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Podina (*Mentha arvensis*): Transformation from Food Additive to Multifunctional Medicine

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Abstract: *The use of herbal drugs is as old as human beings. Podina or Mentha arvensis Linn (MA) belonging to the family Lamiaceae is a common edible and aromatic perennial herb which is cultivated throughout India. It is widely used in pharmaceutical, cosmetic and flavoring industries. Unani physicians had described a number of types of Podina. They extensively used it for various human ailments as is evident from ancient Unani classical literature. In recent times a lot of scientific studies have been performed on MA namely phytochemical, physicochemical, pharmacological and clinical studies. In this review, an effort has been made to provide information on medicinal properties of MA mentioned in Unani classical literature as well as those which have been validated in the light of recent scientific studies and supports the potential of MA as a promising health promoting herbal plant. Hence, more researches can be done to exploit the unexplored potentials of MA which have already been mentioned in Unani classical literature.*

Keywords: Podina, *Mentha arvensis*, Unani System of medicine.

1. INTRODUCTION

The medicinal plants are being therapeutically exploited throughout the world for treating various ailments, and it is the oldest and the safest method to manage or cure illness. The use of herbal drugs is as old as human beings. It is presumed that an encounter with a substance of medicinal value became known after birth of human on this planet. *Mentha arvensis* Linn (MA) in one such herb belonging to the family Lamiaceae and is a common edible and aromatic perennial herb cultivated throughout India. It is widely used in pharmaceutical, cosmetic and flavoring industries (Sharma *et al*, 2001). *Mentha* species have been known to man for a long time and are used in all continents of the world. They are known as kitchen herb from immemorial times. They have been found in Egyptian graves and are described in the ancient literature. Regular cultivation of MA on a large scale started around 1870 in Japan. Commercial establishment of MA cultivation in India was brought about by the joint cooperation of the Government of India's research laboratories and entrepreneurial spirit of the industry. MA was first brought to India by Col. R. N. Chopra and I. C. Chopra of the Regional Research laboratory, Jammu, in 1952, from Japan through the courtesy of United Nations Educational, Scientific and Cultural Organization (UNESCO) (Chand *et al*, 2004).

2. ETHNO-PHARMACOLOGICAL DESCRIPTION

It is a well known aromatic plant in Unani System of Medicine and some Unani scholars called it *Misni* (Baitar, 2003). The Unani scholars knew about this plant and described its three varieties *jungli*, *pahari* and *bustani*. During the medieval period, the Arab scholars described its three more types i.e. *barri*, *kohi* and *nehri*. Later on, the Unani physicians added a few more types. It is an exotic herb not known to the Ayurvedic physicians. Hence, it finds no mention in the Ayurvedic classical literature (Ghani, ynm).

According to the classical literature, it has an erect stem which is quadrangular and slightly whitish in appearance and about 1ft tall. The leaves are oval having toothed margins and very aromatic. Leaves

are minutely hairy especially on lower side. Flowers are small, slightly reddish and blossom in the months of July and August. Its seeds resemble the seeds of *rehan* (Ghani, ynm).

The parts used for medicinal purpose are mainly leaves and stems (Anonymous, 1997). Specimen of fresh Podina leaves is shown in figure 1. The Mizaj (temperament) of this plant described in Unani classics is Hot and dry in second degree. (Anonymous, 2008; Sina, 2007; Kabiruddin, ynm). But, according to some scholars it is Hot and dry in third degree (Anonymous, 1997; Baitar, 2003; Ghani, ynm; Khan, 1892; Momin, ynm).

Fig. 1. *Podina* leaves

3. MORPHOLOGICAL DESCRIPTION

The scientific classification of MA is given below in table no. 1 (Chawla & Thakur, 2013). It is a perennial herb, mainly sowed in February-March. The stem is dark green, quadrangular, 60-90 cm high, bearing opposite leaves at each node. The internode region is smooth and striated. The twigs are 11 cm to 22 cm long bearing 6-9 nodes. Leaf base is exstipulate, petolate; petiole size 0.8 cm to 1.8 cm in length and 0.9 to 1.8 mm in breadth. Lamina surface shows hairs which are 5-celled, unbranched, moderately thick walled with warty surface, length 780 micron. Lamina composition is simple, incision absent, elliptical shape, reticulate venation, serrate margin, acute apex, lamina base symmetrical with tapering base, surface hirsute, green in colour, texture coriaceous, lamina length is variable ranging from 3-7 cm while the breadth ranges between 1 to 2.5 cm. The plant gives a sharp peppermint odour and has a pleasant acrid taste. Flowers are small purplish and arranged in loose cylindrical pattern with slender spikes. Seeds are small and mucilaginous (Anonymous, 2008; Anonymous, 1997; Kirtikar & Basu, 2005).

Table no. 1. *Scientific classification of MA*

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Order	Lamiales
Family	Lamiaceae
Genus	*Mentha*
Species	*arvensis*

It is a native of temperate northern and western Himalayas and Kashmir at the altitude of 5,000-10,000 ft., Punjab, Kumaon, Garhwal, Europe, North and West Asia, China and Japan. Now it is mostly cultivated in gardens and fields especially gardens in Konkan. Owing to commercial value of *Mentha* oil, menthol and peppermint, it has become a cash crop and widely cultivated in the western U.P. (Anonymous, 1997; Chopra *et al*, 1992; Kirtikar & Basu, 2005; Nadkarni, 1994).

4. MICROSCOPIC DESCRIPTION

The transverse section (T.S.) of the stem shows a quadrangular smooth outline. Epidermis is single layered covered with a cuticle layer. A group of annular collenchymatous cells are present below the epidermis in each of the four angles of the stem. The cortex is parenchymatous. Outer cortical cells have chloroplast. Vascular tissue is aggregated in four groups opposite the four corners which gradually thins out towards the sides. The centre consists mostly of parenchyma (Anonymous, 1997). T.S. of midrib of leaf shows protruded midrib towards the lower surface, compact parenchymatous cells, enclose a crescent shaped vascular bundle. Lamina is dorsiventral, epidermal cells of both surfaces are wavy, stomata diacytic, uniseriate, 1 to 4 cells long, 42 to 350 micron in size with pointed apex. Palisade ratio is 6 to 8, vein islet number 18 to 20 , stomatal index for upper epidermis 10 to 20, lower epidermis 15 to 30 (Anonymous, 2008).

5. ACTIONS AND THERAPEUTIC USES OF PODINA

Various actions and clinical indications of Podina are given below in table no. 2.

Table no. 2. *Actions and clinical indications of Podina.*

Actions and Clinical Indications	Reference
Kasir-e-riyah (Carminative), *Nafakh-e-shikam* (Flatulence)	Anonymous, 2008; Anonymous, 1992; Chopra *et al*, 1992; Kirtikar & Basu, 2005; Nadkarni, 1994; Anonymous, 1997; Wyk and Wink, 2004; Momin, 1850; Khare, 2007; Hakim, 2002
Muqawwi-e-meda (Stomachic), *Zof-e-meda* (Weakness of stomach)	Anonymous, 2008; Chopra *et al*, 1992; Kirtikar & Basu, 2005; Nadkarni, 1994; Khan, 1892; Momin, 1850
Mudir-e-baul (Diuretic), *Ehtebas-e-baul* (Anuria)	Anonymous, 2008; Chopra *et al*, 1992; Kirtikar & Basu, 2005; Anonymous, 1997
Mudir-e-tamas (Emmenagogue), *Ehtebas-e-tamas* (Amenorrhoea)	Anonymous, 2008; Chopra *et al*, 1992; Kirtikar & Basu, 2005; Nadkarni, 1994; Anonymous, 1997
Daafe qai (Antiemetic), *Ghisyan* (Nausea), *Qai* (Vomiting)	Khan, 1892; Momin, 1850; Ghani, ynm
Muattir (Aromatic)	Nadkarni, 1994; Ibn Sina, 2007
Munzij-e-mawad-e-ghaleez (Concoctive)	Anonymous, 2008; Momin, 1850; Ibn Sina, 2007
Musakkin-e-alam (Analgesic), *Waja-ul-mafasil* (Arthralgia/ Joints pain), *Asabi dard* (Neuralgia), *Suda* (Cephalgia)	Anonymous, 2008; Nadkarni, 1994; Anonymous, 1997; Khan, 1892; Momin, 1850; Ibn Sina, 2007
Ishal (Diarrhoea)	Anonymous, 2008; Nadkarni, 1982; Anonymous, 1997
Qatil-e-kirm (Anthelmintic)	Anonymous, 2008; Khan, 1892; Momin, 1850; Hakim, 2002
Haiza (Cholera)	Anonymous, 2008; Khan, 1892; Anonymous, 1997; Momin, 1850; Ghani, ynm; Hakim, 2002
Mushtahi (Appetizer)	Khan, 1892; Momin, 1850; Ghani, ynm; Ibn Sina, 2007; Hakim, 2002
Dafe taffun (Antiseptic)	Anonymous, 2008; Anonymous, 1997; Wyk and Wink, 2004
Muharrik (Stimulant)	Anonymous, 1992; Chopra *et al*, 1992; Kirtikar & Basu, 2005; Nadkarni, 1994
Hazim (Digestive), *Su-e-hazm* (Dyspepsia)	Anonymous, 1992; Khan, 1892; Momin, 1850; Anonymous, 1997; Ghani, ynm; Ibn Sina, 2007; Hakim, 2002
Amraz-e-kabid (Ailments of liver), *Yarqan* (Jaundice), *Istisqa* (Dropsy)	Kirtikar & Basu, 2005; Anonymous, 1997; Khan, 1892; Ghani, ynm; Momin, 1850
Amraz-e-tihal (Ailments of spleen)	Kirtikar & Basu, 2005
Dafe tashannuji dard (Antispasmodic)	Chopra *et al*, 1992; Kirtikar & Basu, 2005; Nadkarni, 1994
Mubarrid (Refrigerant), *Hummiyat* (Pyrexias)	Chopra *et al*, 1992; Kirtikar & Basu, 2005; Wyk and Wink, 2004
Nafs-ud-dam (Haemoptysis)	Khan, 1892; Momin, 1850
Munaffis (Expectorant), *Warm-e-shobatur-riya* (Bronchitis), *Dama* (Asthma)	Kirtikar & Basu, 2005; Khan, 1892; Ibn Sina, 2007; Khare, 2007

Fawaq (Hiccup)	Khan, 1892; Nadkarni, 1994; Momin, 1850; Ghani, ynm
Muqawwi e kulya (Renal tonic)	Kirtikar & Basu, 2005
Muarriq (Diaphoretic)	Kirtikar & Basu, 2005
Muqawwi-e-qalb (Cardio-tonic), *Khifqan* (Palpitation)	Khan, 1892; Ghani, ynm
Mufarreh (Exhilarant)	Khan, 1892; Momin, 1850; Ibn Sina, 2007
Anti bacterial	Khare, 2007; Wyk and Wink, 2004
Anti fungal	Khare, 2007; Wyk and Wink, 2004
Musqit-e-janeen (Abortifacient)	Khare, 2007
Muraqqiq-e-dam-e-ghaleez	Khan, 1892; Momin, 1850
Khuraj wa Dubila (Abscess)	Khan, 1892
Muhallil (Resolvent)	Khan, 1892; Momin, 1850; Ghani, ynm
Khanazir (Parotitis)	Khan, 1892; Ghani, ynm
Mushil-e-safra (Cholagogue)	Khan, 1892; Wyk and Wink, 2004; Khare, 2007
Warm-e-pistan (Mastitis)	Khan, 1892; Momin, 1850
Qabiz (Astringent)	Khan, 1892; Momin, 1850; Ghani, ynm
Mulattif (Demulcent)	Khan, 1892; Momin, 1850; Ghani, ynm; Ibn Sina, 2007; Hakim, 2002
Mujaffif (Desiccant)	Khan, 1892; Momin, 1850; Ghani, ynm
Anti implantation	Khare, 2007
Muqawwi-e-bah (Aphrodisiac)	Khan, 1892; Momin, 1850

6. ADVERSE EFFECTS AND TOXICITY

It is non-toxic, hence, no processing is required (Anonymous, 1997). The Research Institute for Fragrance Materials (RIFM) and the joint FAO/ WHO Expert Committee on Food Additives has reviewed the available data on toxicity of menthol and its isomers and concluded that they were not genotoxic, teratogenic or carcinogenic. Flavour and Extract Manufacturer's Association (FEMA) has assessed the use of menthol as flavor ingredient and reported that menthol isomers exhibit very low acute, sub-chronic and chronic toxicity (Chawla & Thakur, 2013).

7. ADULTERATION

Adulteration of MA with *Mentha pulegiton* (pennyroyal) may occur from wild crafting (Bone & Mills, 2013). Initially the oil of MA was reported to be adulterated with various oils such as camphor oil, cedar wood oil, balsam oil, eucalyptus oil, sandalwood oil, castor oil, mineral oil, paraffin oil, etc. Later on with the advent of chromatographic techniques, the addition of synthetic compounds was ceased and use of de-mentholised oil or oil of inferior mint species was noted (Chawla & Thakur, 2013). In India, adulteration of MA oil by field distillers has been observed occasionally. Sometimes cottonseed oil is used for this purpose (Pruthi, 1998).

8. SCIENTIFIC STUDIES ON MA

I. Phytochemical Studies

Organic constituents include glycosides, phenolics/tannins, proteins, reducing sugars, resins and steroids/terpenoids. The volatile oil contains menthol as main constituent. The leaves yield about 0.2 - 0.8% essential oil. According to the monographs of International Pharmacopoeia (I.P.), various constituents are limonene (1.0-5.0%), cineole (3.5-14.0%), menthone (14.0-32.0%), menthofuran (1.0 -9.0%), isomenthone (1.5-10.0%), menthyl acetate (2.8-10.0%), isopulegol (max. 0.2%), menthol (30.0-55.0%), pulegone (max. 4.0%) and carvone (max. 1.0%). Inorganic chemical constituents include antimony, calcium, iron, magnesium, potassium and sodium (Anonymous, 2008; Anonymous 1998; Anonymous, 1997; Chopra *et al*, 1992; Alankar, 2009).

In researches carried out at the Calcutta School of Tropical Medicine shows that the amount of essential oil obtained from the whole dried plant from Kashmir was 0.18 – 0.2%. It is likely that specimens of fresh herb will give higher percentage of oil as some authorities state that the drying of herb before distillation results in a loss of 50% of the oil. It has also been found by the U.S.A. Dept. of Agriculture researches that if the leaves are collected during the budding and flowering stages, the yield of oil on distillation is much higher than obtained otherwise (Nadkarni, 1994).

In a study, the GCMS analysis of MA extract revealed the presence of Eucalyptol, Isomethone, Linalool, methnol, 4-Terpineol, OleicAcid, Tetradecanoic acid, 12-methyl-, methyl ester, Hexadecanoic acid, (Palmitic acid) methyl ester (Dwivedi *et al*, 2012).

In another study, the volatile oil composition of MA showed the presence of various components namely dl-Limonene, Eucalyptol, α-Pinene, δ-3-Carene, α-Phellandrene, Octyl cyclobutanecarboxylate, 3-Octanol, L-Menthone, *cis*-Sabinene hydrate, Isomenthone, Linalool, neo-Menthol acetate, *trans*-Caryophyllene, neo-Menthol, 4-Terpineol, Menthol, *trans*-Anethole, δ-Terpineol, 2-Acetylfuran, α-Terpineol, *cis*-Piperitone oxide, Isomenthone, 5-Isopropyl-6,7-epoxy-8-hydroxy-8-methylnon-2-one, 2,6,6-Trimethyl-cyclohex-1-enecarboxylic acid, 3-Methyl-3-(4-methyl-3-pentenyl)-oxiranemethanol, Caryophyllene oxide and 2,5-Dimethyl-3-hexyne-2,5-diol (Sharma *et al*, 2009).

II. Physicochemical Studies

Foreign matter	:	Not more than 2%
Total ash	:	Not more than 14%
Acid insoluble ash	:	Not more than 4%
Alcohol soluble extract	:	Not less than 2%
Water soluble extract	:	Not less than 7%
Essential oil	:	Not less than 0.2%
Loss on drying at 105˚C	:	5.66%
Solid contents	:	72.01%
pH	:	6.5

(Anonymous, 2008; Anonymous 1998; Anonymous, 1997, Gupta *et al*, 2010)

III. Pharmacological Studies

- **Antioxidant activity**

In a study, the analysis of antioxidant activity of methanolic and aqueous extracts of MA was done using free radical scavenging assays like DPPH, FRAP, SO, NO and H_2O_2. The presence of greater amount of phenolic compounds lead to a more powerful radical scavenging effect as was shown by methanolic extract of the leaves when compared to the aqueous extracts. MA showed significant concentration of phenols and thus good activity against deleterious oxidants (Garg *et al*, 2012).

In another study, the *in vitro* antioxidant activity of ethanolic extract of MA was investigated using DPPH radical scavenging assay and the extract showed free radical scavenging activity in assay (IC_{50}~41 µg/ml) compared to the standard antioxidant ascorbic acid (IC_{50}~19 µg/ml) (Biswas *et al*, 2014).

Another study was carried out to evaluate the antioxidant potential of methanolic root extract of MA from Kashmir region by using 1, 1-diphenyl, 2-picrylhydrazyl (DPPH) scavenging, reducing power, metal chelating, nitrous oxide scavenging and hydrogen peroxide scavenging assays. The results indicated that the methanolic root extract of MA has good antioxidant potential (Dar *et al*, 2014).

- **Antimicrobial activity**

In a study, 63 urine samples were collected from Urinary tract infected patients and were subjected to microscopic observation and biochemical characterization to identify the presence of bacteria. The *Proteus mirabilis* were isolated on specific medium using XLD (xylose lysine deoxycholates agar deficient), Macconkey agar, Mullen hinton agar, CLED and UTI agar. The positive isolate was used for the study. Leaves of MA were extracted by using acetone, isopropyl alcohol and petroleum ether. A comparative study on the total antibiotic activity of plant extracts was found to be effective against the tested isolated organism *Proteus mirabilis* and MTCC 442 strain. Minimal Inhibitory Concentration (MIC) and Minimal Bactericidal Concentration (MBC) were performed by agar dilution method. The result showed that plant extract of MA showed high antibacterial activity against tested organism (Pidugu *et al*, 2012).

In another study, crude extract of MA in different solvent 50% and 10% methanol, ethyl acetate, chloroform was obtained and was tested against human Cariogenic pathogens *Streptococcus mutans, Streptococcus sangunis, Staphylococcus aurues, Lactobacillus casei*, which were isolated from patients having dental disease. The crude extracts activity was studied by disc diffusion and both dilution methods in different concentration. MIC results exhibited the profound and promising activity of MA (Dwivedi *et al*, 2012).

In a study, cytotoxic potential of ethanolic extract of MA was investigated. The anti bacterial activity was studied by disc diffusion assay against some Gram-positive and Gram-negative bacterial strains. Brine shrimp lethality assay was used to investigate cytotoxity effects of the plant extract. The extract produced prominent antimicrobial activity against *Salmonella typhi*, *Salmonella paratyphi*, *Shigella boydii*, *Streptococcus pyogenes* and *Staphylococcus aureus* compared to standard drug kanamycin. The extract exhibited lethality against the brine shrimp nauplii with the LC_{50} values of 40 µg/ml, and also 90% mortality (LC_{90}) value was found to be 160 µg/ml (Biswas *et al*, 2014).

In another study, *in vitro* evaluation of the antimicrobial effects of essential oil of MA for a possible application to reduce the content of microorganisms in the air of animal farms was done. The essential oil of MA was screened against bacteria *Staphylococcus aureus*, *Enterococcus faecium*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Proteus mirabilis* and *Candida albicans*. The MIC of the essential oil was tested using broth dilution assay. The oil showed a wide spectrum of antibacterial activity (Mickiene *et al*, 2011).

In another study, The anti-bacterial efficacy of chloroform, ethanol, ethyl acetate and water extracts of inter-nodal and leaves derived calli extracts from MA against *Salmonella typhi, Streptococcus pyogenes, Proteus vulgaris* and *Bacillus subtilis* was determined by disc diffusion method and incubated for 24 h at 37°C. The ethanol extracts of leaves derived calli showed the maximum bio-efficacy than other solvents. It was concluded that the calli mediated tissues showed the maximum zone of inhibition (Johnson *et al*, 2011).

- **Antifertility activity**

In a study, a uterotonic fraction of MA (UM-fraction) was tested for antifertility effect in rats. Subcutaneous administration of the UM-fraction to rats pregnant from day 1 to day 10 caused a significant interruption in pregnancy. The effect was pronounced during the post-implantation period (Kanjanapothi *et al*, 1981).

In another study, alcoholic extract of leaves of MA at a dose of 100mg/kg and 500 mg/kg showed 80 and 100% inhibition of implantation respectively in female rats. The alcoholic extract of leaves also showed encouraging anti-ovulatory activity in rabbits (Rastogi and Mehrotra, 1999).

Recent study shows that uterotonic fraction of MA has anti-implantation activity by enhancing the estrogenic effect of estradiol as it contains menthol, menthone, camphene (Khan *et al*, 2016).

- **Antiemetic activity**

In a research study, the efficacy of oil of MA as a treatment for postoperative nausea was investigated. The study demonstrated that inhalation of oil vapors significantly reduced postoperative nausea and the requirement for pharmacologic antiemetics following gynecologic surgery (Tate, 1997).

- **Antidepressant activity**

In this study, aqueous and methanol extracts of MA were investigated for antidepressant activity by Tail suspension and Forced swim test in Swiss albino mice. Fluoxetin was used as a positive control. It was concluded that Methanol extract of MA showed significant antidepressant activity as compared to aqueous extract (Tupe *et al*, 2010).

- **Analgesic activity**

An *in vivo* study was conducted to investigate the analgesic activity of ethanolic extract of MA by acetic acid-induced writhing test in Swiss albino mice. The extract demonstrated statistically significant analgesic effect in mice (Biswas *et al*, 2014).

- **Anti allergic activity**

In this study, the anti-allergic activity of ethanolic and aqueous extracts (leaves, stem and roots) of MA was determined by histamine release inhibition test. The inhibitory effect on histamine production by mast cells was evaluated using a modified method reported previously and was compared with standard drug, disodium cromoglicate. Results revealed that ethanolic extracts of leaf and root possessed marked inhibitory activity (Malik *et al*, 2012).

- **Anti inflammatory activity**

Anti-inflammatory activity of ethanolic and aqueous extracts of MA was determined by histamine induced paw edema in mice. The effects of extracts were tested and compared with standard drug, diclofinac sodium. All ethanolic extracts of leaves, stem and roots showed more pronounced anti-inflammatory effect as compared to their respective aqueous extracts. (Malik *et al*, 2012).

- **Anticataleptic activity**

In the study, the protective effect of the aqueous extract of MA on haloperidol induced catalepsy in mice was found, by employing the standard bar test and the assessment of the locomotor activity. The effects of the test drug, MA and the standard drug, trihexyphenidyl were assessed after their repeated dose administration in mice for fourteen days, 30 minutes prior to the administration of haloperidol. The mice were sacrificed on the fourteenth day and the TBARS, glutathione, SOD and the catalase activities in their brain tissues were estimated. A significant reduction in the cataleptic scores was observed in the test drug treated groups as compared to the toxic control. The study suggested that MA had significantly reduced the oxidative stress and the cataleptic score which was induced by haloperidol (Ahmad *et al*, 2012).

- **Radioprotective activity**

In this study, the radioprotective effect of various doses of MA on the survival of mice exposed to various doses of whole-body gamma radiation was evaluated. The 10 mg/kg of MA extract was found to afford best protection as evidenced by the highest number of survivors at 30 days post-irradiation. Further radiation-sickness and mortality up to 30 days post-irradiation was also observed. The MA extract pretreatment was found to reduce the severity of symptoms of radiation sickness and mortality at all exposure doses and a significant increase in the animal survival was observed (Jagetia & Baliga, 2002).

- **Anticancer activity**

In a study, ethanolic extract of MA was studied for the *in-vitro* cytotoxicity against Human liver cancer (Hep G2 cell line). The results demonstrated that MA significantly suppresses growth and induces apoptosis in Hep G2 cell lines by MTT assay (Chandan *et al*, 2014).

In another study, *in-vitro* anticancer potential of methanolic and aqueous extracts of whole plants of *Mentha arvensis, M. longifolia, M. spicata* and *M. viridis* was evaluated against eight human cancer cell lines — A-549, COLO-205, HCT-116, MCF-7, NCI-H322, PC-3, THP-1 and U-87MG (from six different origins (breast, colon, glioblastoma, lung, leukemia and prostate) using sulphorhodamine blue (SRB) assay and it was concluded that Methanolic extracts of above-mentioned *Mentha* Spp. displayed anti-proliferative effect against four human cancer cell lines, namely COLO-205, MCF-7, NCI-H322 and THP-1; however, aqueous extracts were found to be active against HCT-116 and PC-3 (Sharma *et al*, 2014).

- **Anti ulcerogenic activity**

A study was done to examine the antiulcerogenic effects of various extracts of MA on acid, ethanol and pylorus ligated ulcer models in rats and mice. Aqueous, petroleum ether and chloroform extracts of MA were used. It was concluded that various extracts of MA clearly showed a protective effect against all ulcer models (Londonkar *et al*, 2009).

IV. Clinical Studies

- A randomized, double-blind clinical trial was conducted to determine the efficacy of Mentha species in preventing chemotherapy-induced nausea and vomiting (CINV). Prior to the study, patients were randomly assigned into four groups to receive the test drug. The treatment and placebo groups

applied essential oils of *Mentha* or a placebo, while the control group continued with their previous antiemetic regimen. The results showed a significant reduction in the intensity and number of emetic events in the first 24 hour with *Mentha* in both treatment and placebo groups when compared with the control, and no adverse effects were reported. The cost of treatment was also reduced when essential oils were used (Hassanzadeh *et al*, 2013).

- In a single blind, randomized placebo controlled study, the efficacy of Tukhme Sambhalu (*Vitex agnuscastus*) and Arq Podina in the management of *Mutlazima Qabl Haiz* (Premenstrual Syndrome) was evaluated and it was concluded that the test drugs were effective in reducing the somatic and psychological symptoms of *Mutlazima Qabl Haiz* (Premenstrual Syndrome) as compared to placebo (Hafeeza *et al*, 2014).

9. CONCLUSION

With the increasing health consciousness day by day and with increasing side effects of conventional therapies, the trend is shifting towards non-conventional systems of medicine namely Unani tib. In recent years, there has been a growing interest in the nutraceutical potential of various plants which provide health benefits other than their nutritional benefits. Thus, the use of herbal plants like MA is rapidly gaining momentum. Traditionally, MA has been used for both culinary as well as medicinal purposes. Incorporation of MA in diet will provide various health benefits as discussed earlier. This review provides extensive information on the medicinal uses of MA and supports the potential of MA as a promising health promoting herbal plant. Hence, more researches can be done to exploit the unexplored potentials of MA which have already been mentioned in Unani classical literature. Also, more clinical trials are warranted to validate the therapeutic efficacy of this Unani herb.

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Conflict of Interest

There is no conflict of interest to declare.

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