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Formulation, Evaluation and Various Pharmacological Properties and Uses of Thyme

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ABSTRACT

Medicinal plants have played an essential role in the development of human culture. Medicinal plants are sources of new drugs and many new medicines are produced directly from plants by various processes. During studying medicinal plants helps to understand plant toxicity, use long with protect human and animals from natural poisons. This paper reviews studies conducted to explore the physiological and pharmacological properties of thyme plant "Thyme vulgaris". Thymus vulgaris L. (T. vulgaris) a significant aromatic plant with around 100 species in the world is widely used for medicinal purposes as well as in culinary dishes. It is obtained from European countries, along with France, Spain, Italy, Bulgaria, Portuguese Republic and Ellas. Thymus vulgaris L. is also known as Thyme, (Pahari, Pudina, Mountain Thyme). The genus Thymus are important medicinal plants, highly recommended due to a wide variety of therapeutic properties of their essential oils, and the oil normally known as Thyme oil. The biological active components of thyme vulgaris such as flavonoids, luteolin, carvacrol, eugenol, thymol as well as aliphatic phenols, tetramethoxylated flavones and saponins that attribute to thyme pharmacological properties.

KEYWORDS: *Thyme, Antidiabetic, Antitumor, Insecticidal activity, Hepatoprotective, Tincture of Thymol*

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INTRODUCTION:

Thyme or T. vulgaris L. known as "garden thyme" is an aromatic and perennial flowering plant belonging to the Lamiaceae family. Herbalism is the study of medicinal properties and usage of plant and their related Activity and biological background along with safety approaches to needs clinical tests and prevelance use of health livings. This article is related leaves and oils and other chemical obtain from thyme exreaction of the of thyme plant. For the genus of thyme Plants, Thymus. For the Active ingredient in thyme oil and thymol. Thyme extract is known to posses spasmolytic effects on isolated trachea and to increase ciliary activity. A small part of this effect is mediated via β-2 receptors, but other receptors are supposed to be involved. Endothelin has a pathophysiological impact in asthma with respect to hyper-reagibility and contracting isolated trachea smooth muscles and was, therefore, investigated.[1] The plants produce phytochemicals to protect themselves from bacteria, viruses and fungi, and they also protect food from spoilage when added to food. In recent years, great interest has been focused on using natural preservatives in food products in light of recent studies that have indicated the possible adverse effects related to the consumption of synthetic additives. In addition, natural preservatives improve human health because they protect against diseases, Currently, the natural plant extract industry is moving

millions of euros around the world. Approximately 1340 plants are known to be potential sources of antioxidant and antimicrobial components and more than 250,000 plant species contain a wide variety of bioactive components. In 1999 alone, the global business of selling natural supplements exceeded 15 trillion dollars, of which $7 trillion was in Europe and $3 billion was in North America; and every year, the sales increase. Plant extracts are included in the group of additives classified as "aromatic and flavoring substances", which include "all natural products and corresponding synthetic products", and can be consumed by all animal species without any restriction on the dose of product[2] Thyme is cultivated in most of the European countries, together with France, Svizzera, Spain, Italy, Bulgaria, Portuguese Republic and Ellas. Yield and quality of oil varies in line with the genetic make-up of stuff, crop maturity at harvest, setting and distillation follow. The dried product should be processed to get rid of the leaves from the stems, and so sieved to get rid of dirt and to provide a consistent product. Many strategies exist from sun to classy driers. The employment of sun-drying strategies leads to poor quality of the volatile oil. Artificial drying strategies permit higher management of product quality. Once drying, the leaves should be separated clear of the stems, sieved and hierarchic. Fresh turn out has got to be clean of foreign material and looking out recent and tender with a decent color and flavor[3]. The plant is useful as infusion to treat cough, diabetes, and cold and chest infections; and in a syrup form for digestive upset. It is also soothing for sore throat, as thyme is has antiseptic, antibiotic, antiviral, and antifungal properties Thyme has been thought of to be astringent, anthelmintic, carminative, Antidiabetic, Antilipidemic, Antitumor, Antimicrobial, Insecticidal activity Hepatoprotective, disinfectant, and tonic. Applied to the skin, thyme is reported to relieve bites and stings, neurology, rheumatic aches, and pains, the essential oil can be used as a rub for aching joints or rheumatic pain, and can also be used in the treatment of athlete's foot (Tinea pedis).[4] Thyme is important aromatic plant among Mediterranean flora, used as conventional medication and as spices. Richard et al. identified many types of Thymus across the world (Richard et al., 1985). Several studies reported that thyme possess active biological action such as antifungal, antibacterial, antioxidant activities, anti-tabagism, antispasmodic and germicidal. Also, the use of thyme oil as dietary addition sustained a higher total body status of antioxidant, glutathione peroxides and superoxide dismutase activities. At non-toxic concentrations, thyme extracts were recognized as a natural antimutagen with the ability to improve the error repairing of free DNA. Thyme extracts, such as essential or volatile oils, utilized in animal feeding and considered as growth and immune enhancers due to their antioxidant, antimicrobial and digestion properties.[5] Fresh and dried herbs particularly the upper part of the above ground portion of wild thyme, collected when the plant is in bloom, possess certain healing properties due to the presence of significant amounts of essential oils. Recent years have seen increased interest in ethnobotanical, phytochemical, and pharmacological investigations into the medicinal properties of the species T. serpyllum which serves as a high quality source for many different formulations in pharmaceutical and chemical industries. The herb is used in preparations of natural herbal remedies, such as syrups, tinctures, infusions, decoctions, tea, and oil. The increase in multidrug resistant strains[6] Among the best-known species in Spain that experience greater propagation and exploitation are Thymus rumidicus hispánicos, Thymus zygis, Thymus vulgaris, Thymus hyemalis, Thymus mastichina, Thymus citríodotus, Thymus corydothymus, Thymus loscossi, Thymus pipirella, Thymus communis, . (Figure 1). In all thyme species and varieties, the main part used commercially is its leaves, with purposes that vary from seasoning to herbalism. The essence of thyme has multiple applications, both in medicine and perfumery.[7]

(A)

(B)

(C)

(Figure 1) (a) Thymus hyemalis (b) Thymus vulgaris (c)Thymus zygissubsp. Gracilis

Plant description:

Thyme is a tiny perennial shrub, with a semi evergreen ground cover that seldom grows quite 40 cm tall it's each horizontal and upright habit. 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 2). It desires full sun to grow to its best potential. Thyme doesn't like excessive wet as a resultof its condition it will gets rot diseases. 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[8] . The thyme plant has an erect or ascending growth habit and possesses many branching stems. The leaves of the thyme plant are linear or elliptical and are arranged alternately on the stems. The leaves are densely covered in minute hairs and have numerous red-brown oil glands on the surface which take the appearance of small dots. The leaves can be green or variegated. The plant produces whorls of tiny pink, lilac or pale purple flowers on a terminal spike and tiny brown fruits, each with one seed. Thyme can reach a height of up to 50 cm (20 in) and can be grown as an annual or a perennial. Thyme may also be referred to as common or garden thyme and originates from the Mediterranean.

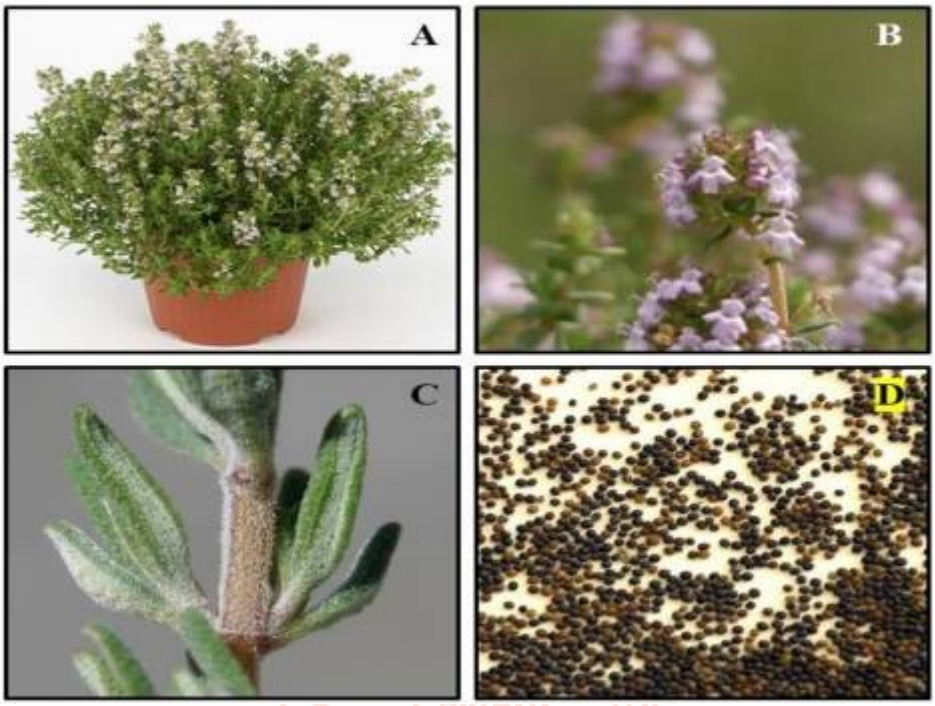
(Figure 3)[9]

(Figure 2)

(Figure 3)

However, the morphological characters may vary according to environmental conditions. T. vulgaris L. grows well in arid, temperate, and unshaded areas. T. vulgaris L. grows well in hot, arid conditions with well-drained soil, and is usually planted in the spring. The plant can be propagated using seed, cuttings, or by dividing rooted sections. The plant also takes up deep freezes and can be found on mountain highlands[8] The two-lipped, and

possess a hairy glandular calyX. They measure up to 5 mm long with leaf-like bracts in loose whorlsarranged in axillary clusters on the branchlets or in terminal oval or rounded heads(Figure 4)[10]



(Figure 4)

Table no. (1) Taxonomical Classifiction[11]

1.	kingdom	Plantae
2.	Class	Magnoliopsida.
3.	Order	Lamiales
4.	Family	Lamiaceae
5.	Subfamily	Nepetoideae
6.	Genus	Thymus L
7.	Species	Thymus vulgaris L

Different Names of Thyme:

Botanical Name: Thymus vulgaris Hindi: Banajwain

Punjabi: Marizha, Masho Urdu:Hasha

English:Thyme**[1,12]**

Soure / material:

Thyme Used in this research was obtained from the local market and medicinal gurdan.

Methods of Extraction of Thyme Oils:

Michalak reported that the thyme essential oil quality and yield depend on many factors and choosing a suitable extraction method is very important. Essential oil of thyme herb has usually been obtained by some methods such as:

1. Steam Distillation:

The Steam distillation procedure is widely used for essential oil separation, for its efficiency, this method gives a greater or lesser compounds instability under the influence of high temperature. There are two methods use steam distillation: simple steam distillation and Clevenger system[16].

(Figure 5). Steam Distillation Appratus.

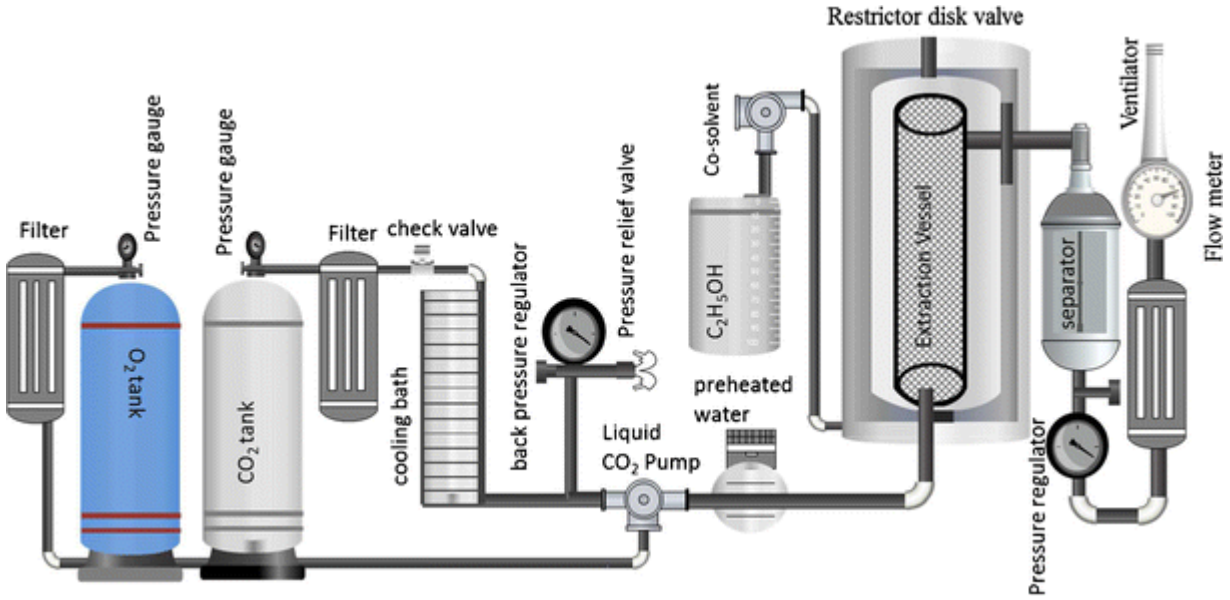
2. Solvent Extraction:

Solvent extraction was the main method adopted by most researchers to extract phenolics from thyme leaves. This is a process designed to separate soluble compounds by diffusion from a solid matrix using a liquid matrix. The aim of extraction is concentrate antioxidant components of raw material[17].

(Figure 6) . Solvent Extraction Appratus

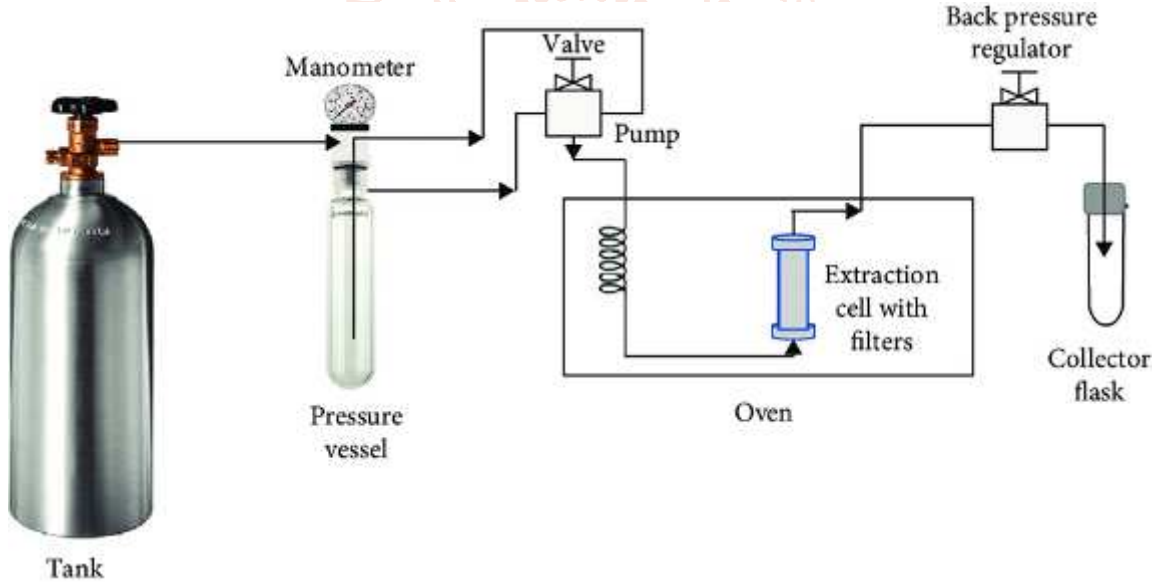
3. Supercritical Fluid:

Extraction Can offer a good yield and preserve the properties of antioxidants. This method can be used for the extraction of polyphenol from plant tissue and greatly facilitates the extraction process and reduces extraction time due to low viscosity and relatively high density of supercritical fluid; it can also minimize possible degradation because it can operate in absence of light and air. Supercritical carbon dioxide is the most widely used extraction solvent [18].



(Figure 7) . Supercritical Fluid Extraction 4.Pressurized Liquid Extraction (PLE):

A relatively recent solvent extraction technique could in principle eliminate some of the drawbacks of the classical solvent extraction methods. Pressurized liquid extraction is based on the use of solvents at temperatures above their normal boiling points and pressures enough to keep the extracting fluid in the liquid state during the whole extraction process. By applying these conditions, faster extraction processes result in which typically higher extraction yields are obtained with lower volumes of organic solvents[19].



(Figure 7). Pressurized Liquid Extraction (PLE).

Active competent isolation:

A. Tannins:

Tannins was isolated from Thyme by adding (75) ml of distilled water to (0.5) g of Thyme

powder The mixture put in boiled water bath for (30) minutes, then the mixture run in centrifuge at (200 cycle \ minutes) for a period of (20) minutes .The solution transfer to flask(100) ml and complete the volume to the mark with distilled water then added to the mixture(20) ml of 4% lead acetate with shaking then continued and filtered. The sludge dried at (70)°C in electric furnace. [20]

B. Saponins:

Weight (10) g of Thyme powder added to (50) ml of (20% ethanol) and then heated using a water bath for half an hour and (55) °C with constant stirring, after that the solution filtered and separated then added to it (100) ml. The solution heated by using a water bath at (90) °C until final solution volume become (40) ml, where the filtrate transfer and added to it (20) ml of ether in separation funnel then water layer separated and ether layer neglected, add to water layer (10) ml of n-butanol then the resulting solution evaporation in water bath and dry the solution to get saponins. 21,22]

C. Volatile oil:

Volatile oils extracted in Thyme by continues extraction method by using (Soxhlet) device, then by using ether as organic solvent where (5) g of Thyme powder with (150) ml of ether were carried out by extraction process for a period of (24) hours after that we separate solvent from volatile oils [23].

Table (2): Percentage of active chemical of Thyme.

Active chemical constituents	Percentage (%)
Tannins	9.2%
Saponis	21.1%
Volatile oil	50.7
Thymol	54.26

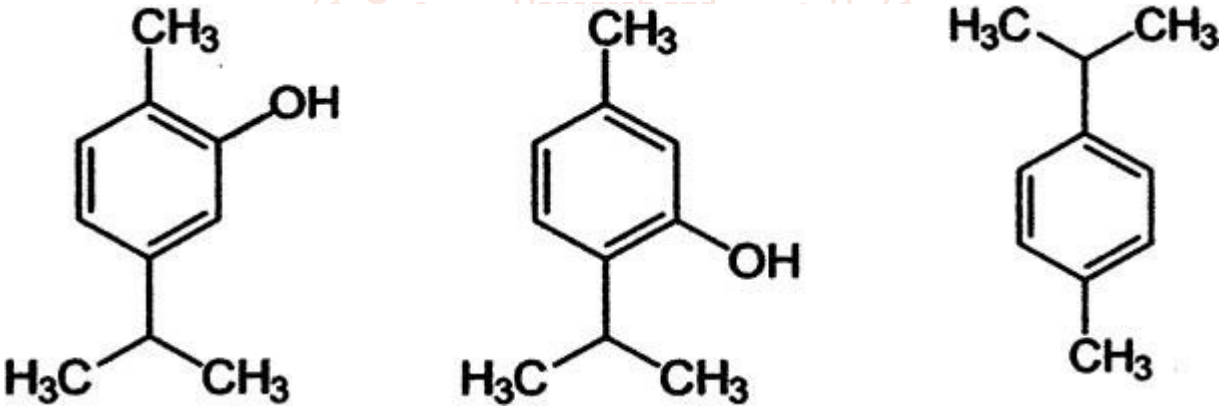
Table(3): Chemical composition of thyme essentioal oil

Component	Formula	Relative Concentration (%)	Component	Formula	Relative Concentration (%)
3-Hxenol	C6H12O	0.10	Anisole	C7H18O	0.23
α-Tujene	C10H16	1.52	Geraniol	C10H18O	0.10
δ-3-Carene	C10H16	0.11	Citral	C10H16O	0.24
α-Terpinene	C10H16	2.36	Thymol	C10H14O	54.26
ρ-Cymene	C10H14	7.61	Carvacrol	C10H14O	4.42
γ-Terpinene	C10H16	9.50	Octadienoic acid	C18H12O	0.10
Terpineol	C10H18O	1.37	Geranic acid	C10H16O2	0.30

[24]

Essential oil:

There are at least 6 chemotypes of Thyme with different compositions of the essential oil; only the 'thymol'-type with thymol as predominant compound complies with the definition in the European Pharmacopoeia. The dried herbal substance contains up to 2.5% essential oil; the main components are thymol, carvacrol, p-cymene, γ-terpinene, linalool, β-myrcene, terpinen-4-ol. Some compounds occur partly asglycosides [25].



(Figure 8) . The chemical structure of Thymol, carvacrol and p-cymen [26]

The chemical structure of more important compounds. Thymol carvacrol and p-cymene are presented in Prasanth et al. (2014) reported that the essential oil from Thyme 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 amountof all other components of the oil was less than 19%.[27]

Various Formulation of Thyme:

Tincture (15%w/w), Syrup(thymol 51.34%), Cream (Carvacrol (63.65 %), Jelly, Soaps, Cosmetics, Perfumes, Toothpastes, Food Colours, Thymol oil, Tea.

(Figure 9). Formulation of Thyme

Evaluation:

1. Gas chromatography and mass spectrometry:

Gas chromatography and mass spectrometry (GC-MS) analysis of the essential oil was performed on a GC-MS QP2020 equipped with an Rxi-5Sil MS column (5% diphenyl-95% dimethylpolysiloxane 30 m × 0.25 mm i.d., df = 0.25 µm; RESTEK GC Columns, USA). The injector and detector temperatures were set at 250°C. Temperature programming of the oven included an initial hold at 40°C for 2 min and a rise to 240°C at 4°C/min and held for 53 min. Helium was the carrier gas, with a linear velocity of 43.4 cm/s. The samples were diluted with n-hexane (1:10, v/v), and a volume of 1.0 µl was injected into the GC with the injector in the split mode (split ratio: 1:25). The ionization voltage applied was 70 eV (electron volt), with a mass range m/z (mass-to-charge ratio) of 40–400 amu (atomic mass unit). [28]

2. Total phenolic and flavonoid content:

To determine the total polyphenol content, 0.5 ml of the sample extract was mixed with 2 ml of Folin-Ciocalteu's reagent. After 5 min, 2.5 ml of 7.5% Na_2CO_3 solution was added, and the mixture was incubated for 90 min in the dark. The reaction mixture absorbance was measured at 760 nm, and the reaction mixture without the sample was used as a blank. Gallic acid was chosen as a standard, and a 6-point standard curve was prepared (0–50 mg/L). The TPC of the plant extract was expressed as gallic acid equivalents (mg GA/g) for dry powder (Riahi et al., 2013; Singleton & Rosi, 1965). All samples were analyzed in duplicate.To determine the TFC, 1 ml of diluted plant extract was mixed with 1 ml of 2% $AlCl_3$ methanolic solution. After incubation at room temperature for 15 min, the absorbance of the reaction mixture was measured at 430 nm. Quercetin was chosen as a standard, and a standard curve was prepared (0–50 mg/L). The TFC was expressed as mg quercetin equivalents/g for dry weight (Djeridane et al., 2006; Riahi et al., 2013). All samples were analyzed in duplicate.[28]

Pharmacological properties and Uses:

1. Antioxidant properties:

An antioxidant is a agent that inhibits the oxidation of different molecules and product. 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. Antioxidant stops 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 Thyme. L. oil and to evaluate the protecting effects of this oil against aflatoxininduce oxidative stress in rats. The results indicated that the oil contains Carvarcrol(45 mg/g), Thymol (24.7 mg/g), β-Phellandrene(9.7 mg/g), essential oil(4.1 mg/g), Humuline(3.1 mg/g), α-Phellandrene(2.3 mg/g) and Myrcene(2.1 mg/g) [10]. However, α and β-pinene, Myrcene, α-thyjone, Tricyclene, 1, 8-cineole, and β-sabinene were found in

very lower concentrations. Treatment with aflatoxins alone disturbs lipid profile in blood serum, decreases total antioxidant capability, increase creatinine, uric acid and nitric oxide in blood serum and lipid peroxidation in liver and excretory organ attended with a sever histological changes within the liver tissues. [29]

2. Antidiabetic Action:

Recently, researchers' interest increased in medicinal plants to treat hyperglycemic status (Mansi and Lahham, 2008). Several researchers suggested to utilize these plants for their different biological effects in special disease like diabetes (Jung et al., 2006). Maqsood et al. recommended thyme amongst those plants that has antidiabetic action (Maqsood et al., 2009). Thyme aqueous extract revealed antihyperglycemic effect in alloxan induced hyperglycemic rabbits without effect on body weights. Due to the plant's ability to boost elimination of glucose from circulation, reduce liberating of glucagon or rise of insulin, decrease absorption of glucose from the GIT or stimulate the peripheral tissues for glycolysis process, directly (Marrif et al., 1995 and Alamgeer et al., 2012).[30] that T. serpyllum and its extracts have inhibitory action on α-glucosidase in vitro (Gholam-hoseinian et al., 2008). The α-glucosidase is among the en- Other studies found that thyme oil is rich in active substance like phenolic and flavonoids compounds, especially carvacrole and thymol (Fachini-Queiroz et al., 2012). This may be caused hypoglycemic effect due to action of thymol or carvacrole that mimics insulin, beside, the ability of its oil to counteract the inhibitory effects of alloxan on glucokinase which is the glucose sensor of the β cells (Ra- himi et al., 2011; Hanna et al., 2014). Enzymes present in the intestine at the brush border, it converts polysaccharides into simple sugars. Diminishing the action of this enzyme delays increment of glucose in blood after ingestion of carbohydrate rich diet and it is one of the important methods to reduce the postprandial glucose in circulation that may prevent the triggering of complications of late diabetes[30]

3. Antimicrobial Activity:

Many scientists ascribe the anti- microbial activity of species from the Thymus genus to the high concentration of carvacrol in its essential oil.[31] It has biocidal properties, which lead to bacterial membrane perturbations. Moreover, it may cross cell membranes, reaching the interior of the cell and interacting with intracellular sites vital for antibacterial activities[32] The biological precursor of carvacrol and another significant component of the plant extracts, p-cymene, has very weak antibacterial properties, but it most likely acts in synergy with carvacrol byexpanding the membrane, causing it to become destabilized[33]

4. Antibacterial Activity:

The oil from Thyme fully flower was the foremost effective at stopping the growth of the microorganism species examined [34]. The oils tested were conjointly shown to possess smart antibacterial activity by direct contact, that gave the impression to a lot of marked against the gram-negative microorganism. Some 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[35,36]

5. Disinfectant and wound healing:

Thyme is reported to be used as a disinfectant, where dried plant bundles were burned to purify the surroundings. Romans and Greeks evoked a spirit of courage by burning these bundles to purify their homes and temples [37]. This reminds us of the modern day fumigation, where the disinfection is done with various antimicrobial substances. However, studies have proven the presence of γ-terpinene and p-cymene, which are the biochemical precursors of thymol and carvacrol, to be responsible for the observed antimicrobial properties [38,39]. Nurses in the 19th century used to apply bandages soaked in thyme water, as this plant was believed to be a natural healer and an antiseptic. Also, the examination of the aqueous extract of Thyme has been proved to improve immunemodulatory functions [40].

6. Anti-Viral Properties:

Silke Nolkemper et al. conducted an experiment with aqueous extracts from species of the L. amiaceae 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 [41].

7. Anti-inflamattory Properties:

Thyme oil is a combination of monoterpenes. the most compounds of this oil are the natural terpenoid thymol and its phenol chemical compound carvacrol [42,43] that have antioxidative, antimicrobial, medicinal drug, antitussive, antispasmodic, and antibacterial effects. Terpenoids, flavonoid, aglycones, flavonoids, glycosides, and synthetic resin acids were additionally found in Thyme [44,45]

8. Antitumor, Antineoplastic activity and Cytotoxic activity:

As one of the principal constituents of thyme essential oil, carvacrol has important in vitro cytotoxic effects on tumour cells [46]. Experiments have confirmed that carvacrol from Thyme and different wild varieties of thyme demonstrates significant cytotoxic activity against leukaemia P388 in mice[47] and Hep-2 [48]. However, according to Tsukamoto et al., thymol, which is also one of the major constituents in the essential oils of Thyme might be involved in stimulating the active proliferation of pulpal fibroblasts [49]. By comparing the antitumor activities of the essential oils of the various species on the growth of four human tumour cells, Nikolic´ et al. confirmed that it is the essential oil of thyme that exhibits the greatest antitumor activity [50]. Thyme the most potent in all the tested cell lines and contains thymol as its major constituent, a phenolic compound known in literature for its anti proliferative activity [51]

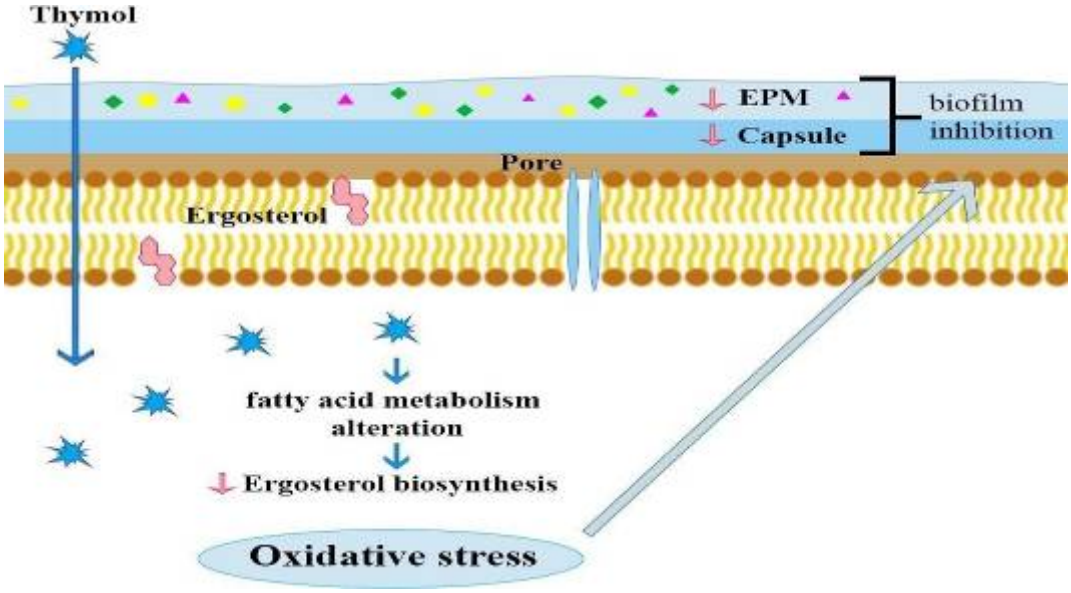
(Figure 9). Antitumor Activity of Thyme

9. Antilipidemic Activity:

The antilipidemic potential of thyme might be due to its constituent of active biological agents, many researchers suggested that carvacol and thymol could reduce plasma cholesterol concentration, it elevate the action of microsomal geranyl pyrophosphatase (Taku et al., 2007). The constitutional variety of the isopropanoids could inhibit the synthesis of cholesterol due its ability to rise the effect of pyrophosphatase. Thymoquinone is considered important derivative of thymol due to its antilipidemic activity (Ali and Blunden, 2003; Badary et al., 2000). Benkhayal et al., 2010, explain the role of biological constituents of thyme on the typical biochemical traits and histological studies of the kidney and liver in rats treated by thyme because it regenerates alteration normal roles secondary to antihyperglycemic action. Several researcher revealed the antihyperglycemic and antilipidemic effects of volatile oil of Thyme. The decrese in LDL concentration may be attributed to the compounds of thyme oil that possess antioxidant potential that inhibit peroxidation of lipid, subsequent LDL declines, and inhibit fat decomposition (Tuama, 2016), furthermore, the flavone is one constituents of thyme oil owning the antioxidant properties that decrease triglycerides and cholesterol concentration, causing lipid depression (Nadia and Rachid,2013).[52]

10. Antifungal Properties:

Ergosterol is a unique sterol found only in the cell membrane of fungi, important for their proper growth and functioning. Therefore, compounds affecting its level may have antifungal activity. The probable antifungal mechanism of thymol is based on the effect on fatty acid metabolism, including ergosterol in the fungal cell. It leads, among other effects, to an increased concentration of reactive oxygen species and oxidative stress, which causes a decrease of the extracellular polymer matrix (EPS) and capsular polysaccharide (Figure 5). Ergosterol decrease was observed in cell membranes of Candida and also Cryptococcus treated with thymol, which caused disruption of membrane integrity, membrane-associated enzyme disturbances, extensive damage and, as a consequence, cell death [53]



(Figure 10). Possible mechanism of antifungal action of thymol.

11. Gastrointestinal effect of thyme oil:

Several studies have demonstrated that thyme and its oil are active in both gastric and intestinal environments. A previous study conducted by Mossaet al. suggested that thyme extract could be administrated orally to treat indigestion. Individual thyme constituents also affect gut health in vivo. It was demonstrated that feeding an equal amount of thymol and carvacrol to animals led to the increase in activities of intestinal and pancreatic trypsin, lipase and protease. They may also improve liver function and act as an appetite stimulant[54] thyme oil is incredibly useful in cases of intestinal infections and infestations like hookworms, ascarids, gram-positive and gram- negative bacteria, fungi and yeasts such as Candida albicans. Its active constituent, thymol, is active against enterobacteria and coccid bacteria. It was speculated that thyme oil may improve intestinal health even without substantially improving the population of beneficial gut microbes[55]

12. Thyme as Functional Food:

The use of herbs and spices dates back to 5000 B.C. Therefore, they might be considered one of the first functional foods. Experimental evidence supports the health benefits attributed to spices and herbs, for example, cardio-protective and anti-atherogenic potential, digestive stimulant action, antidiabetic effects, antilithogenic properties, cancer-preventive potential and anti- inflammatory properties. Nowadays, spices are considered by the scientific community to be potential providers of healthbenefits beyond only food adjuncts for flavor and taste[56]

13. Hepatoprotective effect:

Thymol (150 mg/kg) showed to inhibit paracetamol induced hepatotoxicity in mice by preventing the alterations in the activities of hepatic marker enzymes (Janbaz et al., 2003). Thymol (50 µg/ml) inhibited oxidative damage to liver cells by inhibiting ROS overproduction, ameliorating lipid peroxidation, preventing apoptosis and increasing antioxidant levels in tert-butyl hydroperoxide (t- BHP) induced Chang liver cells (Kim et al., 2014). Thymol (1 ml/kg and5.6 ml/kg) from thyme tincture and syrup inhibited CCl4 induced liver injury by reducing lipid peroxidation mediated oxidative stress and it maintained the levels of hepatic markers in Wistar rats (Raskovic et al., 2015).[57]

14. 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 was less influenced and only by pure oil components. In young larvae the application 1% thyme oil, thymol and carvacrol, caused mortality of 50.0, 86.67and85%,respectively[58]

Other Pharamcological Properties of Thyme:

Thyme is used for swelling (inflammation) of the main airways in the lung (bronchitis), cough, patchy hair loss (alopecia areata), stomach problems, and many other conditions. Along with thyme use as an aromatic, analgesic, antiseptic, diaphoretic, anthelmintic, expectorant, diuretic, spasmolytic, carminative, sedative, stimulant, and

tonic, most frequently used in the treatment of illnesses and problems related to the respiratory, digestive, and urogenital tracts, Due to its pharmacological characteristics, the essential oil of wild thyme represents an important natural resource for the pharmaceutical industry[6]

(Figure no. 11)

Conclusions:

The present study showed that the extract of Thyme plantcontain high amount of flavonoids, tannins, volatile oil Saponnin studied for its Antioxidant, Anti diabetic, Antilipidemic, Antitumor, Antimicrobial, Insecticidal activity Hepatoprotective, Antioxidant, Tincture of Thymol. Currently, thyme can be used as an easily available source of natural antioxidant in new advances and techniques in food technology. for increase spice consumption and, as a consequence, have a positive impact on human health. However, just a few essential oils or plant extracts containing phenolic compounds are currently included in foods. These essential oils and natural extracts represent potential replacements of competitive synthetic antioxidants, Preservative and antimicrobials in food and possible value-added products for human consumption.

However many experiments illustrating its potentiality towards many diseases, more clinical and pathological studies must be conducted to investigate the unexploited potential of the Thyme plant.

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