

## The Application of *Thymus vulgaris* in Traditional and Modern Medicine: A Review

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**Abstract:** Medicinal plants have played an essential role in the development of human culture. Medicinal plants are a source of traditional medicine. This study illustrates the importance of traditional and modern medicine in the treatment and management of human diseases and ailments. It has been confirmed by WHO that herbal medicines serve the health needs of about 80 percent of the world's population; especially for millions of people in the vast rural areas of developing countries. Meanwhile, consumers in developed countries are becoming disillusioned with modern healthcare and are seeking alternatives. *Thymus* is a flowering plant in the mint family Lamiaceae. *Thymus* is a widely used medicinal plant in food and pharmaceutical industries. Among different species of *Thymus*, *Thymus vulgaris* is used more than other species in therapeutic dosage forms. In traditional medicine *T. vulgaris* is cultivated in many countries by most people especially in rural areas depend on herbal medicines to treat many diseases including inflammation-related ailments such as rheumatism, muscle swelling, insect bites, pains, etc. Also the modern medicine in essential oil of thyme has demonstrated the compounds have shown anti-inflammatory, immunomodulatory, antioxidant, antibacterial and antifungal properties. In this review the objective is to consider the past and present value of medicinal plants such as *Thymus vulgaris* used in traditional and modern medical practices as bioactive natural compounds.

**Key words:** Medicinal Plants • Traditional and Modern Medicine • *Thymus vulgaris* • Bioactive Compounds

### INTRODUCTION

Traditional medicine has remained as the most affordable and easily accessible source of treatment in the primary healthcare of. People have a long history of traditional plant usage for medicinal purposes. The medicinal use of plants is very old. The writings indicate that therapeutic use of plants is as old as 4000–5000 B.C. and Chinese used first the natural herbal preparations as medicines. In India, however, earliest references of use of plants as medicine appear in Rig-Veda, which is said to be written between 1600–3500 B.C. Later the properties and therapeutic uses of medicinal plants were studied in detail and recorded empirically by the ancient physicians in Ayurveda (an indigenous system of medicine) which is a basic foundation of ancient medical science in India [1]. Medicinal plant is an important element of indigenous medical systems all over the world. The ethnobotany and ubiquitous plants provide a rich resource for natural drug

research and development [2]. Medicinal plants are resources of new drugs and many of the modern medicines are produced indirectly from plants. It is estimated there are more than 250,000 flower plant species. Traditional use of herbal medicines implies substantial historical use, and this is certainly true for many products that are available as 'traditional herbal medicines. In many developing countries, a large proportion of the population relies on traditional practitioners and their armamentarium of medicinal plants in order to meet healthcare needs. Although modern medicine may exist side-by-side with such traditional practice, herbal medicines have often maintained their popularity for historical and cultural reasons [3]. Natural products have played an important role throughout the world in treating and preventing human diseases. Natural products from various sources including terrestrial plants, microorganisms, marine organisms and terrestrial vertebrates and invertebrates and

its importance in modern medicine has been discussed in different reviews and reports [4,5]. In recent years, the research work on natural Products chemistry received great interest [6] due to chemical structure and biological activities of naturally occurring secondary metabolites [7]. The World Health Organization (WHO) has also recognized the importance of traditional medicine and has created strategies, guidelines and standards for botanical medicines. Proven agro-industrial technologies need to be applied to the cultivation and processing of medicinal plants and the manufacture of herbal medicines [8]. Studying medicinal plants helps to understand plant toxicity and protect human and animals from natural poisons. In this review the objective is to consider the past and present value of medicinal plants such as *Thymus vulgaris* used in traditional and modern medical practices as bioactive natural compounds.

#### **Plant Geographical Distribution and its Description:**

*Thymus vulgaris* is cultivated in most of the European countries, together with France, Svizzera and nowadays it is cultivated worldwide. *Thymus vulgaris* (thyme) is an aromatic plant used for medicinal and spice purposes almost everywhere in the world. *Thymus vulgaris* is a flowering plant in the mint family Lamiaceae. It is growing upto 15-30 cm tall by 40 cm wide [9]. Thyme is a tiny perennial shrub, with a semi-evergreen groundcover that seldom grows quite 40 cm tall it's each horizontal and upright habits. The stems become woody with age. Thyme leaves are terribly little, usually 2.5 to 5 mm long and vary significantly in form and hair covering, depending on the variety, with every species having a rather completely different scent. *T. vulgaris* leaves are oval to rectangular in form and somewhat fleshy aerial components are used for volatile oil production, principally by steam distillation. The contemporary and dried herb market uses it for cookery functions (Figure 1).



Fig. 1: *Thymus vulgaris*

Thyme grows well during a temperate to heat, dry, sunny climate and wherever the plants don't seem to be shaded. It desires full sun to grow to its best potential. Thyme doesn't like excessive wet otherwise it will get rot disease. Thyme prefers lightweight, well drained soils with a pH of 5.0 to 8.0. Thyme species do best in coarse, rough soils that may be unsuitable for several alternative plants [10].

#### **Background and History of Traditional Herbal Medicine:**

The use of plants as medicine goes back to early man. Fossil records date human use of plants as medicine at least to the Middle Paleolithic age. Evidence of this early association have been found in the grave of a Neanderthal man buried 60 000 years ago. Pollen analysis indicated that the numerous plants buried with the corpse were all of medicinal value. The earliest known medical document is a 4000-year-old Sumerian clay tablet that recorded plant remedies for various illnesses. By the time of the ancient Egyptian civilization, a great wealth of information already existed on medicinal plants. Among the many prescribed remedies were mandrake for pain relief and garlic for the treatment of heart and circulatory disorders. This information, along with hundreds of other remedies, was preserved in the Ebers papyrus about 3500 years ago. Ancient China is also a source of information about the early medicinal uses of plants [11]. Although animal and mineral materials have been used, the primary source of remedies is botanical. Of the more than 12 000 items used by traditional healers, about 500 are commonly used. Botanical products are used only after some kind of processing, which may include, for example, stir-frying or soaking in vinegar or wine. In clinical practice, traditional diagnosis may be followed by the prescription of a complex and often individualized remedy. Traditional Chinese medicine is still in common use in China. More than half the population regularly uses traditional remedies, with the highest prevalence of use in rural areas. About 5000 traditional remedies are available in China; they account for approximately one fifth of the entire Chinese pharmaceutical market [12]. Many herbal remedies found their way from China into the Japanese systems of traditional healing. Herbs native to Japan were classified in the first pharmacopoeia of Japanese traditional medicine in the ninth century [13]. In India, herbal medicine dates back several thousand years to the Rig-Veda, the collection of Hindu sacred verses. This has led to a system of health care known as Ayurveda medicine. One useful plant from this body of knowledge is the turmeric root, used for centuries for its sedative effects.

The number of higher plant species on this planet is estimated at 250,000, with a lower level at 215,000 [14] and an upper level as high as 500,000. Of these, only about 6% have been screened for biologic activity, and a reported 15% have been evaluated phytochemically. With high throughput screening methods becoming more advanced and available, these numbers will change, but the primary discriminator in evaluating one plant species versus another is the matter of approach to finding leads. There are some broad starting points to selecting and obtaining plant material of potential therapeutic interest. However, the goals of such an endeavor are straightforward. Plants have an advantage in this area based on their long-term use by humans (often hundreds or thousands of years) [15].

**Herbal Medicines in Developed Countries:** Plants and their metabolites constituents have a long history of use in modern 'western' medicine and in certain systems of traditional medicine and are the sources of important drugs such as atropine, codeine, digoxin, morphine, quinine and vincristine. Use of herbal medicines in developed countries has expanded sharply in the latter half of the twentieth century. In recent years, the use of traditional medicine information on plant research has again received considerable interest. While the western use of such information has also come under increasing scrutiny and the national and indigenous rights on these resources have become acknowledged by most academic and industrial researchers. Meanwhile, the need for basic scientific investigations on medicinal plants using indigenous medical systems becomes imminent [16]. The desire to capture the wisdom of traditional healing systems has led to a resurgence of interest in herbal medicines [17], particularly in Europe and North America, where herbal products have been incorporated into so-called alternative, complementary, holistic or integrative medical systems. Monographs on selected herbs are available from a number of sources, including the European Scientific Cooperative on Phytotherapy [18], German Commission E [19] and the World Health Organization [20]. The WHO monographs, for example, describe the herb itself by a number of criteria (including synonyms and vernacular names) and the herb part commonly used, its geographical distribution, tests used to identify and characterize the herb (including macroscopic and microscopic examination and purity testing), the active principles (when known), dosage forms and dosing, medicinal uses, pharmacology, contraindications and adverse reactions. During the latter part of

the twentieth century, increasing interest in self-care resulted in an enormous growth in popularity of traditional healing modalities, including the use of herbal remedies; this has been particularly true in the USA [21]. In the European market there are a lot of products derived from natural plants, which are recognized to possess different biological properties, such as antioxidant, antiseptic, diuretic, stimulating the central nervous system, sedative, expectorant, digestive, etc. Some of these plants have been used in traditional medicine since ancient times and are available on market as infusions, tablets and/or extracts. Consumers have reported positive attitudes towards these products, in large part because they believe them to be of 'natural' rather than 'synthetic' origin, they believe that such products are more likely to be safe than are drugs, they are considered part of a healthy lifestyle and they can help to avoid unnecessary contact with conventional 'western' medicine. [22].

**Modern and Traditional Prescription of Herbal Drugs**

**(*Thymus vulgaris*):** The pharmacological treatment of disease began long ago with the use of herbs. Although herbalism waned in the eighteenth and nineteenth centuries, many of the remedies employed by the herbalists provided effective treatment. Some of these became useful prescriptions as physicians began experimenting with therapeutic agents. William was the first in the medical field to scientifically investigate a folk remedy. His studies (1775-1785) of foxglove as a treatment for dropsy (congestive heart failure) set the standard for pharmaceutical chemistry. In the nineteenth century, scientists began purifying the active extracts from medicinal plants. One breakthrough in pharmaceutical chemistry came when Friedrich isolated morphine from the opium poppy (*Papaver somniferum*) in 1806. Continuing this progress, Justus von Liebig, a German scientist, became a leader in pioneering the field of pharmacology. With increased knowledge of active chemical ingredients, the first purely synthetic drugs based on natural products were formulated in the middle of the nineteenth century [22]. In plants, these compounds are mostly secondary metabolites under the title bioactive compounds such as alkaloids, steroids, tannins and phenol compounds, flavonoids which are capable of producing definite physiological action on the body [23]. The medicinal plants are rich in secondary metabolites and essential oils of therapeutic importance. The important advantages claimed for therapeutic uses of medicinal plants in different ailments are their safety besides being economical, effective and their easy availability.

Because of these advantages the medicinal plants have been widely used by the traditional medical practitioners in their day-to-day practice. Among all plant secondary metabolites which act as antioxidants phenolic compounds form a large and varied group. Phenolic compounds contribute significantly to the antioxidant potential of several plant species[24]. Among different Thymus species, *T. vulgaris* is cultivated in many countries by most people especially in rural areas depend on herbal medicines to treat many diseases including inflammation-related ailments such as rheumatism, muscle swelling, insect bites, pains and so on[25]. *T. vulgaris* is used more in pharmaceutical dosage forms because it contains more essential oil than other species with high amount of thymol which exhibits considerable antitussive and expectorant effects [26]. Considering the fact that *Thymus vulgaris* is more expensive, some herbal industries tend to use other species of Thymus with different components. So it is crucial to develop a suitable and reliable identification method to confirm the quality of extracts and herbal drugs. Separation and detection of different constituents in plants have been always complicated. Thymus has approved expectorant, antitussive and spasmolytic activities. Its antiseptic property is estimated to be 25 times more effective than phenol, with less toxicity [27]. Different species of Thymus are different in content and type of components. Generally they contain thymol, carvacrol, flavonoids and phenolic compounds such as rosmarinic acid which may have anti-edemic and macrophage-inhibiting effects [28]. *Thymus vulgaris* shows a polymorphic variation in monoterpene production, the presence of intraspecific chemotype variation being common in the genus *Thymus*. Each of the six chemotypes, geraniol (G),  $\alpha$ -terpineol (A), thuyanol-4 (U), linalool (L), carvacrol (C) and thymol (T), is named after its dominant monoterpene [27]. Many pharmacological *in vitro* experiments carried out during the last decades revealed well defined pharmacological activities of both, the thyme essential oil and the plant extracts. The non-medicinal use of thyme is worthy of attention, because thyme is used in the food and aroma industries; it is widely used as culinary ingredient and it serves as a preservative for foods especially because of its antioxidant effect. Thyme essential oil constitutes raw material in perfumery and cosmetics due to a special and characteristic aroma. *Thymus vulgaris* oil is a combination of monoterpenes and those will act as anti-oxidative, antimicrobial, medicinal drug, antitussive, antispasmodic and antibacterial activities [29].

**Chemical Composition of the Essential Oil of *Thymus vulgaris*:** The essential oil from *T. vulgaris* showed a high content of oxygenated monoterpenes (56.53%) and low contents of monoterpene hydrocarbons (28.69%), sesquiterpene hydrocarbons (5.04%) and oxygenated sesquiterpenes (1.84%). The predominant compound among the essential oil components was thymol (51.34%) while the amount of all other components of the oil was less than 19% [30].

**Medicinal Applications:** Thyme has been thought of to be antiseptic, antimicrobial, medication, astringent, anthelmintic, medicinal drug, carminative, disinfectant, medicinal drug and tonic. Thyme is incredibly useful in cases of assorted intestinal infections and infestations, like hookworms, ascarids, gram-positive and gram-negative bacterium, fungi and yeasts as well as *Candida albicans*. Its active constituent, thymol, is active against enterobacteria and coccid bacteria. Thyme may also improve liver functioning and act as an appetite stimulant. It will be used in treatment of cartilaginous tube, bronchial and urinary infections [31]. Thyme is helpful in treatment of laryngitis and inflammation. The main component of the volatile oil of thyme, thymol, is active against enterobacteria and coccid bacteria. It is used for skin issues like oily skin, sciatica, acne, dermatitis, skin condition and bug bites. In aromatherapy, the distinct types, thymol, red thyme oil, linalool kind for its terribly light soft action and thuyanol for antiviral properties are used. A corrected product, 'white thyme oil' is also used and it's milder on the skin. Applied to the skin, thyme relieves bites and stings and relieves neuralgia and rheumatic aches and pains [32].

**Antioxidant Properties:** An antioxidant is a molecule that inhibits the oxidation of different molecules. Oxidation is a chemical process that transfers electrons or hydrogen from a substance to an oxidizing agent. Oxidation reactions will produce free radicals. In turn, these radicals will begin chain reactions. Once the chain reaction happens in a cell, it will cause damage or death to the cell. Anti-oxidants stop these chain reactions by removing free radical intermediates and inhibit different oxidation reactions. The leafy parts of thyme and its oil are utilized in foods for the flavor, aroma and preservation and additionally in folk medicines. El-Nekeety conducted an experiment to work out the elements of *Thymus vulgaris* oil and to evaluate the protecting effects of this oil against aflatoxin induce oxidative stress in rats. The results

indicated that the oil contains Carvacrol (45 mg/g), Thymol (24.7 mg/g),  $\beta$ -Phellandrene (9.7 mg/g), essential oil (4.1 mg/g), Humulene (3.1 mg/g),  $\alpha$ -Phellandrene (2.3 mg/g) and Myrcene (2.1 mg/g) [9]. However,  $\alpha$  and  $\beta$ -pinene, Myrcene,  $\alpha$ -thujone, Tricyclene, 1, 8-cineole and  $\beta$ -sabinene were found in very lower concentrations. Treatment with aflatoxins alone disturbs lipid profile in blood serum, decreases total antioxidant capability, increases creatinine, uric acid and nitric oxide in blood serum and lipid peroxidation in liver and excretory organ attended with a severe histological changes within the liver tissues. The oil alone at the 2 tested doses didn't induce any important changes within the biochemical parameters or the histological image. The combined treatment showed important enhancements altogether tested parameters and histological footage within the liver tissues. Moreover, this improvement was additional pronounced within the cluster received the high dose of the oil [33].

**Anti Bacterial Activity:** The essential oils obtained from *Thymus vulgaris* harvested at 4 biological process stages were evaluated for their biological chemical components. The thyme volatile oils were analyzed for their inhibition effects against 9 strains of gram-negative bacteria and 6 strains of gram-positive bacteria. The bio-impedance methodology was chosen for finding out the antibacterial activity of the essential oils and also the parameter chosen for outlining and quantifying the antibacterial activity of the thyme oils was the detection time. The plate counting technique was used for studying the inhibitory effect by direct exposure. All the thyme essential oils have a significant bacteriostatic activity against the tested microorganisms. This activity was additional marked against the gram-positive bacteria. The oil from thyme flower was the foremost effective at stopping the growth of the examined microorganism species. The oils tested showed to possess smart antibacterial activity by direct contact that gave the impression to be marked against the gram-negative microorganism. Some number of the species were capable of recovering a minimum of 50% of their metabolic function once contact with the inhibitor, whereas most of the strains were shown to have been inactivated almost completely [34].

**Anti-Viral Property:** Silke et al. conducted an experiment with aqueous extracts from species of the Lamiaceae family were examined for their antiviral activity against Herpes simplex virus (HSV). Extracts from thyme (*Thymus*

*vulgaris*) has shown inhibitory activity against Herpes simplex virus type 1 (HSV-1), type 2 (HSV-2) and an acyclovir-resistant strain of HSV-1 was tested in vitro on RC-37 cells in a plaque reduction assay [35].

**Anti-Inflammatory Property:** *Thymus vulgaris* oil is a combination of monoterpenes. The most compounds of this oil are the natural terpenoid thymol and its phenol chemical compound carvacrol [33] that has medicinal drug, anti-oxidative, antimicrobial, antitussive, antispasmodic and antibacterial effects [30]. Terpenoids, flavonoid aglycones, flavonoid glycosides and synthetic resin acids were additionally found in *Thymus* spp.

**Insecticidal Activity:** The insecticidal activity of thyme volatile oil, thymol and carvacrol was evaluated in laboratory against completely different larval stages of lesser mealworm. The sooner and later larval stages were reared on diets containing one or two acetone solutions of tested compounds. Insecticidal activity of thyme volatile oil and pure monoterpenes against *A. diaperinus* larvae relied on the dose and age of larvae. The growth of younger larvae was considerably affected, whereas those of older larval stage were less influenced and only by pure oil components. In young larvae the application 1% thyme oil, thymol and carvacrol, caused mortality of 50.0, 86.67 and 85%, respectively [36].

## CONCLUSION

The outset of the new millennium the World Health Organization (WHO) estimated that the majority of the populations of most countries were still relying primarily upon indigenous or traditional forms of medicine for meeting everyday health care needs. It has been estimated that in developed countries such as United States, plant drugs constitute as much as 25% of the total drugs, while in fast developing countries such as China and India, the contribution is as much as 80%. Consumers have reported positive attitudes towards these products, in large part because they believe them to be of 'natural' rather than 'synthetic' origin, they believe that such products are more likely to be safe than are drugs, they are considered part of a healthy lifestyle and they can help to avoid unnecessary contact with conventional 'western' medicine. Although modern medicine may exist side-by-side with such traditional practice, herbal medicines have often maintained their popularity for historical and cultural reasons.

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