ZEUGMA BIOLOGICAL SCIENCE

ZEUGMA 2021

BIOLOGICAL SCIENCE v:2 n:1 p:1-19

Review on the medicinal properties of some aromatic hydrosols

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Abstract:

Essential oils that derive from aromatic plants are typically obtained by steam distillation known as important sources of novel therapeutic molecules. Also, during distillation, part of these essential oil components become dissolved in and remain in the distillation water and giving a 'product' called as hydrosol, which is also known as the distillate water. Hydrosol possess various applications in health, cosmetic and food industries selectively contains polar volatile components. Also, it finds application in aromatherapy that has been steadily gaining popularity in today's society as a form of complementary and alternative medicine. This review discusses bioactive properties of some important hydrosol and their medicinal potential.

Keywords: Hydrosol, Essential oil, Aromatherapy, Medicinal proprieties

Introduction:

One of the large interests by human through various civilization is the development of natural products from traditional plants. Herbs and spices are derived from medicinal plants rich in minerals and organic matter remain the mainstay of about 85% of the world's population for health care and gaining popularity in developed and developing countries (Sumit et al.,2012).

Nowadays because of the emergence of drug resistant strains of pathogens from one side and increasing the prices of medicine due to war and sanctions in some countries such as Syria on other side (Roula, 2020) people have motivated to use the complementary and alternative therapies such as aromatherapy.

Aromatherapy makes use of pure oil essences from plants and flowers that act as hormone-like stimulants to improve a patient's health balance (Leger et al.,1986), Essential oils that derive from aromatic plants are typically obtained by steam distillation (Simon, 1990). Also,during distillation, part of the essential oil components become dissolved in and remain in the distillation water and the 'product' is called hydrosol or Aromatic waters (Azadeh et al., 2017)

Hydrosols find application in aromatherapy for their antibacterial, antifungal, antiseptic, astringent, analgesic, ant infectious, antioxidant, cicatrizing, aphrodisiac, digestive, healing and calming properties (Rose, 1999; Catty,200L; Plotto et al., 2001; Price & Price, 2004; Paolini et., 2008). Also, it has implications in food, cosmetic and phytotherapeutic industries to find natural preservative alternatives (Tornuk et al., 2011; Hamedi et al., 2017; Labadie et al., 2015). They are with odor imparting Polar, oxygenated, hydro philic, volatile oil components that can form hydrogen bonds with water, get disproportionately partitioned into the distillation water phase (Rajeswara Rao et al., 2002).

The biological activities of hydrosols are attributed to the major compounds and their functional groups by some researchers (Inouye, 2009). It is largely dominated by oxygenated lightly water-soluble compounds (Śmigielski et al., 2013)

Traditionally floral and herbal waters are employed for medicinal purpose. Nowadays, Aroma therapists and aromatherapy companies are aggressively advertising and trading hydrosols of diverse aromatic plant species (Catty, 2001). The economic value of the hydrophilic essential oil fractions of aromatic oils that escape into the hydrosols gaining interest (Pangarkar, 2008), swept their way into global markets as flavoring, perfumery ingredients (Rajeswara Rao, 2012; Verma, 2012), and caught the attention of global consumers, aromatherapy practioners, beauticians and scientists.

The current researches focuses on biological activities of essential oils and hydrosol driven from medicinal plants for potential use in complementary medicine, food systems, cosmetic and fragrance formulations. This review highlights on different implications for some of these aromatic hydrosols.

I. Thyme hydrosol:

The genus *Thymus* is a permanent, herbaceous shrub belonging to the family *Lamiaceae*, It is growing up to 15-30 cm tall by 40 cm wide (Christopher, 2008) commonly grown wild throughout the Mediterranean region. Thyme has been used medicinally for thousands of years, well known for its antimicrobial, antitussive, spasmolytic and antioxidant activity (Ethan,2004), and it was considered to the ancient Greeks, as a symbol of love, honor and happiness.

It has long been used as a source of the essential oil (thyme oil) that showed according to (Maher et al.,2011) 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%) while thymol and carvacrol, are considered the main phenolic monoterpenes of it**.** Also, phenolic acid (rosmarinic acid) and flavonoids (quercetin, eriocitrin, luteolin and apigenin) are proposed to be the polyphenolic compounds responsible for the antioxidant effects of aqueous extracts (Kulisic et al., 2007). Figure 1. Showed the structure of the most important constitutes of thyme essential oil.

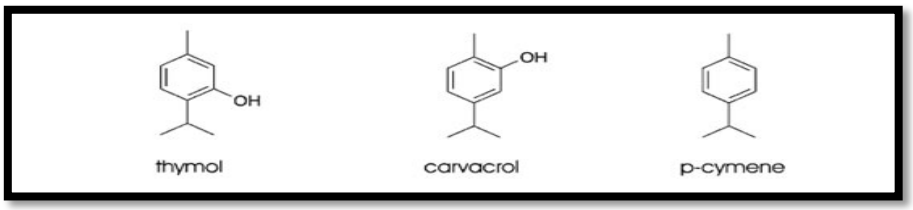

Figure 1. Chemical structure of the main compounds of Thyme

Different research confirms the potential effect of thyme hydrosol as possible means to treat different disease, having multi-implication of for medical use as:

1. Antibacterial affect:

In recent years, the resistance of pathogens to biocides has led to the search and development of safe and natural antimicrobial agents, such as plant essential oils and hydrosol. Foteini et al., 2016 highlighted the significant antimicrobial action of *Thymus capitata* hydrosol against both

planktonic and biofilm cells of a common foodborne pathogen "*Salmonella*" which is recognized as one of the most significant enteric foodborne bacterial pathogens. Also, the two thyme (*Thymus vulgaris* L. and *Thymus serpyllum* L.) were tested by (Sasdig, 2003) for their inhibitory effects against four pathogenic bacteria (*Escherichia coli* ATCC 25922, *E. coli* O157:H7 ATCC 33150, *Staphylococcus aureus* ATCC 2392 and *Yersinia enterocolitica* ATCC 1501). And these hydrosols appeared to have bactericidal effects at concentrations above 50 mL/100 ml. The most sensitive of the bacteria against the spice hydrosols was *S. aureus*. Thymol (a major constituent of thyme) has been used for various bacterial infections.

2. Antifungal Effect:

Thyme hydrosol as antimicrobial agents can be used as an antifungal agent for food industry such as dairy and meat. It can help prevent fungi growing on the surface of foods. Terpenes are the most important volatile compounds found in thyme hydrosol, and it was found that it is responsible of the antifungal activity of thyme (*Thymus vulgaris* L.) hydrosol and propolis extract (PE) (PE) against natural mycobiota on the surface of sucuk (Ismet,2014).

3. Inflammatory Response:

The anti-inflammatory effects of the main constitutes of thyme oil and hydrosol "thymol and cavacrol (CVL)" were studied by (Fernanda et al.,2012) and it has showed inhibition of inflammatory edema and leukocyte migration.

4. Food manufacturing:

Using of synthetic additives in foods in recent years, has been suspected due to their proven and potential negative effects on health. So that, the interest in natural additives and their use in food systems have been increased. Sagdic *et al*., 2017 investigated the effect of brine solutions containing thyme and garlic extracts on physicochemical, and it was found that addition of thyme hydrosol (TH) and garlic aromatic water (GAW) into the brine caused higher acidity and lower pH values while increase in salt level resulted in higher dry matter (DM) of Turkish white cheese made from raw milk. In general, TH, GAW or their mixture increased hardness, gumminess and chewiness of the cheese at the 1st day. Also (Hayaloglu and Fox, 2008) has proved the effect of used *Thymus* hydrosol on the biochemical and microbiological characteristics of the cheeses.

5. Controlling Asthma

Bronchial asthma is a complex syndrome characterized by airway hyper responsiveness (AHR) and reversible airflow obstruction associated with airway inflammation and remodeling and occasional high serum level of IgE (Cohn et al., 2004). Maha (2013) confirms the potential effect of thymol as possible means to treat asthma, the study indicates that thyme and thymol increased the rates of antioxidants in the body, and the ability to get rid of oxidative agent and free radicals that are generated inside the body, or due pollution environment.

6. Blood pressure control:

Hypertension is a common problem facing many peoples in this modern world due to the stressful daily retinue. Research has found a variety of alternative therapies such as aromatherapy to be successful in reducing high blood pressure. Chemical principles from natural sources may contribute significantly to reducing blood pressure. Such as phenol and flavonoid contents of aqueous extract obtained from *Thymus serpyllum* L. (wild thyme, TE), it

has antioxidant capacity, free radical scavenging activity and potential antihypertensive effect, that (Mihailovic et al., 2013) studied the effect of aqueous extract obtained from *Thymus serpyllum* L. (wild thyme, TE) in spontaneously hypertensive rats (SHR) and in normotensive Wistar rats. It was found that the bolus injection of TE (100 mg/kg body weight i.v.) induced significant decrease of systolic and diastolic blood pressure.

II. Lavander hydrosol:

Lavender is a plant from the Lamiaceae family, it grows in Mediterranean region, and commercially grown around the world (e.g., in Bulgaria, France, Spain, Portugal, the United Kingdom, China, Australia, and the United States), primarily for their essential oils (Ziaee et al., 2015). Traditionally, lavender as an herbal remedy has been associated with anxiolytic properties. lavender is chemically made of over 100 constituents, and the major constituents are linalool, linalyl acetate, geraniol, β-caryophyllene, lavandulyl acetate, 1,8-cineole, limonene, trans-β-ocimene, cis-β- ocimene, 3-octanone (Krzysztof et al., 2013). Linalool is considered the primary active constituent responsible for the pharmacological effects of lavender, including its supposed calming and sedative activity (Basch et al., 2004). Figure 2. Showed the structure of the most important constitutes of lavender essential oil.

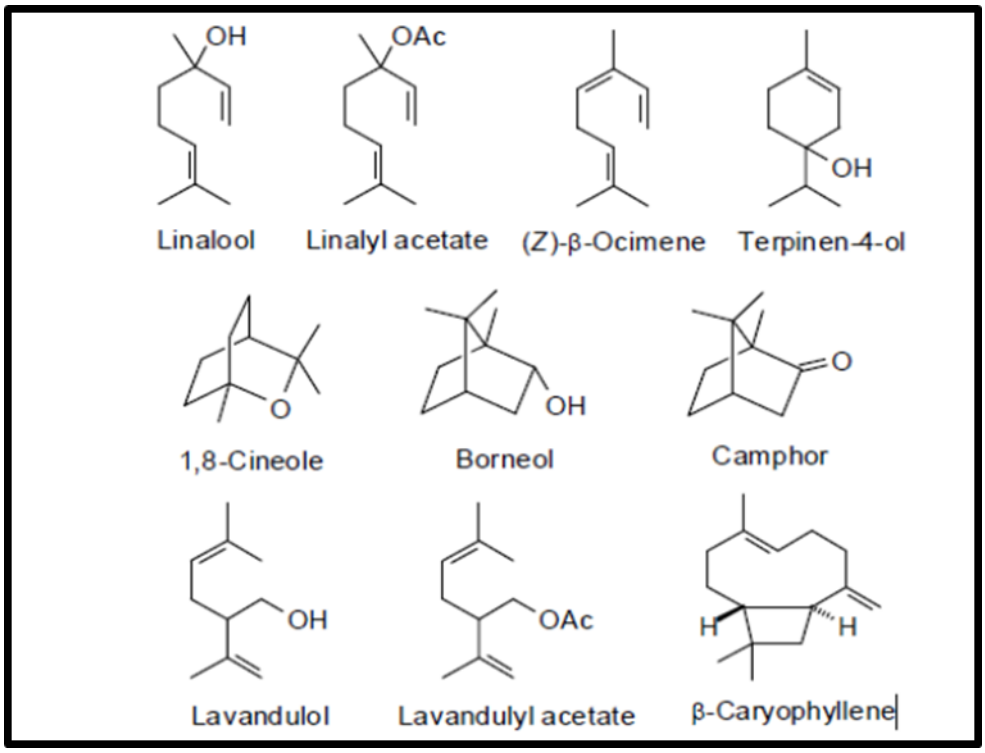

Figure 2. Chemical structure of the main compounds of lavender oil (Cavanagh and Wilkinson 2002)

Lavender hydrosol is among the popular hydrosols used in aromatherapy. It is very useful for beauty, health and wellness. It also been shown to be rich in phytochemicals and possess biological activity. Although most volatile constituents found in lavenders are present in the essential oils, numerous terpenes, phenolic and lactone compounds are left in the hydrosol. In the following some of its biological proprieties:

1. Preservative activity:

Lavender hydrosols used as a replacement for water phase in cosmetics may contribute to maintaining microbiological stability of cosmetic formulations.

Kunicka et al., (2015) indicated the usefulness of lavender hydrosols as a natural, ecologically friendly component of cosmetics with potential preservative activity in formulations, the use of lavender hydrosols in the cosmetic industry as a replacement for water phase in cosmetics may not only result in expenses reduction for chemical stabilizers and preservatives but also in substantial decrease in sewage disposal. *L. angustifolia* hydrolate may also be used as a food additive (Catty, 2001).

2. Controlling Anxiety:

Anxiety is one of the uprising psychiatric disorders of the last decades (Bandelow and Michaelis, 2015), Lavender aromatherapy reduced preoperative anxiety in ambulatory surgery patients (Michael et al., 2017). *Lavandula angustifolia* hydrosol exhibits also revitalizing and relaxing properties when consumed in the form of an additive to water or food (Rose, 1999)

3. Antioxidant properties:

Lavender hydrosols generated by the distillation industry could utilized as a natural source of antioxidants. It has been shown that it is rich in phytochemicals and possess biological activity, and numerous terpenes, phenolic and lactone compounds which left in the it after distillation and could be responsible of its antioxidant properties (Lesage-Meessen et al.,2015), (Torras-Claveria et al., 2007) also has been reported that there is strong linkage between the strength of antioxidant activity and content of phenolic compounds present in the lavender hydrosol. On the other hand (Blazeković et al.,2010) had indicated that lavender antioxidant properties is due to the presence of rosmarinic acid.

4. Antimicrobial activity

The application of hydrosols as a raw material in the cosmetic industry results in both reducing expenses and maintenance the environment (Kunicka et al., 2015) proved antimicrobial activity of hydrosols obtained from fresh or dried *Lavandula angustifolia* herbs or flowers in moisturizing body gel, Lavender hydrosols seem to be promising cosmetic components and may contribute to maintaining their microbiological stability**.**

5. Protective Effect

Due to having active antioxidant ingredient in Lavender, the protective effect of the extract of this plant in gentamicin-induced renal toxicity checked out by (Kalantar et al.,2016), he indicated that the hydro extract of *Lavandula officinalis* reduces biochemical indices and oxidative stress parameters against gentamicin-induced nephrotoxicity in rats.

6. Antifungal activity

Dermatophytes cause infections of the skin, hair and nails as they use the keratin within these tissues to obtain nutrients (Weitzman and Richard,1995), antifungal drugs which treat infections often have side effects, also increasing resistance to them encouraged the interest in of complementary and alternative medicine, such as Lavander oil and its extract that showed wide-spectrum antifungal activity and is highly potent (Huff and Writer, 2011)

III. *Rosa Damascena* hydrosol:

Rosa damascena mill L. commonly known as Damask rose belong to Rosaceae family. it has been referred to as the king of flowers (Cai et al.,2005). This plant is cultivated in all over the world including Syria, Iran, Europe, Bulgaria, Turkey and India, for using in perfume, medicine and food industry (Mohammad et al.,2011). *Rosa damascena* Mill. is an important aromatic plant for commercial production of rose oil, water, concrete and absolute (Verma, 2011).

Essential oil of *R. damascena* is prepared by hydro distillation, its percentage varied between (0.032% and 0.040%) and major constitutes are geraniol, nerol, and phenylethyl alcohol (Baydar et al., 2005), and the other major product of its distillation is rose water, two to three kg of rose water is produced per kg of flower. A study in Iran showed that the quality of rose water is higher in the traditional method compared with the industrial method. It is probably because of shorter interval between harvesting and distillation (Malek, 2001) and the main components of it are phenyl ethyl alcohol, beta-citronellol and geraniol, having a lot of pharmacological effects (Yassa et al.,2009). Figure 3. Showed the structure of the most important constitutes of *R. damascena* essential oil.

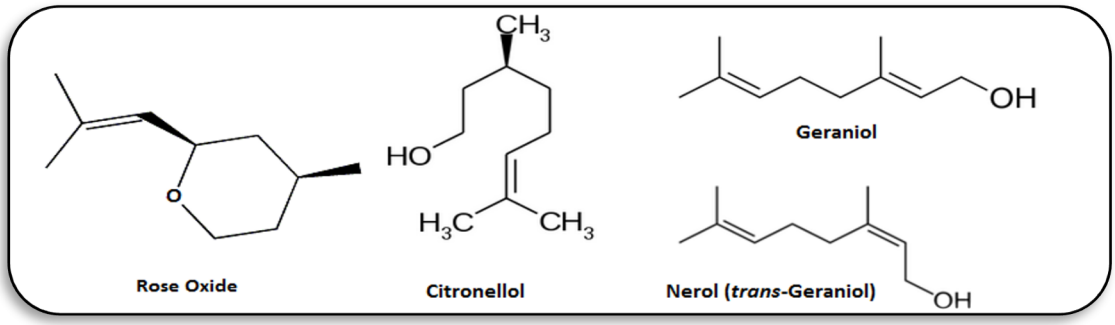

Figure 3. The major components of *Rosa damascena* oil (Verma,2011)

Several Pharmacological studies have been performed on *R. damascena* extracts, and its medicinal functions are attributed to their components such as terpenes, glycosides, flavonoids, and anthocyanin that have beneficial effects on human health, on the following some of them:

1. Diabetes mellitus:

Diabetes mellitus is a multisystemic metabolic disorder that may affect the eyes, kidneys, vessels, and heart happened to high blood sugar levels over a prolonged period (Marina and Maria, 2012). According to study of (İlker et al., 2019) on rose hydrosol, it exerts significant protective properties in diabetes mellitus and has no toxic effect on all studied systems in healthy test groups. Rose hydrosol components significantly increased the lens enzymatic activities of glutathione peroxidase and decreased the activity of aldose reductive to prevent cataract genesis.

2. Hypnotic Effect

Rosa damascena (Rosaceae) has been found to act on central nervous system including the brain. Rakhshandah et al. (2004) indicated that ethanolic and aqueous extracts in doses of 500 and 1000 mg/kg (mice) significantly increased the pentobarbital induced sleeping time, which was comparable to diazepam.

3. The anti-inflammatory effect

Inflammation is a pathophysiological response of mammalian tissues to a variety of hostile agents including infectious organisms, toxic chemical substances, physical injury or tumor growth leading to local accumulation of plasma fluid and blood cell (Sobota et al.,2000).

According to (Hajhashemi et al.,2010) *R. damascena* extract has a potent analgesic effect in acetic acid and formalin tests and also showed anti-inflammatory activity in carrageenan model and these results provided enough credit for the plant use as a remedy against painful and inflammatory conditions. Hydroalcoholic extract of *R. damascena* on rat paw edema induced by carrageenan was demonstrated. the extract could significantly reduce edema which maybe acted by inhibiting the mediators of acute inflammation, this could be to the presence of phenolic compound and vitamin C which have antioxidant and anti-inflammatory effects (Maleev et al., 1972).

4. Antioxidant effects

The presence of phenolic compound in *R. damascena* extract has been shown by Kumar et al (2009), which is responsible of its antioxidant properties. Also, the effects of rose-flower extract on antioxidant enzymes were studied, the activities of catalase “CAT” and glutathione peroxidase “GPx” in SAM mice treated with rose-flower extract showed a marked increase in whole blood and liver (Ng et al.,2005). Also (Özkan et al.,2004) indicated that fresh (F) and spent (S) *Rosa damascena* flower extracts have antioxidant activities. However, the antioxidant activity of FF extract was higher than that of SF extract.

5. Anti-aging effects

The petal extract of *R. damascena* was recently found to decrease *Drosophila melanogaster* mortality without impairing reproductive fitness or metabolic rate. According to Samuel et al., 2012 *R. damascena* extends lifespan by protecting against iron, which concomitantly leads to decreased HSP expression and compromising heat tolerance. Also, the effects of a rose-flower extract on the mortality rate of *Drosophila melanogaster* were evaluated by (Jafari et al.,2008) It has been showed that supplementing *Drosophila* with the plant extract resulted in a statistically significant decrease in mortality rate in male and female flies.

6. Effect on respiratory system

Several recent observations suggest that tachykinins, such as substance P and neurokinin A, might be involved in the pathogenesis of bronchopulmonary alterations (Advenier and Emonds, 1996). The exact mechanism of antitussive effect of *R. damascena* might be due to its possible tachykinin inhibitory substance content mediating both bronchodilatory and antitussive effects according to (Advenier et al., 1997).

IIII. Rosemary hydrosol:

Rosmarinus officinalis L., commonly known as rosemary, belongs to the Lamiaceae family is a perennial shrub, which is originated in the Mediterranean area. The plant is also cultivated in Spain, Morocco, Tunisia, and the southeast of Europe (Wicht, 2009).

The essential oil from rosemary is commonly gained by hydro distillation (HD) or steam distillation (SD) with a maximum extraction yield of 1.0-2.5%. The colorless or slightly yellow oil contains 1,8-cineole, camphor, a-pinene, and borneol (Alexander et al., 2016). Rosemary

contains an abundance of secondary metabolites, such as phenolic compounds (diterpenoids and flavonoids) and volatile compounds (Mena et al.,2011) Figure 4. Showed the structure of the most important constitutes of *Rosmarinus officinalis* essential oil.

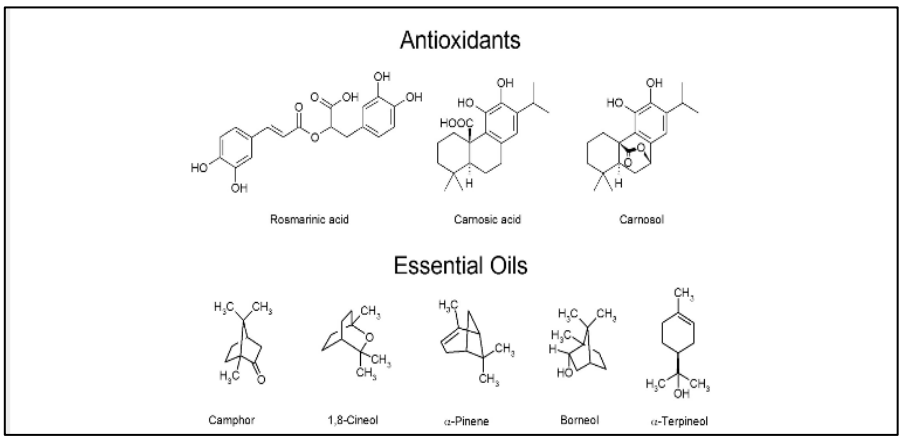

Fig. 4. Chemical structures of the main compounds present in rosemary oil

Several medicinal applications for *R. officinalis* hydrosol have been identified due to its various biomolecules, in the following some of these biological effects:

1. Antimicrobial activity:

A new approach to prevent the proliferation of microorganisms or protect food from oxidation is the use of essential oils hydrosol as natural additives in food. *Listeria monocytogenes* is a Gram-positive, short, motile, psychrotropic rod that can cause serious illness such as septicemia and meningitis in humans (Emrullah et al., 2006). Tanja and Barbara, 2009 indicated the antimicrobial activity of rosemary extracts (*Rosmarinus officinalis* L.) against different species of *Listeria* and different strains of *L. monocytogenes* depended on the selected strain.

2. Antioxidant activity:

Rosemary is one of the major resources for natural antioxidants. The most important compounds are the phenolic diterpene carnosic acid (CAc) and the phenolic rosmarinic acid (RAc). Carnosol (CA) and rosmanol. Alexander et al. (2016) determined by DPPH assays the antioxidant activity of hydro distillation water residues from *Rosmarinus officinalis* L. leaves. It is shown that after 2.5 h of hydro distillation the amount of rosmarinic acid and the antioxidant activity in the water residue reaches a maximum value. *R. officinalis* extract has strong antioxidant activity, which is mainly attributed to its phenolic compounds

3. Antifungal effect:

The main chemical classifications of hydrosols are oxygenated monoterpenes. Nuh and Musa (2005) indicated the anti-fungicidal activity of rosemary herb hydrosols were against *Rhizoctonia solani*, *Fusarium oxysporum* f. sp *tulipae*, *Botrytis cinerea* and *Alternaria citri*. Also (Inouye et al.,2007) indicated Inhibitory activity of rosemary hydrosols against filament formation and the growth of *Candida albicans*

4. Stimulating the nervous system:

Hydrosol mainly consists of water with some aroma components, whereas essential oil consists of highly concentrated volatile components. Camphor and borneol were found both in rosemary essential oil and hydrosol. These facts indicate the possibility of utilizing hydrosol for stimulating the central nervous system (Kenichi et al.,2016)

5. Promotion of Hair Growth

Rosemary Hydrosols consist entirely of cellular botanical water, which includes unique water-soluble compounds that provide it with distinct characteristics and benefits. According to (Kazuya et al., 2013) *Rosmarinus officinalis* leaf extract showed an anti-androgenic effect and hair growth promoting activity in each of the corresponding in vivo assays.

6. Skin care

The skin is the largest organ in the human body; sensation, regulation, and protection are among its most critical function (Kolarsick et al., 2011). The biological activities of secondary metabolites Carnosic acid and extracts of *R. officinalis* has been studied by (Park et al., 2014) it showed that it inhibited the proliferation and adhesion of B16F10 melanoma cells in a dose-dependent manner through the inhibition of the expression of cell migration markers (MMP-9,TIMP-1, uPA, and VCAM-1) and phosphorylation of signaling molecules (Akt, FAK, and Sr), It was demonstrated by (Martin et al., 2008) that rosemary extract inhibits UV-induced metalloproteinase-1, indicating that it may reduce the skin damage caused by sunlight

V. Laurel hydrosol:

Bay tree or laurel (*Laurus nobilis* L) belongs to the Lauraceae family, which comprises 2.500-3.500 species grouped in around 50 genera, is a large shrub with aromatic evergreen leaves (bay leaf), widely distributed in the Mediterranean area and Europe (Ross, 2001) contains about 1.3% essential oils and basic components are 1.8-cineole, linalool and a-terpinyl acetate) Santos et al., 2014). Figure 5. Showed the structure of the most important constitutes of *Laurus nobilis* essential oil.

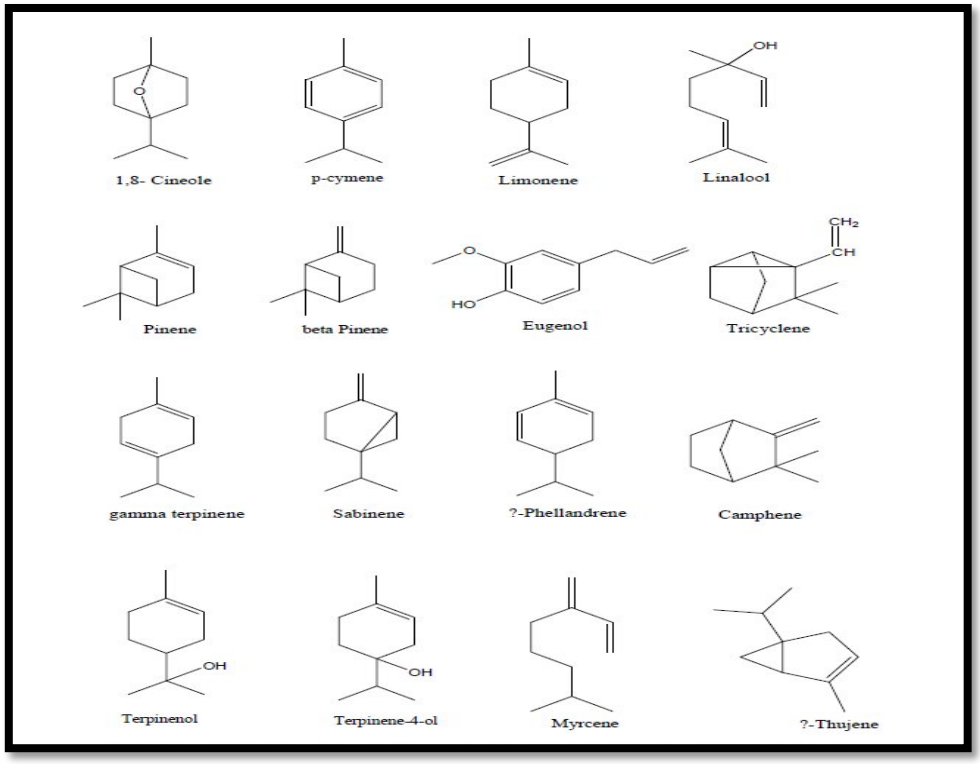

Fig. 5. Chemical structures of the main compounds present in Laurus nobilis oil

The aqueous extract of Laurel tree has been used since ancient times, it possesses significant pharmacological potential for the treatment of different ailments and diseases and found to be safe. in the following covering of some of the more important biological activities of laurel extracts:

1. Antibacterial Activity:

Due to these resistance properties of microorganism against antibiotic, the seeking to alternative way for treatment or for preventing diseases has been increased. The presence of phenolic compounds the essential oil and hydrosol of *Laurus nobilis* such as 1,8-cineol has been gaining attention due to its antibacterial function (Belgin et al.,2018). A study conducted by (Ghadiri et al.,2014) indicated the antibacterial use of the *Laurus nobilis* extract for the treatment of *Staphylococcus aureus* infection.

2. Antioxidant Activity:

Results obtained by (Biljana et al.,2010) concluded that the *L. nobilis* leaf extracts exhibited a certain protective effect, which is more pronounced on the liver than on blood-hemolysate parameters. Also, the results obtained after oral administration of *L. nobilis* leaf extracts are in good agreement with their antioxidant capacity, confirming the relationship between pharmacological efficacy and antiradical activity (Ester et al.,2011).

3. Hygienic Behavior:

The presence of phenolic compounds, such as flavonoids and the antioxidant capacity of hydro-extract of *L. nobilis* could be responsible of its hygienic behavioral effects and colony strength,

according to (Natalia et al., 2019) it was added as supplementary diet to bees in field conditions, and able to inhibit the bacterial growth of all *P. larvae* strains.

4. Gastro protective Effect:

Histological evidences confirm the results evaluated by (Ester et al.,2011) and The gastric damage was significantly reduced by *L. nobilis* extracts administered.

5. Antidiabetic Effect:

Diabetes is a chronic disease that is characterized by high blood glucose (hyperglycemia) due to a total or partial insulin deficiency (Alfonso et al.,2017). Dearlove et al. observed that a hydroethanolic extract *of L. nobilis* inhibited fructose-mediated protein glycation due to its concentration of phenolics, also according to (Yanardag et al.,1994) the *L. nobilis* extract produced a significant decrease in blood glucose levels in diabetic rabbits.

6. Anticancer Effect:

L. nobilis extract has anticancer activities (Berrington and Lall, 2012), and the Sesquiterpenoids that have been isolated from a hot water extract of laurel leaves has been indicated as the active compounds (Komiya et al.,2004) induce cell death and morphological change indicative of apoptotic chromatin condensation in leukemia cell.

VI. Ginger hydrosol:

Zingiber officinale commonly known as ginger, a member of Zingiberaceae family is a spice widely used for culinary and traditional medicines Since thousands of years ago (Mbaveng, 2017). It is grown in areas as diverse as China, India [Cochin], Nigeria, Sierra Leone, Sri Lanka, Vietnam, Australia and Jamaica (Corrigan,1997). The yield of its essential oil varying from 1.0 to 3%. its chemical compositions Zingiberol, zingiberene, phellandrene and linalool, that differ with the source of rhizome, freshness or dryness and extraction methods (Mohaddese, 2019).

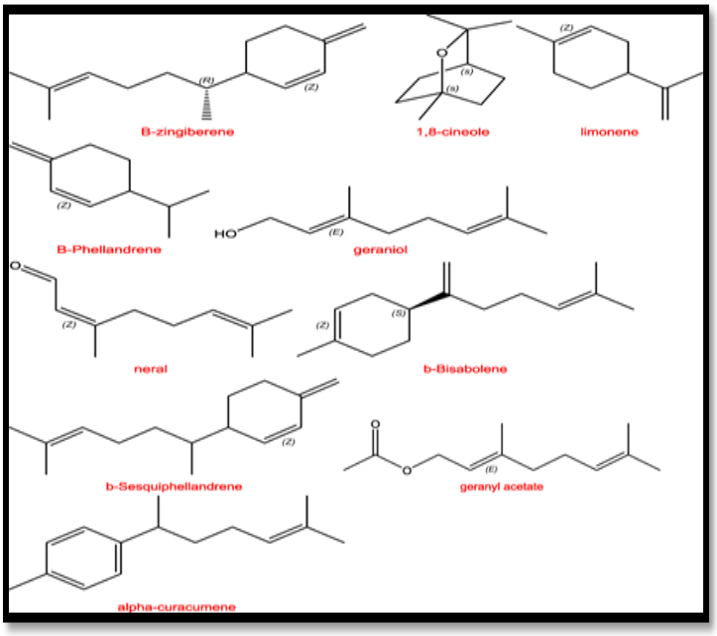

Fig. 6. Chemical structures of the main compounds present in *Zingiber officinale* oil

The hydrosol of *Zingiber officinale* could be used for various commodities of medicinal and pharmacological attributes, in the following highlight on some of its therapeutic properties:

1. Antioxidant activity:

The aqueous extract of ginger (*Zingiber officinale*) rhizome and their oxidative stability was examined by (Kumari et al., 2016) Oxidative stability test revealed that, the ginger hydrosol acted against lipid oxidation. The anti -oxidative capacity of the ginger extract could be attributed to the presence of polar phenolic as they were found in the extract at low concentration.

2. Anti-inflammatory effects:

The ginger rhizome extracts have been used in Malay traditional culture to treat various types of ailments such as inflammatory- and pain-mediated diseases (Mehdi et al., 2017). According to Grzannar et al. (2005) indicated that ginger extract inhibits the induction of several genes involved in the inflammatory response due to a specific substance called α-zingiberene.

3. Antimicrobial Activity

The health benefits of ginger are mainly attributed to its phenolic compounds, such as gingerols and shogaol, it has been developed into natural effective antimicrobial agents against many pathogenic microorganisms (Qian et al., 2019).

Hepatitis C is a major global health burden. Clinical trial was designed by (Adel et al., 2013) to evaluate the beneficial therapeutic effects of ethanolic extracts of *Zingiber officinale* in HCV patients. Clinical response and incidence of adverse drug reactions were assessed initially, periodically, and at the end of the study. It was found that ginger extracts significantly ameliorated the altered viral load, alpha fetoprotein, liver function parameters.

4. Protective effect:

Decreasing the side effects of chemotherapy has been the goal of many studies, the protective effects of *Zingiber officinale* extract on rat testis were investigated by after chemotherapy. Using ginger extract the antioxidant and testosterone levels in serum were increased and an obvious improved histological change has been reported (Mohammadi et al., 2014).

5. Mood booster:

Studies have revealed that anti-inflammatory agents could provide beneficial effect in lowering the incidence/progression of neurological diseases (Ayodele and Philip, 2018). According to Oboh et al. the extract of ginger rhizomes inhibits acetyl cholinesterase activity (key regulatory enzyme involved in neurodegeneration) in vitro resulting in boosting the mood.

6. Reducing xerostomia

Xerostomia, which literally means dry mouth, is defined as decrease in salivation and it is one of the common complaints among diabetic patients (Antonio et al., 2009) ginger herbal spray could act as a new, cheap, and available treatment for diabetic patients with dry mouth, resulting in an increase in salivating (Homeira et al.,2017) similarly, Alaei et al. (2009) demonstrated that ginger is effective in improving dry mouth in patients after head and neck irradiation.

Conclusion:

For ages, aromatic plants have been used for the treatment of various ailments in traditional and folklore medicine, it processed by different distillation techniques and yield distinct products such as essential oil and hydrosol. Nowadays, people have motivated to use the complementary and alternative therapies such as aromatherapy. Due to their mild nature, hydrosols are finding extensive application in aromatherapy industry, and they possess biological activities and have potential as medical products.

This review highlights on biological effects of some aromatic hydrosol. These products need the attention of the researchers as they release volatile substances with varied effects. Likewise, farmers/producers need to be trained in collecting, processing and trading hydrosols to solve the problems of lacking medicines due to some issues such as war and sanctions.

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