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Mentha arvensis, a medicinal and aromatic plant, has high nutritional value and several-uses: A review

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ABSTRACT

Mentha arvensis or mint is a renowned medicinal and aromatic plant. It is annual plant and cultivated in the tropical and sub-tropical regions under irrigation. Its cultivation has significant importance, such as for food flavoring, medicinal applications, essential oil applications, and also using in traditional purposes. Its essential oil contains many components phenolic, aldehydes, ketones, and carbohydrates. Menthol is a fundamental component of *Mentha arvensis* essential oil. Menthol has also several industrial applications, especially in food, cosmetics, pharmaceuticals, and by-products. There are many types or variations of menthol found in *Mentha arvensis* depending on the species or cultivars as well as cultivation conditions, such as weather, irrigation, soil type, pruning, and other agronomical practices. It has interesting and valuable botany, morphology, and ecology. Its growth rate is strongly affected by the change of variables, such as pH, temperature, and nutritional values of soil. The extraction of essential oil and the post-harvest analysis are done by using traditional methods for *Mentha arvensis* oil production in developing countries. Research on oil extraction methods, maximizing yield per hectare, and optimum preservation are needed for the further, especially in post-harvest of mint leaves and roots.

INTRODUCTION

Botany

Mentha arvensis or mint belongs to Lamiaceae or Labiatae family. Lamiaceae is a family of 'flowering plants'. It is closely related to the family Verbenaceae. Its nomenclature system faces huge difficulties in making the correct name due to higher biodiversity. Each country of the world has its almost native language. *Mentha arvensis* plants are named as podina or pudina or phodana (Qing, 2002). In the worldwide, *Mentha arvensis* is well known as wild mint or corn mint or field mint. Phuttiya or phutya or padina are commonly used as the local name of *Mentha arvensis* in India. It is commonly used as a medicinal and ornamental plant in the world. Mentha genus contains a huge number of species. Its ratio of species is too much higher than other genera of this family. Approximately 13 to 24 species of genus Mentha are found in the world. It is a native plant of tropical regions. However, some taxa of *Mentha arvensis* also exist in temperate and sub-tropical regions of the world (Ishtiaq, et al., 2014). It can be successfully hybridized with other plants of genus Mentha. Its direct interactions of sunlight can change its color, length, age, and aroma of new hybridized mentha plants (Fatiha, et al., 2017). It can grow strongly at a moderate temperature. Its flowers are found in white color, and most color of leaves is in deep green or light green. Mint plants can be grown in different soil pH, such as acid, neutral, and basic (alkaline). Heavy clay (bases) soil is the best soil for the remarkable growth of mint. Soil pH range 6.5-8 and range of atmospheric humidity 60-70%. It can grow under semi-shade, but the growth rate will be lowered. Good Agronomic practices gave good health to flowers and leaves of wild mint (Mounira, et al., 2009). Origins, genetics, and nutritional value of soil are factors that affect essential oil yield. Germination from seeds is difficult than other germination methods such as budding and grafting (Gobert, et al., 2002).

The United States of America, China, and India are the three big countries producing mint oil. They covered about 95% demand for the mint in the world. India has a big market for the production of mint in the world (Kokab, et al., 2010). This plant is also being used in natural and modern synthetic products. The chemical composition of essential oils shows a considerable variation (Johnson, et al., 2011). Consequently, mint essential oil of different parts produces several chemicals and exhibits variation in biological activities (Borris,1996). Literature reports of *Mentha arvensis* showed that it has strong anti-inflammatory activity, antioxidant activity, anticancer activity, and antibacterial activity (Khanuja, et al., 2000).

Mentha arvensis has twisted edge leaves. The leaves of each pair grow in opposite directions from each other. The flowers of mints are seen in colors like pale purple, pink, and white (Jamal, et al., 2006). The color of the stems varies from brownish-green to green under development stages. It is generally known as a perennial herb. The growth rate is deeply affected by climate, but in the U.S.A. its active growth period is during the spring season. Its height is ranged from 1 to 6 m, 10-120 cm height; the length of wild mint is mostly 4-7 mm long. The wild mint produces flower at the maturity stage at the top of the plant. Wild mint has a strong tendency to make new leaves, stems, and roots if they cut due to causing some reasons (Sushil, et al., 2000).

History/Origin

The history of *Mentha arvensis* is very ancient. It was an old history that available about genus Mentha. It was believed that the Mentha word was originated from Greek legend nymph Minthe. She was beautiful and attracted to Greek god Hades. She was a superior woman and more beautiful than Hades's wife, Persephone. Persephone was jealous of her. She disliked and killed her. Then Greek god Hades transferred her dead body of Minthe into a mint plant. Greek king gave Minthe or mint to the England king as a gift (Van, et al., 1997). About 2000 years ago, people were known and used Mentha as a medicinal plant. First time in history, Sweden biologist Linnaeus was used Mentha as a genus in 1753 (Ogunleye and Ibitoye, 2003).

Table 1 Taxonomy and botanical description

Taxon	Name
Tibbi	Pudina
English	Marsh mint
Botanical	Mentha arvensis
Urdu	Podina, pudina
Family	Labiatae
Common	Corn mint, field mint, podina
Part used	Leaves, flowering tops and stems.

During the earliest period, it was considered that for the first time in history, *Mentha arvensis* was harvested for vegetation in Europe. Then its cultivation was started by Japan for commercial purposes in the late 19^{th} century. Over time, China and Japan have started their uses in medical fields. It was introduced in the sub-continent, especially in India and Pakistan, known as pudina (Okumu, 2016). Furthermore, taxonomy and botanical description of mint is presented in Table 1.

Demography and location

The demography of wild mint is very interesting. It has been found in almost all regions with different climatic conditions. The demography of wild mint shows that field mint has various habitats. It has good potential to bear different climate effects. Diversity of *Mentha arvensis* has increased its importance day by day due to high invasion in nature and high demand for its products in the world (Rastogi and Mehrotra, 1991). Asian countries such as India, Pakistan, Iran, Japan, China, and Afghanistan are providing the best soil for maximum growth. They are a significant supplier of wild mint worldwide (Bahl, et al., 2000). France, Germany, Spain, Italy, the U.K., and other famous countries in the Euro have many wild mint varieties. There are several varieties of wild mint available in the U.S.A. However, Austria is also a competent user of mint products in the world. The soil of Austria is suitable for the maximum growth of wild mint. African countries are showing particular interest towards growing of wild mint. Wild mint is significantly growing in Arabian countries due to the particular interest of wild mint in food purposes. The demand for wild mint is increasing every day due to the high consumption of mint essential oil. India, China, and the U.S.A. are the prominent producer of mint in the world. India has first-class varieties of mint as compared to other countries. India beats the U.S. economy in the field of mint production. America has been using a lot of its mint production in food flavoring. One million farmers of India are cultivating the mint plant in 300,000 hectares in 2006. In 2016, about two million peoples were cultivating the mint crop in a range of 300,000-600,000 hectares. America's mint price of \$25 kg $^{-1}$ and India give the mint price \$15 in 2006. Now India is providing mint at \$20-50 kg $^{-1}$ in 2016. China is the third-largest mint supplier in the world after America (Choudhury, et al., 2006). China is using most of its mint oil or menthol production to make medicines. Now, several other countries, especially Afghanistan, Pakistan, China, Iran, are also cultivating suitable varieties of mint for better production of mint oil (Alvi, et al., 2001). However, they are unable to beat India in the field of mint production due to lower yields of mint oil.

Climate resistant

Essential oil plants can be cultivated in various ecological aspects and exhibits adaptations to various climatic conditions like drought, temperature fluctuations, and nutritional misbalance. The climatic resistance of essential oil crops depends on different factors like morphological, eco-physiology, and biochemical characters (Stevovi and Calic-Dragosavac, 2010). The intensive resistant nature of *Mentha arvensis* in different climatic conditions made this plant a subject of a detailed study by scientists. Under waterlogged conditions, *Mentha arvensis* showed an extensive growth rate, which exhibits its resistance against abiotic stress. As a result of climatic stress, leaf fall and chlorosis conditions were observed and happened. These studies exhibit that *Mentha arvensis* has better adaptations and tolerant properties against climatic stress, and it can eagerly change its phenotype properties according to climatic conditions (Phukan, 2013).

Morphology

Morphology of wild mint interacts with the botany of the plant. Each part of the wild mint has shown different morphological traits. Wild mint has a roots system with low depth and multiple capillaries. A robust roots system provides long time conservation under the influence of various stress factors (Londonkar, et al., 2009). Wild mint has leaves with a strong aroma, while stem, roots, and flower are least fragrance parts of wild mint. Wild mint has square branched stems, which contains a significant amount of liquid water with a light fragrance of mint aroma. The shape of mint leaves is mostly oblong-ovate. Wild mint gets maximum maturity of flowers from September to October. The plant shows faster growth rates from April to June than other months (Trudel, et al., 1992).

Ecology

Ecology of wild mint has shown enormous biodiversity under various climates conditions. Wild mint has a strong potential to tolerate different stress. Dry leaves and stems have a huge tendency to regrow new plants in good water and nutritional soil. The dry root of wild mint grows more effectively than dry stems. The optimum temperature for the maximum growth of wild mint is 15-25 ^{0}C. Germination from fresh seeds of wild mint is not preferable and also difficult to grow a new plant. The germination rate of wild mint is observed 30-70% but depends upon the type of mint species characteristics used for germination. Soil nature, availability of water, and supported climates give healthy growth rate wild mint. Humidity, sunny and windy climates provide an excellent effect on wild mint plant growth. Tropical, temperate, sub-tropical, and less Polar Regions are the world are best places for maximum growth of wild mint. However, temperate and tropical regions are suitable habitat for wild mint (Okut, et al. 2017). The growth rate is approximately observed under a range of 50-70%. Seeds based germination of this plant is mostly done in the moist climate. The essential oil contents of Mentha have shown a huge variation with climate change. Early spring or late winter is the best climate for planting. Proper uses of fertilizers, irrigation, and pesticides are increased yield (Harbans, et al., 2009).

CHEMISTRY

Mentha arvensis has a strong aroma, and leaves of the plant have a strong aroma as compared to stem and root. It gives sweeter taste when eaten. It gives extraordinarily results in the digestive system of animals and humans. Different parts of wild mint essential oil exhibited variation of chemical composition in essential oil, especially in total phenol and flavored contents (Hussain, et al., 2011). The yield of essential oil content increases its applications at the commercial level. The essential oil of stems, leaves, and roots of *Mentha arvensis* provide good menthol. It is reported that leaves essential oil consisted of (93.7%) menthol as a major component, and minor components are menthone (1.5%), carvenone (0.7%), and isomenthone (3.2%) (Joshi, 2013). There are several other components present in *Mentha arvensis* essential oil, but menthol, menthone, carvenone, isomenthone, limonene, alpha-pinene, caryophyllene, and hexatone are considering as major components (Hussain, et al., 2010).

Chemical composition

Wild mint has a variety of flavor components and well known as a cold releasing plant worldwide. Wild mint has good nutritional value, but it is not a good source of food. It also contains amounts of the mineral, fiber, and trace elements like zinc, phosphorus, copper, and manganese. Calcium and iron are also present as a form of mineral nutritional value (Ghasemi and Mohammadi, 2013). It also contains significant amounts of vitamins such as riboflavin, folic acid, niacin, and vitamin C. It has good pharmacological uses due to excess amount of total phenolic contents (TPC) has vast properties to control damages of fungal, bacterial and viral. It is a good source of antioxidants and antimicrobial activities (Hussain, et al., 2010).

Phytochemistry

In the last few decades, photochemistry of wild mint essential oil is getting the intense attention of chemists (Rao and Lakshminarayana, 1988). *Mentha arvensis* has a strong aromatic smell due to the presence of phenolic and flavonoid contents in oil. Menthol, menthone, isomenthol, pulgone, and alpha pinene were reported as significant compounds of wild mint leaves essential oil (De Sousa Guedes, et al., 2016).

POST –HARVEST TECHNOLOGY

Harvesting is a useful step for the extraction of essential oil. Nature of harvesting machine, time, and the optimum temperature is useful assays involved for the pre-harvesting stage. Early in the morning is the best timing for the extraction of essential oil. Machine-based harvesting of mint crops gives good yield than manual harvesting due to the consumption of time and preservation of volatile components of essential oil. Similarly, harvesting in the winter season of wild mint gave a high yield of essential oil than summer harvesting. Harvesting of wild mint is done early in the morning, which gives better essential oil yield than a sunny climate of the winter. Harvesting of the wild mint crop is done in September and October. At this stage, the temperature of the climate is ambient. Flowers and leaves get maximum maturity to place the maximum volatile contents of essential oil. Harvesting in the early morning brings more chilling injury for labor (Singh and Pandey, 2018).

Transportation of mint leaves and preservation of fresh are essential steps. During the preservation process, fresh leaves and flowers lost too many essential oil contents in the storage of the freezer and icebox. In the storage of big shelter in the absence of fresh air, fresh flowers, leaves, and roots of mint turn black. On the fresh plant, many insects attack than plants show various symptoms like yellow and black coloring. Dried leaves of mint are mostly stored in polyethylene for better perseveration. Several protections are used during harvesting, packing, storage or preservation, transportation, and handling. Some industries require wild mint essential oil to make perfume, medicines, and cosmetics. However, some industries made animal feeds from the extract of leaves and mint's roots (Akram, et al., 2011).

PROCESSING

Freezers are also using to store fresh leaves in natural flavor. There are some conventional methods of storage also observed worldwide (Sharma, et al., 2003). Dropped leaves of mint in fresh water and store in dark places are also using by stores for a short time. These types of activities reduced the essential oil contents of leaves, roots, and flowers. It also controls physio-chemical processes such as oxidation, evaporation, discoloration, and dehydration. Direct interaction of sunlight with harvested wild mint changes the physical properties and chemical nature of essential oil (Gang, et al., 2001).

Stem hydro and hydro distillation are famous and low-cost apparatus that commonly used for extraction of essential oil from various mint varieties. With the process of stem hydro distillation, all parts of wild mint can be used to extract oil. When dropped fresh leaves of mint along pure water, then for heating required temperature is (100-120 ℃), and pressure is (780-1560 mmHg). Essential oil contents and liquid water converted into the gaseous phase for condensation and again converted into a liquid state to bring them at room temperature (20-300C). Oil contents are separated from liquid water and stored into a black bottle to reduce the evaporation of essential oil (Hussain, et al., 2015).

Wild mint essential oil must be stored at 200 ℃ for proper preservation. Mostly 15 to 400 ℃ temperature range is also useful to store oil in a black bottle. Similarly, dried leaves of mint are ground and stored in plastic bags at a temperature of 15-200 ℃for maximum preservation of oil before shifting to industries. When the oil is extracted from fresh leaves, roots, and flowers of mint, extracted materials are packed in big black blankets to transfer heavier industries to make useful food products. The nature of the solvent becomes an essential step for the better extraction of wild mint oil. Methanol and chloroform gave a better yield of mint essential oil than water and ethanol due to higher interaction with the volatile contents of oil (Fazal, et al., 2011).

VALUE ADDITION

Mentha arvensis is commonly used in animal food products such as feeds. All parts of wild mint gave a good amount of oil that can show effective progress in biological activities or products like perfumes, cosmetics, shampoo, and medicines, others. Wild mint oil has excellent applications in refresher products industries. Excess usage of *Mentha arvensis* oil gave side effects on mammals. The strong aroma becomes a great source of pesticides, insecticides, viricides, and fungicides. Mint oil has a strong ability to kill common pests such as wasps, ants, hornets, and cockroaches (Coutinho, et al., 2015).

USES

Wild mint gives a significant contribution toward better health and food. Mint has a good amount of mineral, carbohydrates, vitamins, protein, and water. It exhibits antifungal and antimicrobial activities' significant properties due to the presence of phenols and flavonoid contents in oil. It also becomes an essential raw material for many industries, especially cosmetics, perfumes, medicines, soaps, detergents, shampoo, and other flavor products, are most common. Cattleman also uses dried roots, stems, leaves, and flower extract powered wild mint in the form of feed for improvement of milk concentration to make good animal health, especially of their stomach. Excess of mint leaves can be reduced blood circulation in humans. Therefore, high blood pressure peoples are also using it as traditional medicines to control blood circulation (Khan, et al., 2019). Broader uses and properties of *Mentha arvensis* in different regions of world presented in Table 2.

Table 2 Broader uses and properties of *Mentha arvensis* in different regions of world

Region	Indications	Reference
Macedonia	Menthol was major component of leaves(32.47%), flowers (35.64%) and whole plant (52.53%) essential oil	Mihajlov et al., 2019
India	Menthol was main constituent of leaves (84.63%)	Derwich et al., 2010
northeastern Algeria	Menthol was reported in fresh leaves (55%) essential oil	Benabdallah et al., 2018
Oman	Menthol was major component of dry leaves (31.81%)	Al-Sabahi et al., 2016
Chennai, Tamil Nadu	Menthol present as major constituent fresh leaves (52.34%) essential oil	Arjun et al., 2017
Cuba	Menthol was major components of leaves essential oil (51.68%)	Pino et al., 1996
Kumaon Region of Western Himalaya	Menthol was effective and major part leaves essential oil (20-40%) at various places of western regions	Verma et al., 2010
India	Menthone(13.03%) and menthol (14.64%) were present in greater proportions in aroma parts of plant	Machale et al.,1997.
Iran	Drought resistant species	Haydari et al., 2019
Pullman	Climatic resistant cultivars is an important component of Verticillium wilt management.	Dung et al., 2010
Japan	Essential oils repressed the proliferation of each strain in liquid culture.	Imai et al., 2001
India	Anti-allergic and Anti-inflammatory Activity, Antifertility Activities, Antibacterial Activities, Antioxidant Activities and Active Constituent	Thawkar et al., 2016
India	Possess abortifacient property	Aggarwal & Kunnumakkara, 2009.
Australia	Decoctions were used to treat colds and coughs. Plant is also used as an abortifacient	Tang et al.,2016

General uses

It is used as a fragrance element in detergents and also used in aromatherapy. The leaves, as well as the oil of these plants, are used in kinds of toothpaste and mouthwashes. It can also be used to reduce toothaches and swellings of gum. It can alleviate mouth ulcers, toothache, and swollen gum. Wild mint leaves to water is using to wash out the injection of diseases. Fresh leaves of mint are a useful source for repellent of fungal and bacterial. In general uses, wild mint is divided into numerous applications such as health, food, medicines, cosmetics, and perfumes that are most common in the world (Phatak et al., 2002). The mint-flavored leaves are used as an herb in various cuisines. Sometimes raw leaves are added to salads and other preparations to add flavor to the food. Dried leaves are used to make herbal tea. The oil extracted from these plants is used as a flavoring agent for beverages and sweets. Due to carbohydrates nature, mint juice is watching or drinking every juice corner. It is also adding to improve sweetness and flavor juices of apple and strawberry. Concentrate roots oil of mint is using to make several products of whiting creams and cosmetics. It also removed spots from the human body (Rech et al., 1986).

Pharmacological uses

Menthol mint has known as a great medicinal herb in medical history. It shows a progressive report in medicines, especially in pharmacological uses. Recently, various methods of menthol extraction are developed for maximum menthol extraction. Menthol gives much diversity, mainly in foods, industrial, and medicinal are most commonly these days. In the last few decades, menthol becomes a famous compound for the preparation of flavors, fragrance, pharmaceutical, and cosmetics industries (Chand et al., 2004). *Mentha arvensis* exhibited strong pharmacological applications as an antioxidant, antifertility, anti-hepatoprotective, antibacterial, antifungal, antimicrobial, anti-inflammatory, and anti-viral and others. Research data of wild mint essential oil showed that it is exhibited strong biological application due to the presence of phenolic and flavored contents essential (Thawkar, 2016).

1 Antioxidant activity

The methanolic root extract of *Mentha arvensis* exhibited significant antioxidant activity due to the presence of flavonoid and phenolic compounds into *Mentha arvensis* extract. The methanolic root extract of *Mentha arvensis* is an effective and low-cost source for an antioxidant activity that can be applied to control several diseases (Dar et al., 2014).

2 Antifertility activity

Petroleum ether leaves extract of *Mentha arvensis* has effective and significant antifertility activity. The antifertility activity was tested against mature albino mice. On different days, various doses concentration 10 and 20 mg per mouse per day were used for 20, 40, and 60 days. The administered orally showed that a dose-dependent and observed reduction in the number of offspring of the treated male mated with normal females. Negative fertility of albino mice was observed in both dose concentrations after 60 days of treatment. The bodyweight of albino was remaining unaffected. Moreover, results showed that a significant reduction was observed in the weight of the testis, cauda epididymal sperm count, epididymis, viability, viability, and normal morphology of the spermatozoa. Whereas the levels of serum protein G.O.T., bilirubin, G.P.T., blood urea, and hematological indices were remaining the same throughout the investigation. All the altered parameters were reversible following the withdrawal of treatment. The petroleum ether extract of the leaves of M. arvensis exhibited reversible antifertility activity without adverse toxicity in male albino mice (Sharma and Jacob, 2001)

3 Anti-hepatoprotective activity

Chloroform, ethanol and aqueous extracts of *Mentha arvensis* leaves showed hepatoprotective activity. This activity was tested against CCl4 induced liver damage in rats. CCl4 was increased hepatotoxicity in the liver of rats and studied changes in serum glutamate pyruvate transaminase (sGPT), serum bilirubin (sB) serum glutamate oxaloacetate transaminase (sGOT) and histopathological alkaline phosphatase (sALP) along with silymarin as standard Hepatoprotective agents. The flavonoids, steroids, triterpenoids, alkaloids, glycosides, carbohydrates, tannins, phenolic compounds of *Mentha arvensis* leaves extracts might be responsible. The results showed that various solvents extracts of *Mentha arvensis* became a cause in a significant reduction in the values of sGOT, sGPT, sALP, and sB ($P < 0.01$) almost comparable to the silymarin. The Hepatoprotective activity was determined by histopathological examination. At last, the results showed that *Mentha arvensis* exhibited strong hepatoprotective activity against CCl4 induced liver damage in rats (Patil and Mall, 2012).

4 Anti-allergic and anti-inflammatory diseases

Allergic diseases have been noticed worldwide due to several reasons. He was reported that the spreading rate of allergic diseases was much higher than other common diseases. It was all due to the increasing growth rate of pathogenic in our favorable pollute environment. The aqueous and organic extracts of *Mentha arvensis* leaves, roots, and stems were used for the determination of anti-allergic and anti-inflammatory activities. These extracts were tested on animals. The results showed that all tested parts of *Mentha arvensis* showed conclusively against allergic and inflammatory diseases at higher concentrations. It is all due to the presence of secondary phytochemicals in significant concentration. All these results showed that this plant was supported for the preparation of ethnomedicine (Malik et al., 2012).

5 Antibacterial activity

Fresh leaves of *Mentha arvensis* showed strong antibacterial activity due to the phytochemical presence in hydro-distilled essential oil. *Mentha arvensis* exhibited a good 0.71% essential oil yield. The antibacterial activity was tested in vitro on gram-positive bacteria (Staphylococcus aureus, Bacillus subtilis, and Streptococcus pyogenes) and gram-negative bacteria (Escherichia coli and Pseudomonas aeruginosa) using agar disc diffusion assay and minimum inhibitory concentration (M.I.C.) was also determined. The pathogens were sensitive to the oil and showed highly effective antibacterial activity with the maximum inhibition zone against S. aureus (22.33 ± 1.15 mm). The minimum inhibitory concentration (M.I.C.) of the oil was higher against gram-positive bacteria than gram-negative bacteria. The results indicate that the fresh leaves oil of M. arvensis has high potential as an antibacterial agent for both pharmaceutical and pesticide industries. The gas chromatography-mass spectrometry (GC-MS) and the gas chromatography-flame ionization detector (GC-FID) were used to determine the chemical composition of *Mentha arvensis* essential oil. They displayed that monoterpenes, oxygenated derivatives with menthol compounds as major components. These compounds might be responsible for antibacterial activity (Bokhari et al., 2016).

The study of *Mentha arvensis* showed that isopropyl alcohol petroleum ether and acetone extract of *Mentha arvensis* leaves exhibited good antibacterial activity. Sixty-three urine samples of different patients were collected in various hospitals in India. These collected samples were used to explain antibacterial activity against different doses of wild mint essential. Antibacterial activity was tested against organism Proteus mirabilis and MTCC 442 strain. Various doses concentration from 0.97mg/ml to 250mg/ml was used. The resulted of wild mint showed significant antibacterial activity against tested organisms. Various active components, such as the total phenolic content of extract, may be responsible for effective antibacterial activity (Srinivas and Arun, 2012).

Another study of *Mentha arvensis* (wild mint) showed that ethanol extract *Mentha arvensis* has exhibited significant antibacterial activity properties. This unique type of activity was tested against multi-drug resistant Acinetobacter baumannii. Disc diffusion and Micro-dilution methods were used for the determination of the antibacterial activity in wild mint extract. The minimum inhibitory concentration (M.I.C.) and minimum bactericidal concentration (M.B.C.) methods were used to determine the zone of inhibition of the extract against the test bacteria. The ethanol extract of *Mentha arvensis* (wild mint) showed dose-dependent growth inhibitory effects against A. baumannii with M.B.C. and MIC 72.1 and 23.5µg/mL respectively. The results showed that the ethanol extract of *Mentha arvensis* was a potent antibacterial activity against A. baumannii (Zhang et. al., 2015).

6 Antimicrobial activities

Mentha arvensis was containing menthone, iso-menthone, l-menthol, dementholated oil, Mentha monoterpenes, and menthol liquid. Microbial, including bacterial and fungal, and others were increasing diseases in the world. Menthol was used to synthesize seventeen compounds and check their antimicrobial activity against 12 bacteria and nine fungal strains. The essential oil as derivatives of menthol showed inhibition of diseases, which became a cause of microorganisms (Kumar et al., 2011).

Wild mint had been applied as antispasmodic, antiseptics, analgesic, and carminative in the Unani system of medicine was an old traditional medicinal system that produced lager medicines from Plants. The active components of *Mentha arvensis* essential oil, mainly phenolic and flavonoid contents, were primarily responsible for the antibacterial, antifungal, and many other pharmacological activities (Akram et al., 2011).

7 Anti-atherothrombotic activity

Atherothrombotic diseases are common disorders that are treated by urokinase (U.K.) and streptokinase (S.K.). They are highly costly. More ever, we are commonly using plant-based drugs because they are cheap, low side effects, safe and effective against many diseases.

Determined the catalysis effect and cyto-toxic effects of *Mentha arvensis*, Streptokinaseas were used as a positive control, and water was used as a negative control. In this study, various solvents extracts of *Mentha arvensis* were used, including ethanol, methanol, acetone, and chloroform. The methanol, ethanol, chloroform, and acetone were showed clot lysis activity 32.56%, 32.04%, 31.87%, and 30.29%, respectively. From these results, the methanol extract of *Mentha arvensis* showed maximum cloth lysis. The cytotoxic assay of methanol extract of M. arvensis showed LC50 value s of 2.088. This result was compared with standard reference Vincristine sulfate. The results showed that the various extract of M. arvensis had clot lysis activity and low cytotoxic activity (Shahik et al., 2014).

CONCLUSION AND RECOMMENDATIONS

Wild mint is not an annually growing plant and belongs with family Lamiaceae and genus Mentha. It has been cultivated in the world at a suitable time, especially at the end of summer. It has a strong potential to abiotic stresses and has been used as medicines thousands of years ago. It exhibited significant potential for food flavoring, essential oil applications. Mostly *Mentha arvensis* contains menthol as the major content of mint essential oil. The extent and concentration of chemical constituents of an essential oil vary, and it depends on the type of species or cultivars as well as cultivation conditions such as weather, irrigation, soil type, pruning, and other agronomic practices. Oil and demand for menthol and mint essential oil are becoming an essential component of several industrial applications such as perfumes, cosmetics, toothpaste, drugs, shampoo, soaps, and food. Menthol or mint essential oils are using as raw sources for the preparation of several by-products. Post harvesting process, preparation, processing, and extraction of essential oil methods are most traditional in under-developing countries. However, developed countries are made good and useful apparatus that are using in these processes with less effort with much of time also. Further research on oil extraction methods, maximizing yield per hectare, and optimum preservation are needed, especially in post-harvesting of leaves, flowers, and roots are conventional.

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