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Pharmacological and Therapeutic Potential of Origanum Majorana : A Comprehensive Review

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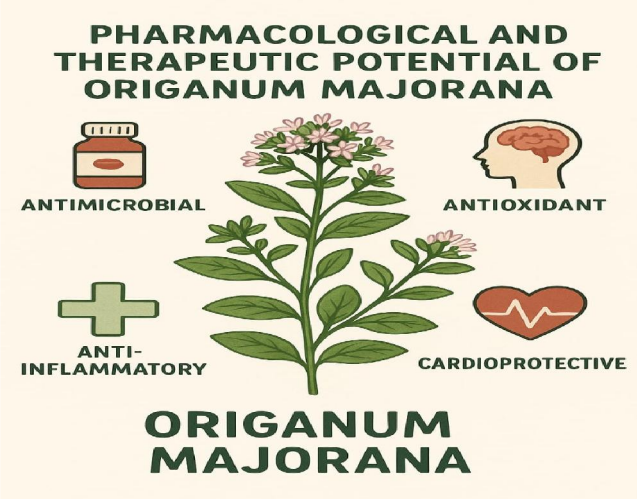

Abstract: *Sweet marjoram (*Origanum majorana*) is a pleasant-smelling perennial herb from the mint family. It is mainly grown in Mediterranean countries and also in many other places, including India. For a very long time, people have used it not only as a flavorful kitchen herb but also as a natural remedy. In traditional medicine, it is commonly used to help with digestion problems, breathing issues, heart troubles, joint pain, and disorders related to the nerves.Scientific studies show that sweet marjoram contains many beneficial natural chemicals, especially essential oils. These oils are rich in compounds like carvacrol, thymol, linalool, terpineol, and eugenol, which are responsible for its strong aroma and many of its health benefits. Advanced laboratory studies have also discovered some unique compounds in this plant, including 1H-indole-2-carboxylic acid, lariciresol, isolariciresol, and procumboside B.Procumboside B is especially important because it shows strong effects on the immune system. It helps activate immune cells by increasing the production of substances like nitric oxide and certain immune signals, and it also improves the surface activity of specific immune markers on macrophages. These actions are linked to its effect on important immune signaling pathways in the body. In modern medicine, sweet marjoram has been found to show many helpful properties, such as reducing inflammation, protecting the liver, fighting microbes, helping control blood sugar, supporting heart health, protecting against tumors, reducing anxiety, improving digestion, and helping wounds heal faster. Nutritionally, it is a rich source of vitamins and minerals like beta-carotene, vitamin A, iron, lutein, zeaxanthin, and folate. These nutrients contribute to its antioxidant effects and may help in improving hemoglobin levels. Overall, sweet marjoram is more than just a culinary herb. It is a powerful natural plant with strong health-boosting and immune-supporting properties. Its wide range of benefits supports its importance in traditional medicine and shows its potential for future use in modern healthcare and natural medicine.*

Keywords: Origanum majorana Linn, Aromatic perennial herb, Essential oil–rich plant, Glycosides, Volatile oils, Antioxidant compounds, Antidiabetic potential Anticancer potential

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I. INTRODUCTION

Marjoram, scientifically known as *Origanum majorana*, is a well-known medicinal herb from the mint family. Earlier, it was called *Majorana hortensis*. It originally grew in the mountainous areas of the Mediterranean region, including parts of Europe, Asia Minor, and Cyprus. Today, it is grown in many parts of the world. The name "Origanum" means "joy of the mountains," which suits this herb because of its natural fragrance and where it first grew. Marjoram is often confused with oregano because both have a similar taste and smell.In different parts of India and around the world, marjoram is known by many local names like sweet marjoram, pot marjoram, wild marjoram, ban tulsi, rao tulsi, margamu, maru, and mirri. Since ancient times, it has been used both as a cooking herb and a natural remedy. People used it to help with sleep problems, anxiety, breathing difficulties, digestion problems, and even poisoning and convulsions. It was also applied to cuts, wounds, colds, and coughs because of its natural antiseptic properties.Traditionally, marjoram has been used to treat infections caused by bacteria, viruses, and fungi. It has also helped with skin problems, stomach disorders, diabetes, and heart issues. In the past, people even carried it while working outdoors to treat insect or snake bites. Apart from medicinal uses, marjoram was also used to make rooms smell pleasant, add flavor to food, and prepare herbal teas.Today, marjoram essential oil is widely used in skin care, cosmetics, and aromatherapy. It is believed to help relax sore muscles, reduce joint swelling, and ease menstrual cramps. However, its essential oil should not be used by pregnant or breastfeeding women. Essential oils are highly concentrated plant liquids that contain natural aromatic compounds. These oils give plants their strong smell and special healing properties[1,2,3].

***Fig.1*:** Origanum majorana plant

Synonyms

Marwa, Mariva, Sanghani, Ushira gandha, Gandha-patra.

Biological Origin

Sweet marjoram is obtained by drying the leaves and the flowering parts of the Origanum majorana plant[4].

Family lamiaceae

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Historical perspective

Sweet marjoram, which is the common name for Origanum majorana, has a long and interesting history that goes back to ancient times. It belongs to the mint family and is a fragrant perennial herb that has been valued for many years for its use in cooking, traditional medicine, and cultural practices. The plant was first scientifically identified and named in the 18th century[5].

Ancient Origins and Cultural Significance

Marjoram is believed to have originally come from the eastern Mediterranean region, especially areas like Egypt and Arabia, and later spread throughout other Mediterranean countries. The ancient Egyptians valued this plant highly because of its pleasant fragrance, healing properties, and spiritual importance. They used it to make perfumes, prepare medicines, and even during mummification rituals.

In ancient Greek culture, marjoram was called "Amarakos" and was seen as a symbol of love, happiness, and respect. It was commonly used in wedding decorations and perfumes as people believed it brought peace and joy to married life. Greek healers described its medicinal benefits, especially for digestive problems, breathing difficulties, and as a natural disinfectant. It was also believed to protect against poisoning.

The Romans later adopted the use of marjoram and continued to use it both in cooking and medicine. They included it in fragrant oils, wines, and healing ointments, appreciating its calming and health-supporting properties.[6,7].

Historical Spread and Traditional Uses

During the Middle Ages, marjoram became popular across Europe and was widely used for medicine, cooking, and making perfumes. It was often grown in monastery gardens because people valued it for treating common problems like colds, stomach troubles, and nerve-related issues. Many also believed that it had spiritual powers and could bring peace while keeping away negative energies.In traditional medicine, marjoram was commonly used to help with sleep problems, cough, and digestive discomfort such as bloating and gas. Its sweet and slightly woody flavor made it a favorite herb in Mediterranean cooking. Even today, it is still widely used in dishes like soups, sauces, and meat preparations[8].

Modern Cultivation and Legacy

Today, marjoram is cultivated in different parts of the world, including Mediterranean regions, parts of Asia, and North Africa. Because it adapts well to various environmental conditions and has many uses, it has remained popular for a very long time. Modern studies support many of its traditional benefits, showing that it has properties that help fight germs, reduce inflammation, and protect the body from damage.[9].

Demographics Location

Marjoram grows best in warm, dry weather and prefers rich, well-drained soil, although it can also survive in chalky soil. It can adapt to different types of soil, whether slightly acidic or alkaline. The plant prefers full sunlight but can grow in partial shade as well. Even though it is drought tolerant, it dries out quickly, so it needs regular watering and good drainage. Because it is a delicate herb, it is usually grown as an annual plant outdoors and replanted every year. It can be grown using either seeds or stem cuttings.The essential oil of marjoram has a saponification value between 23 and 40 and an acetylation value between 68 and 86. Around 400 grams of essential oil can be extracted from about 70 kilograms of fresh marjoram. This oil is highly valued for its healing properties and is commonly used for treating sprains and bruises. It is also popular in aromatherapy because it helps relax muscles and reduce tension[10,11,12]

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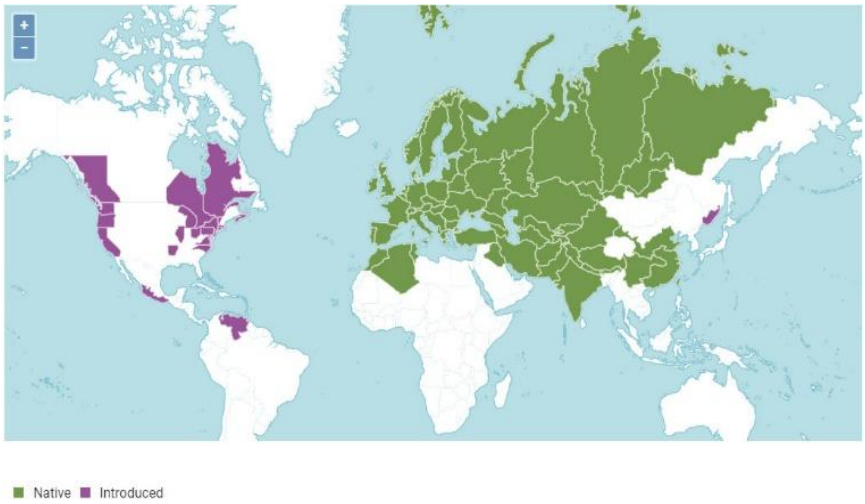

***Fig.2*: Cultivation all over World[13]**

Botanical Description and Morphological features

Marjoram (Origanum majorana L.) is a bushy, semi-hardy plant that is often grown as an annual herb. It has a reddish-brown woody stem that can grow up to 1.5 meters, which is soft and slightly hairy when young. The plant grows upright with a square-shaped stem and many branches, giving it a dense appearance. It has a fresh, pleasant aroma, a smooth slightly astringent taste, and green leaves speckled with tiny brown spots.

The leaves are oblong-oval, smooth, and slightly grayish, growing opposite each other along the hairy stem. They have blunt tips, smooth edges, and a network of veins, tapering at the base.

Marjoram produces small, two-lipped flowers that are pale pink or white with grayish-green bracts. These flowers grow in compact clusters resembling spikes, usually appearing from August to September. Each flower contains both male and female parts and is very small, forming heads about 1.3 cm long. The flower structure is irregular, and the bracts around them are spatula-shaped and slightly hairy.

The plant produces tiny, oval, dark brown seeds. Its roots form a taproot system with a fibrous texture, light brown inside and dark brown outside. The roots are wrinkled lengthwise, have small cracks, a pleasant aroma, and a non-bitter taste. Many rootlets and scars can also be seen[14,15,16,17]

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***Fig.*3:** Morphology *of origanum majorana*

Taxonomy Classification of "*Origanum ajorana* L.

Taxonomy	Classification
Kingdom	Plantae
Sub-kingdom	Viridi Plantae
Super-kingdom	Embryophyta
Division	Tracheophyta
Sub-division	Spermatophyta
Class	Magnoliopsida
Super-order	Asteridae
Order	Lamiacea
Sub-family	Nepetoideae
Species	Origanum majorana L.

Fig.4: Taxonomy classification

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Chemical Constituents

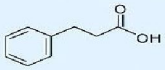
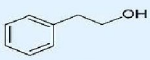
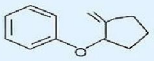
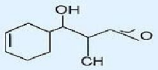
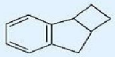
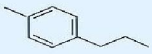
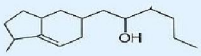
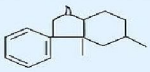
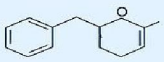
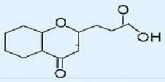
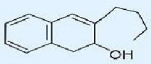
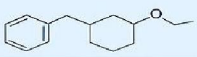
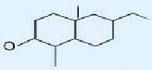
Compound	Chemical Structure	Class of Compound	Biological Activity
1. Terpinen-4-ol		Monoterpenoid alcohol	Major component of essential oil, strong antimicrobial
2. Linalool		Monoterpenoid alcohol	Sedative, anti-inflammatory, and fragrance
3. Thymol		Phenolic monoterpemoid	Potent antiseptic, antioxidant. antifungal
4. Carvacrol		Phenolic monoterpenoid	Antimicrobial, anti-inflammatory, spesmolytic
5. γ-Terpinene		Monoterpene	Acts as a precursor for thymol and carva 'position
6. β-Caryophyliene		Sesquiterpene	Anti-inflammatory, analgesic. cytoprotective
7. Rosmarinic acid		Phenolic acid	Strong antioxidant, neuroprotective, hepatoprotective
8. Caffeic acid		Flavonoid	Free radical sca-venger, anti-inflammatory
9. Apigenin		Triterpenoid	Antioxidant, anticancer, an-tinflammatoy
10. Luteolin		Triterpenoid	Antinoxidant. anti-intlamma-tory
11. Ursolic acid		Triterpenoid	Antioxidant. anticancer, an-tinfiamatory
12. Oleanolic acid		Phytosterol	Anti-inflamma-tory, antiialergic
13. β-Sitosterol		Polyphenolic compound	Astringent, antlanicatic, antimicrobial

Fig.5: Chemical Constituents[19]

PharmacologicalActivity

Marjoram is packed with natural compounds that support digestion by stimulating stomach juices and digestive enzymes. It may also help protect the brain and slow down the development of certain memory-related conditions.

Studies show that marjoram extracts have strong antioxidant properties and may help fight cancer cells. It is also known for its calming effects, helping to reduce anxiety and act as a gentle sedative.

The leaves of marjoram can help manage cholesterol by reducing excess fat production in the body. This makes it a natural option for supporting heart health and controlling high cholesterol levels.

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Additionally, marjoram can help balance the immune system and reduce harmful effects caused by toxins and abnormal cell activity[20,21,22,23,24]

Antioxidant capacity

Studies have shown that marjoram and thyme can help maintain the quality of semi-dried fish during cold storage. One of the biggest challenges in food preservation is fat oxidation, which can spoil flavor and reduce shelf life.

The essential oils of marjoram and thyme are rich in natural compounds called phenolics, which give them strong antioxidant and antimicrobial properties. These oils can help fight harmful microbes and protect against damage caused by free radicals.

Because of their health-promoting effects, marjoram, thyme, and oregano extracts are valued for their natural antioxidant benefits and are increasingly used for medicinal purposes[25]

Anti-Microbial Effects

Marjoram essential oil has been studied for its potential as a natural food ingredient. When combined with herbs like thyme, sage, rosemary, oregano, lemon balm, and basil, it shows strong health benefits and has been used in traditional medicine. This blend of oils has also been tested against harmful bacteria to check its ability to fight infections[26].

Anti-Fungal Capability

Marjoram has strong antimicrobial properties and can effectively fight several types of fungi. It is especially effective against Aspergillus niger, a fungus that often causes food to spoil.

Research also shows that marjoram, along with thyme, works better at stopping fungal growth than **diabetic**essential oils from garlic, onion, grapefruit, lemon, basil, or peppermint[27,28].

Anti-Convulsant Effect

The anti-seizure effects of marjoram were tested in rats at two different doses. The results showed that the chloroform extract was the most effective, significantly reducing the length of seizures[29].

Anti-Diabetic Effects

Marjoram leaf extract made with methanol has been shown to help lower blood sugar in mice. It also helps prevent the buildup of harmful compounds linked to diabetes, and it appears to be more effective in this regard than some commonly used anti-diabetic medications[30].

Anti-Gout Potential

Ethanol extracts from marjoram stems and roots were found to help reduce gout symptoms in rats. The treatment increased antioxidant levels in the body and lowered uric acid, creatinine, inflammation, and oxidative stress in a dose-dependent manner[31].

Anti-Mutagenic Effects

Marjoram extracts from the above-ground parts of the plant have been shown to help protect against mutations in mice, even at low doses[32].

Anti-Ulcer Effects

The essential oil and leaf extracts of marjoram can help heal ulcers in diabetic rats. The effect improves with higher doses and was found to be more effective than some standard medicines and comparable to others[33].

Anti-Protozoal Effects

Marjoram leaves and essential oil also show the ability to fight protozoan infections in lab tests.particularly against Pentatrichomonas hominis[34].

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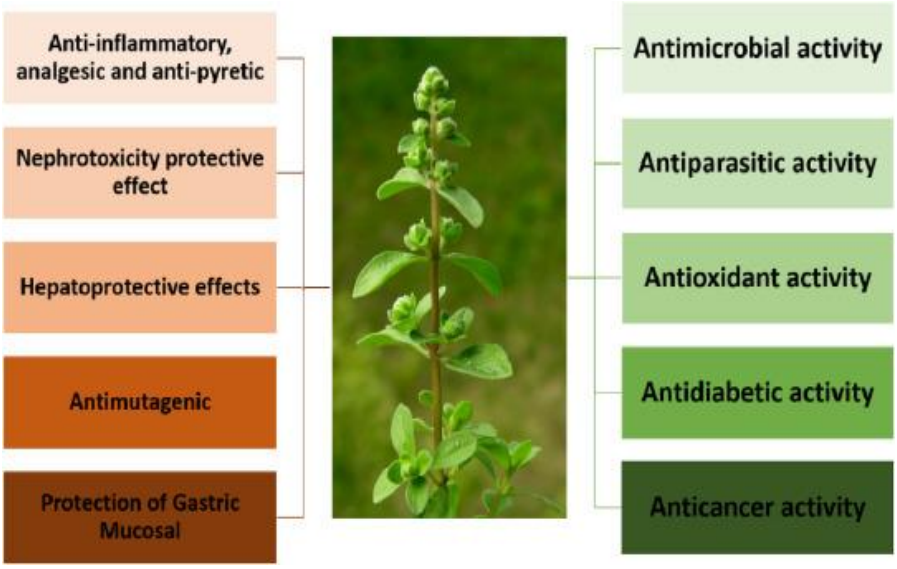

***Fig.6*:** Pharmacological Activities[35]

Mechanism of Action

Antimicrobial Effects

Marjoram contains compounds that can damage the cell walls of bacteria and fungi, leading to their death. It also helps prevent microbial growth and blocks harmful enzymes.

Antioxidant Effects

The plant is rich in natural compounds that fight free radicals, protect cells from damage, and prevent the oxidation of fats.

Anti-Inflammatory Effects

Marjoram can reduce inflammation by lowering the production of chemicals that cause swelling and pain.

Spasm-Relieving Effects

It helps relax muscles, particularly in the digestive tract, which can ease cramps and spasms.

Pain-Relieving Effects

Marjoram may reduce pain by calming inflammation and making nerves less sensitive to discomfort.

Calming and Sedative Effects

Certain compounds in marjoram act on the brain to produce mild relaxation and reduce anxiety.

Digestive Benefits

It can stimulate stomach secretions, improve digestion, and help reduce gas and bloating[36,37].

Toxicity:

Type Of Toxicity	Description	Risk Level
Toxicology of the Gastrointestinal tract	Nausea, Vomiting, Abdominal cramp	Ranges from Mild to Moderate; dosage-dependent
Skin Irritation	Redness, Burning, Itching, Rash	Common with improper topical use
Reproductive Toxicity	Uterine Stimulation Potential to induce Contraction	Avoid in pregnancy &Breastfeeding
CNS effects	Dizziness,Headache,Drowsiness	Rare ;occurs with Overdose
Hepatotoxicity	Liver Stress or Irritation	Very rare;only at very high dosage

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Drug Interaction	Increased bleeding, Increased Sedation,	Important in patient On medication
Allergic Reaction	Sneezing, Itching, Throat irritation	Mild uncommon

Table 1 **:** Toxicities of S. Majorana[38]

Marketed Preparations

- Essential oil of marjoram (different brands: aromatherapy oils)
- Herbal powder packs of marjoram leaf powder
- Dried Marjoram Leaves (packs of culinary herbs)
- Marjoram tablets or capsules (brands of herbal supplements)
- Herbal Tea with Marjoram (loose tea or tea bags)
- Marjoram oil balms and ointments (for massage and pain relief)
- Tincture or Extract of Marjoram (liquid herbal extracts)[39].

Fig.7: *Essential oil [41],[42]*

Fig.8: *Majorana leaf powder[43].*

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Fig. 9: *O. Majorana leaf Tea[44].*

Fig.10: *Majorana Ointment[45]*

Benefits of origanum majorana

- Aids with digestive issues (indigestion, cramps, and gas).
- Used to relieve colds, coughs, and respiratory issues
- Possesses antibacterial and anti-inflammatory properties
- Acts as a gentle sedative, promoting restful sleep and lowering stress levels.
- Used as a flavouring agent in cooking
- Utilized in cosmetics and aromatherapy
- Serves as a natural defence against insects.
- Shows strong antioxidant activity.
- Acts as an antispasmodic for muscle and menstrual cramps.
- Exhibits hepatoprotective (liver-protecting) effects.
- Helps regulate blood glucose with antidiabetic potential.
- Possesses antifungal activity, especially against Candida.
- Provides mild cardioprotective and blood-pressure–lowering effects.
- Shows anti-ulcer and gastroprotective activity.
- Used in aromatherapy to enhance mood and emotional balance.
- Acts as a natural insect repellent.

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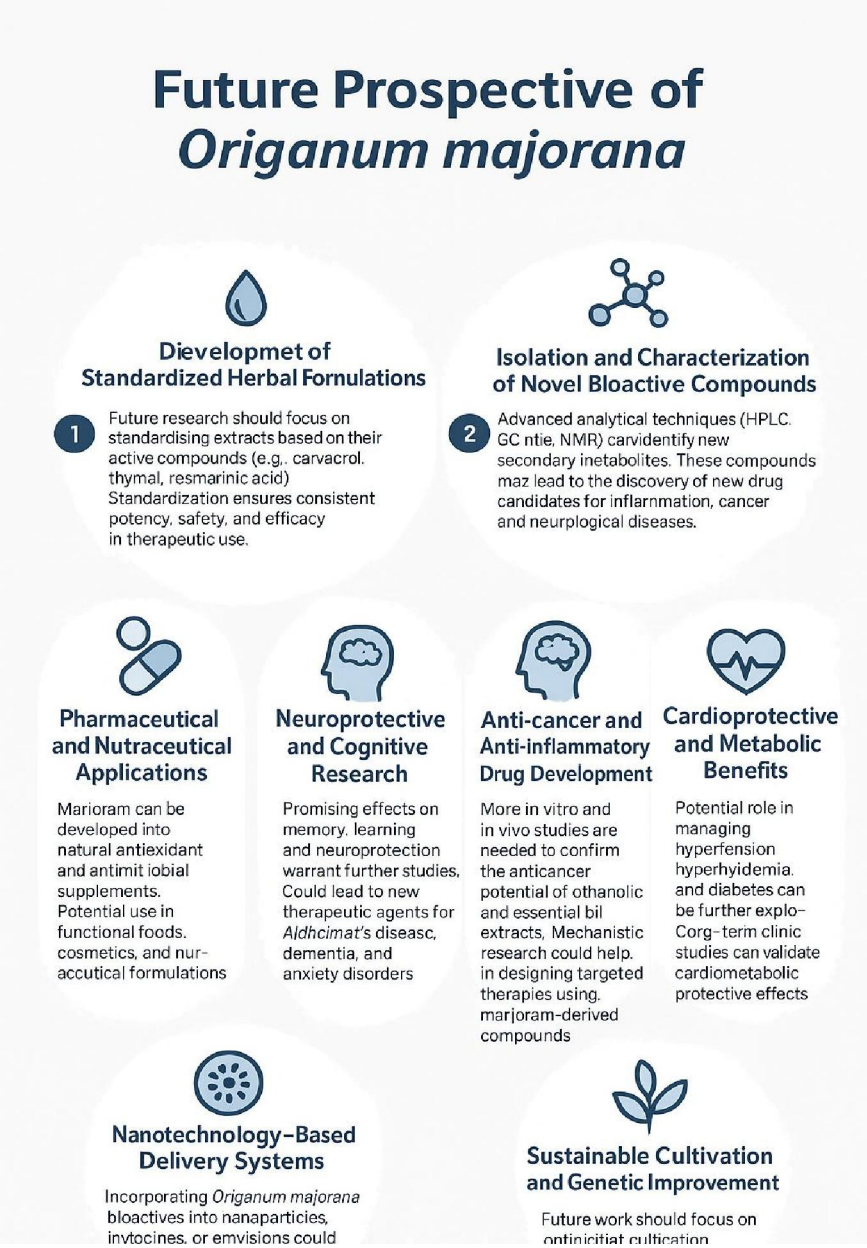
- Supports immune function.
- Consumed as herbal tea for relaxation and digestion.
- Used in massage therapy for muscle relaxation.
- Shows potential anticancer properties (research-based).
- Used traditionally for antidiarrheal benefits[46],[47]

Future Prospective*[48],[49]*



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II. CONCLUSION

Sweet marjoram (Origanum majorana L.) is a valuable herb with a wide range of health benefits. Its natural compounds, such as carvacrol, thymol, rosmarinic acid, flavonoids, and terpenes, help fight free radicals, reduce inflammation, protect the liver and brain, support blood sugar control, and may even have anticancer effects.Many of its traditional uses are backed by scientific studies, showing its potential as both a natural remedy and a functional food. While most research has been done in labs or on animals, more studies in humans are needed to confirm its safety, effectiveness, and proper dosage. Overall, marjoram is a promising natural source of active compounds that could be used to develop new herbal remedies and health supplements for conditions related to inflammation and oxidative stress.

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