionally, using synthetic medications in emerging and poor areas can have negative impacts in addition to being cost-effective. Therefore, the need of the hour is for brand-new, non-toxic medications to tackle microbial diseases. In this perspective, phytomedicines are viewed as significant drug development pipelines for secure and efficient treatment. Mentha spp. Essential oils have been examined for potential antibacterial properties [52]. According to [53] this impact has primarily been linked to volatile bioactive substances such monoterpene and sesquiterpene hydrocarbons and oxygenated monoterpenoids. Mentha essential oils have been shown to suppress the development of both gram-positive and gram-negative bacteria, including Bacillus subtilis, Serratia marcesens, Pseudomonas aeruginosa, and Staphylococcus aureus [54].

**Antioxidant Activity of Mentha**

Natural antioxidants derived from plants are gaining popularity since they are safer and have more health advantages than synthetic versions. In this context, several culinary and medicinal herbs’ extracts and essential oils (Eos) have been explored as a potential source of powerful antioxidants [27] demonstrating a activity against free radicals and reactive oxygen species that is well known. Several in vitro testing for antioxidants using DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavengers [28], Linoleic acid suppression by 2,2’-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS+) Assays for reducing power and peroxidation have both been successfully used by to investigate the antioxidant properties of Mentha plants. A variety of medicines High quantities of antioxidants, such as phenolic compounds, are present in plants, including the Mentha genus [29].

**Antidiabetic Activity of Mentha**

One of the main causes of cardiovascular illnesses is diabetes. Therefore, it is necessary to find possible natural resources to aid in the decline of cardiovascular and diabetes disorders. Researchers have found that mentha oils and extracts have substantial anti-diabetic properties. By inhibiting -glucosidase and -amylase, the essential oil of M. virdis was evaluated. The findings demonstrated that M. virdis essential oils have inhibitory activity against -amylase with an IC50 of 101.72 1.86 g/mL and -glucosidase with an IC50 of 86.93 2.43 g/mL [47]. Rat research conducted in vitro and in vivo helped scientists discover M. arvensis L.’s antidiabetic efficacy. More than 50% and more than 68% of -amylase and -glucosidase inhibition, respectively, were found in the methanolic extract of M. arvensis. Significant postprandial hyperglycemia inhibition was also seen in rats [49]. M. suaveolens essential oils have been discovered to have high inhibitory capability for the enzymes -glucosidase and -amylase, with IC50 values of 141.16 0.2 and 94.30 0.06 g/mL, respectively [48].
Anti-cancer Activity
Cancer is a complex illness with multiple stages that is defined by unchecked cell proliferation and is today a major global health issue [30]. The World Health Organization (WHO) just released a report stating that there are more than 18.1 million 9.6 million cancer fatalities and new cases were reported in 2018 [31]. According to reports, 10–70% About two-thirds of human malignancies would be connected to food, and cancer mortality may be related to nutrition. Be preventable by adopting a suitable lifestyle [32,33]. A lot of advancements have been made in the prevention and treatment of this chronic disease, making cancer a persistent health problem in medical sciences around the world. The Continuous cellular division of the human body is a sign of sickness, with the malignant cell tumors developing as a result of an inability to control or stop having the capacity to spread [34]. Surgery, radiation, and medications made of chemicals are currently used as therapies. There is an emphasis on utilizing alternatives to chemotherapy because it can put people under a lot of stress and further harm their health. Native cancer remedies and treatments [35].

Anticarcinogenic and cytotoxicity activities
Despite significant advancements in the development of new approaches for the prevention and treatment of cancer, it continues to be a difficult public health issue on a global scale [36]. During the progression of cancer, certain cells in the body repeatedly and uncheckedly proliferate, with the potential to develop into malignant tumor cells[37]. The most effective therapeutic approaches against cancer at the moment are chemotherapy, radiation, and drug-based regimens. These tactics have a number of shortcomings, though, which have an impact on the health of the patients. Consequently, the hunt for alternate treatments is ongoing. For many years, the initial source of many medications has been herbal medicine. Additionally, recent research has focused on the synthesis of nanomaterials derived from plants for the treatment of cancer [38]. In this regard, numerous plant species have been examined for their potential anticancer action [39]. Studies looking at Mentha spp.'s anti-tumor effects on various cancer cell lines have been conducted in vitro, in vivo, and in pre-clinical trials [39]. Out of 120 medicinal plants, Mentha spp. Have been shown to be the most efficient against tumor-inducing agents[40]. Another study examined the antitumor properties of Mentha spp. Extract and essential oils. Additionally, extracts made from Mentha showed a dose-dependent cytotoxic impact [41]. The anti-tumor and anti-mutagenic properties of the M. longifolia aqueous and methanolic extracts suggested the presence of bioactive components, which may be helpful in the creation of novel anticancer medicines.

Anti-inflammatory properties
There have been claims that a number of Mentha spp. Extracts has anti-inflammatory properties. The 5-lipoxygenase (5-LOX) inhibition experiment in vitro has been used to demonstrate this ability of M. piperita essential oils [42]. In lipopolysaccharide-activated RAW 264.7 macrophages, this substance may also prevent the production of nitric oxide and prostaglandin E2[43]. Additionally, the down-regulation of the genes for IL-1, IL-6, and COX-2 in J774A.1 murine macrophage cells has been effectively accomplished by M. piperita extracts M. Suaveolens methanolic extracts have been used to treat animals, and these treatments have produced anti-inflammatory benefits in vivo[44]. Wistar albino rats' acute and chronic inflammation was significantly reduced by fractions of M. spicata solvent extracts [45]. Additionally, Male CD-1 mice’s edema was successfully reduced by applying alcoholic extracts of M. aquatica topically [46]. In a dose-dependent way, the M. piperita essential oils greatly decreased the inflammatory response in the mouse ear edema model caused by croton oil.

HEALTH BENEFITS OF MENTHA LEAVES
Due to its medical and therapeutic uses, mentha is a highly sought-after and in-demand herb. Since the Ming dynasty, Mentha species have been known to be used in China [55]. In the London Pharmacopeia, menthol became a recognized component of Materia medica [56]. It was frequently employed as a medicinal herb in the 18th century [57,58]. Mentha species have been linked to a number of health benefits [61]. In vivo studies using mice have demonstrated analgesic activity in Mentha species [62]. Various bacterial and fungal strains were resistant to the antibacterial and antifungal effects of Mentha species [59]. species have historically been used to treat a variety of illnesses and may one day be used to treat cardiovascular disorders. According to a number of studies, Mentha species contain free radicals as well as nonradical species, such as hydrogen peroxide, which is bad for microbial molecules like proteins, lipids, nucleic acids, and carbohydrates. Mentha species’ extracts and essential oils have demonstrated a number of health benefits [60].

NUTRITIONAL COMPOSITION
According to the Office of Dietary Supplements (ODS), peppermint oil could irritate and produce redness on the skin. Reliable Source. They advise against applying the cream straight to the chest, either for parents or for professionals. Or the face of a younger because of potentially harmful side effects directly after inhalation. Although mint contains a number of nutrients, the quantity a person would ordinarily take in a meal is insufficient to meet a sizable portion of their daily needs. The best use of mint in the diet is to swap out salty, sweet, or calorie-dense flavorings. The majority of its advantages come from using mint ointments or supplements [62].

CONCLUSION
Mentha species and their derivatives have a long history of usage in traditional treatments and flavorings. The plants and their extracts are used to treat tumors, skin conditions, gastrointestinal disorders, nausea, fevers, and headaches. There are many essential oils and phytochemicals described from Mentha species, which have a variety of biological activity Molecules 2022, 27, 6728 15 of 20. The antioxidant, antidiabetic, and antibacterial properties of these essential oils show that Mentha species may be an exceptional source for the prevention of cardiovascular illnesses. There are a number of directions that need to be investigated further in order to fully utilize plant extracts. Future studies should first concentrate on the natural chemicals found in the extracts’ modes of action. Second, it’s important to identify the metabolic processes that preserve food flavor and aroma. These are crucial
research issues to investigate the fundamental elements required for the management of diabetes and cardiovascular illnesses using chemicals from Mentha species in food or medicine. Finding the right quantity and quality of plant extracts to use as food additives and preservatives to fight a particular ailment will be made easier by advancements in the study of medicinal plants. Mentha extracts also have the potential to be used as processing aids and synergist chemicals, rather than just for their potential therapeutic benefits. Due to rising consumer demand for food with organically derived preservatives, the usage of natural anti-diabetic and cardioprotective medicines is expected to increase gradually in the future. As effective expectorants, the essential oils from Mentha species have also been used traditionally to treat respiratory illnesses such as bronchitis, sinusitis, TB, and the common cold. The antioxidant, antibacterial, antifungal, anti-yeast, antiviral, and anticancer action has been highlighted by a number of clinical studies. There is evidence that Mentha species, and particularly their essential oils, have potent antibacterial, veridical, and fungicidal effects.

REFERENCE