

**REPUBLIC OF TURKEY
FIRAT UNIVERSITY
THE INSTITUTE OF NATURAL AND APPLIED
SCIENCES**



**ANTIMICROBIAL SUSCEPTIBILITY OF
ROSEMARY AND MINT ESSENTIAL OILS AGAINST
HUMAN DENTAL CARIES PATHOGENS**

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**Master Thesis
Department of Biology
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MAY-2019

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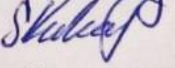
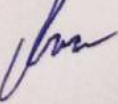
MASTER THESIS

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ABSTRACT

Plants have a high number of benefits that can be much applicable to developing the best medicinal purposes. The different types extracts from the plants are using against a number of pathogens and other high-end diseases. In this context, these extracts from the plants also need to be takes care. One of the key pathogens that the plants can work well in dealing with human dental carriers' pathogens. The aim of the current investigation was to study the antimicrobial activities of some plant essential oils to know if they have antibacterial or antifungal activity on the some dental pathogens micrrorganisms. For this purpose, Essential oils were obtained from the *Rosmarinus officinalis* and *Mentha longifolia* aerial parts with Hydrodistillation by using Clevenger Apparatus. The Agar well diffusion method was used to determine the antimicrobial activity of the essential oils used. However the essential oils were analysed by GC – MS to determine the chemical composition. Tested micrrorganisms (*Streptococcus mutans*, *Escherichia coli*, *Streptococcus sanguis*, *Staphylococcus aureus* *Lactobacillus acidophilus*, *Rothia mucilaginosa* and *Candida albicans*) were taken from 72 patients applied to the Hospital and were used for this purpose. The results showed that both essential oils have some effects on the different microorganism. For instance, the mean values indicate that rosemary and mint essential oil has the most effect on the *S. aureus* bacteria while it has the least effect on *E. coli*. The results also has supported these essential oils can be use to the inhibition of the dental pathogenity and may support the teeth health.

Keyword: Essential oil, *Rosmarinus officinalis*, *Mentha longifolia*, Antimicrobial Activity, Dental Caries

ÖZET

Biberiye ve Nane Uçucu Yağının İnsan Diş Çürüklüğü Patojenlerine Karşı Antimikrobiyal Etkisi

Bitkiler çok iyi tıbbi amaçların geliştirilmesi için kullanılabilecek çok sayıda faydaya sahiptir. Bitkilerden elde edilen değişik tip ekstratlar belli patojen ve yüksek kaliteli hastalıklara karşı kullanılmaktadır. Bu nedenledir ki bitkilerden elde edilen ekstratlar ciddi olarak rağbet görmektedir. Bitki ekstratlarının patojenlere karşı iyi iş gördüğü bir anahtar da insan diş çürüklüğü patojenleridir. Bu çalışmanın amacı bazı bitki uçucu yağlarının bazı diş patojen mikroorganizmalarına karşı antibakteriyal veya antifungal aktivitesinin olup olmadığını tespit etmektir. Bu amaçla, *Rosmarinus officinalis* ve *Mentha longifolia*'nın toprak üstü organlarından uçucu yağlar Hidrodistilasyonla Clevenger Aparatı kullanılarak elde edildi. Bu uçucu yağların Agar well diffüzyon metodu kullanılarak antimikrobiyal etkileri saptanmıştır. Bununla beraber, Uçucu yağların kimyasal kompozisyonunu tespit etmek amacıyla GC – MS ile analiz edilmiştir. Test edilen mikroorganizmalar *Streptococcus mutans*, *Escherichia coli*, *Streptococcus sanguis*, *Staphylococcus aureus*, *Lactobacillus acidophilus*, *Rothia mucilaginosa* ve *Candida albicans* olup, bunlar 72 hastaneye başvuran hastalardan alınmış ve bu amaçla kullanılmıştır. Sonuçlar her iki uçucu yağın mikroorganizmalar üzerinde farklı etkilere sahip olduğunu göstermiştir. İnhibisyon zonlarının ortalama değerleri göstermiştir ki, Biberiye (Rosemary) ve nane (Mint) uçucu yağları *Streptococcus aureus* üzerinde en çok etkiyi yaparken, *E. coli* üzerinde en az etkili olmuşlardır. Sonuçlar, bu uçucu yağların diş patojenitesini engellemede kullanılabileceğini ve de diş sağlığını destekleyebileceğini göstermiştir.

Anahtar Kelimeler: Uçucu Yağ, *Rosmarinus officinalis*, *Mentha longifolia*, Antimikrobiyal aktivite, Diş Çürüklüğü.

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1. INTRODUCTION

The medicinal plants early have been found useful in the treatment of some diseases among those diseases affected by bacterial which is owing to a rich basis of antimicrobial causes. With the information of curative belongings of the medicinal plants beside oral microorganisms and their combination in clinical exercise, we can aim to reduce if not remove this disease objects. Due to a fast increase in the rate of causes or infections, antibiotic confrontation in microorganisms and due to side properties of synthetic antibiotics, medicinal plants are achieving popularity over the medicines. It has got well recognized that medicinal plants offers antimicrobial activity to oral microorganisms. The works survey of the folklore drugs reveals the use of *Psidium guajava*, [1], leaves to maintain oral hygiene, dried fruit of *Terminalia chebula* as an anticaries agent; stem of *Achyranthes aspera* for the treatment of a toothache and stem of *Mimusops elengi* strengthens the gums. Despite several anti-caries agents being available commercially, the search for an active agent continues. Natural products have shown to be an excellent alternative to synthetic chemical substances for caries prevention.

Dental caries cavity is an infectious microbial disease that outcome in localized looseness and destruction of the calcified tissue paper of the teeth. *Streptococcus mutans* is known as the causative bacteria in the formation of dental consonant plaque and dental caries. The battery-acid producing *S. mutans* inhabiting the sass causes damage by dissolution tooth structures in the presence of fermentable carbohydrates such as sucrose, fruit sugar, and glucose. The food debris, acid, bacteria, and saliva combine in the mouth to form a sticky substance called "plaque" that adheres to the teeth. If plaque got unremoved thoroughly and routinely, tooth decay will not only begin but flourish based on [1,2].

Infections affecting dental such as the decay of the tooth and periodontal diseases are prevalent in humans. They have a nature that is not threatening to a life of a person, therefore, making them taken as not significant in overall human health. However, a lot of resources got used in managing the treatment of these infections. The United States spent over 11 billion dollars in 1977 for the treatment of dental and the value had gradually increased by 13 billion dollars in 1984. About 90% of this money got used in methods of restoring teeth or the substance in the tooth that has got lost to tooth decay. These recorded figures only are for the estimated average of 50% of public dental patients who regularly visited dental

hospitals and received treatment. The information roughly shows that periodontal infections are probably the most expensive diseases that a lot of individuals have to come across within the time living. These infections are as costly because symptoms guide the treatment of them and it does not have a flexible preventive approach due to controlling of bacterial factors that lead to decay and periodontal infection. A study has done in 19th-century concluded that dental infections were as a result of the growth of bacteria on the surfaces of the human tooth and the treatment should get directed towards further prevention of the increase. This concept of these infections being non-specific to the bacteria gives no option other than debridement of the tooth facades by the modern versions derived from ancient ways which include toothbrushes, floss and tooth sticks. However, even though careful and professional debridement has proved to reduce the levels of tooth decay and gingivitis, the process is economically expensive because it is labor extensive making most patients opt not to take the case. The treatment costs would be less costly if these infections were specific infections caused by bacteria since the treatment procedure would be oriented to identify the infected individuals then remove the putative pathogens from the plaque [3, 4].

Isolating and studying bacteria is a crucial science method in learning about dental infections. Studies reveal that disease occurs when a specific microorganism approaches the target location, and whenever it reaches there, it finds perfect conditions that enable it to grow and achieve the numbers that destroy the tissue of the host. Concluded that the isolation techniques and used them in studying the microorganisms available in the oral cavity. He found that the bacteria that were inside the saliva were producing acid when added to carbohydrates that are fermentable when closed at a temperature as that of the body. This acid, therefore, was able to decalcify the teeth and there was no decalcification when carbohydrates that cannot ferment got replaced. Thus, brought up Decalcification theory for dental carries where he had two steps; first is that the bacteria that have mixed on the mouth produce acid from carbohydrates that are fermentable, two is that the acid, therefore, disintegrates the tooth surface where a cavity-producing process is started and sustained. Described study caused a lot of controversies involving the work of bacteria in treating dental caries. The questions arose whether the species of the bacterial were the one capable of infection or whether it is a disease that was bacterially infectious. Lately, [5], proposed a hypothesis that cast out the controversy where he came up with a study that eventually brought light in the study of dental caries. He concluded that the bacteria role in

causing caries was non-specificity and removal of a plaque in an infected tooth is a way logically of dealing with the whole dental caries problem.

Dental plaque can lead to caries formation when allowed to increase. It also causes irritability due to inflammation of the gums. Plaque related diseases mostly are supported and progressed by factor considering the oral hygiene and health of the person. Effective removing of the plaque can prevent the growth of plate associated infections. Some dental products marked as anti-plaque agents are a solution that is being used too to support the old-fashioned cleaning ways. An anti-plaque agent causes either removal or reduction on caries or gingivitis when applied [6]. Its response can get seen when the plaque has reduced in size, or when the plate has stopped progressing to further stages on the tooth. Plaque gets formed with two ways that explain. First, the particles that are on the surface of the tooth come together and adhere when not removed. Second, secondary colonizer particles engage to the surfaces of the fundamental particles. This occurrence is now known as coaggregation. To get a proper anti-plaque agent, understanding of coaggregation is vital since any process that interrupts the adherence of the particles logically prevents the development of the plaque. Plants like *Piper betle* and *Psidium guajava* for the most time now have been used in folklore activities in maintaining the health of the mouth.

The infection is very irritative and painful, and some researches involve it in diabetes and high blood pressure causes. Treatment mainly aims at preventing further damage of the surface of the tooth, the earlier the procedure, the less the pain than a progressed decay. The infection, dental caries, also is a considerable cause of foul mouth smell and apart from that; the disease may spread to the surrounding tissues of the mouth. The factor may cause mouth lacking teeth [8].

1.1. Oral diseases

Oral illnesses are among the significant general medical issues and the common of constant sickness that influence human health. The use of characteristic items for the control of oral sicknesses is considered as an intriguing contrasting option to manufactured antimicrobials because of their lower negative effect, and for the push to conquer essential or auxiliary protection from the medication aimed treatment. Therapeutic plants have been discovered valuable in the cure of various sicknesses including bacterial ailments

attributable to a rich wellspring of antimicrobial specialists. With the learning of corrective properties of the restorative plants against oral microorganisms and their consolidation in clinical practice we can mean to lessen if not expel this infection substance. Because of a fast increment in the rate of contaminations, anti-microbial protection in microorganisms and because of symptoms of manufactured anti-microbials, restorative plants are picking up notoriety over the medications. It has been all around reported that restorative plants present antimicrobial movement towards oral microbes. The writing review of the stories prescription uncovers the utilization of *Psidium guajava* leaves to keep up oral cleanliness, dried product of *Terminalia chebula* as an anticaries operator; stem of *Achyranthes aspera* for the treatment of toothache and stem of *Mimusops elengi*, fortifies the gums. In spite of a few against caries operators being accessible financially, the scan for a powerful specialist still proceeds. Regular items have appeared to be a decent other option to engineered concoction substances for caries avoidance [10, 11].

Dental caries is an irresistible microbial sickness that outcomes in limited disintegration and pulverization of the calcified tissues of the teeth. *Streptococcus mutans* is known as the causative microorganism in the development of dental plaque and dental caries. The corrosive delivering *S. mutans* possessing the mouth causes harm by dissolving tooth structures within the sight of fermentable starches, for example, sucrose, fructose, and glucose. The nourishment flotsam and jetsam, corrosive, microscopic organisms, and spit consolidate in the mouth to shape a sticky substance called "plaque" that holds fast to the teeth. In the event that plaque isn't evacuated completely and routinely.

1.2. Role of different phytochemicals against oral pathogens

Phytochemicals refers to plants chemicals that are non-nutritive and have protective or disease defensive characteristics. Plants produce these to defend themselves but current research has demonstrated that they can protect people beside diseases. They have been exposed to be lively not in favor of oral pathogens. The growth of numerous cariogenic bacteria was found to be inhibited by *flavonone phytalexins* from *Sophora exigua* (Leguminosae) with, 4-tetrahydroxy-8-lavandulylflavanone being most active. Many cariogenic bacteria together with oral Streptococci and other mutans, Actinomyces and Lactobacilli were inhibited by two active isoprenyl flavonones namely Artocarpin and artocarpesin, isolated from *Artocarpushet erophyllus* (Moraceae). It has been shown that

Erycrystagallin totally concealed the integration of radio marked thymidine and glucose in *S. mutans*, signifying that compound tamper with bacterial uptake of metabolites [12].

Tea, *Camelia sinensis* (Theaceae) has bactericidal effects on oral bacteria by inhibiting glucan production and amylases thus preventing adherence of bacteria to tooth surfaces. These biologic effects are due to monomeric polyphenols, in meticulous easy catechins like epicatechin gallate epicatechin, and epigallocatechin gallate.

The pastes of tender leaves of guava, *Psidium guajava* were traditionally used to maintain oral hygiene. The menthol extract of this plant exhibits inhibitory action in opposition to two strains of *Streptococcus mutans* owing to decrease of cell facade hydrophobicity experienced in 'early settler' sign bacteria (*S. mutans*, *S. sanguinis* and *Actinomyces* sp.) exposed to 1mg/ml of *P. guajava* extract [13].

1.3. Literature Review

1.3.1. Antimicrobial Assays

Assays that have been utilized to test the antimicrobial properties of restorative plant concentrates and regular items used to treat or avert oral sicknesses include evaluating the limit of the test material to hinder the development of average oral pathogens, for example, *Streptococcus* sp. (for instance, the microscopic organisms ensnared in dental caries). These tests are normally quick and can be completed with negligible cost. Agar dispersion techniques (circle dissemination or well dissemination) are famous and have been utilized as a part of various investigations. These techniques include immunization of the surface of an agar plate with the test smaller scale life form or pouring liquid agar vaccinated with the test living being into a Petri dish. The compound to be assessed can be connected on a paper plate or into a well-made in the agar. After proper brooding, the presence of zones of development hindrance around the plate or well demonstrates antimicrobial movement. Different tests can include straightforward "spot testing" of concentrates by putting little amounts (10 or 25 μ L) on the surface of agar plates containing an overlay of microbes and watching restraint of development after brooding. Elective strategies include adsorbing the test mixes in the answer for a strong lattice (e.g., silica gel plates) and afterward overlaying with agar containing pointer life forms.

Measuring the antimicrobial action includes techniques practically equivalent to those used to decide the base inhibitory centralization of antimicrobial synthetic specialists, for example, antimicrobials or disinfectants. This includes uncovering the test creature to serially weakened concentrate/compound (either in fluid or strong media) and deciding the base focus that restrains development. These strategies are portrayed in ISO 20776 (Clinical research facility testing and in vitro analytic test frameworks), which expresses that "Weakening techniques are utilized to decide the base inhibitory fixations (MICs) of antimicrobial operators and are the reference strategy for antimicrobial helplessness testing. In weakening tests, smaller scale life forms are tried for their capacity to create noticeable development on a progression of agar plates (agar weakening) or in soup (juices weakening) containing serial weakening of the antimicrobial specialist. The most minimal convergence of an antimicrobial operator that, under characterized in vitro conditions, keeps the presence of unmistakable development of a microorganism inside a characterized timeframe is known as the Minimum inhibitory concentration [13].

Rosemary can be characterized as a woody-stemmed which has a needle-like and its leaves are usually 3 feet in tallness. It is an enduring herb and it has pink, white, blue or pink blooms. In the end, amid hotter atmosphere, rosemary extends to 5 feet when not cut. Rosemary can likewise make a great evergreen fence particularly in zone 8 or further south. In zone 7 or the even colder condition, endeavoring to develop rosemary in a compartment may bring inside exposed to the harsh elements climate. It is likewise conceivable to prepare rosemary into various shapes, for instance, topiary shape [14].

The binomial classification name for rosemary is *Rosmarinus*. Rosemary is an individual from mint family, Lamiaceae and it incorporates different herbs. The expression "rosemary" is gotten from Latin names "dew" for (ros) and "ocean" for (marinus). As it were, rosemary was gotten from the Latin words "dew of the ocean." The plant can likewise be alluded to as anthros. This plant has a stringy root system [15].

The essential oils have recently begun to receive much attention as possible sources of safe and natural alternative medicines because they have been known to possess various medicinal activities. Therefore, studies on important oils to assess the pharmacological houses if you want to find viable opportunity medicines have end up energetic in latest years. Researchers from all over the world are trying to signify various organic houses of vital oils which incorporates antimicrobial, antiviral, antimutagenic, anticancer, antioxidant, antiinflammatory, immunomodulatory, and antiprotozoal activities [16].

Competences of various essential oils are associated by analyzing the attentions required to constrain the growth of board organisms. Commonly, least growth inhibitory concentrations (MICs), minimum deadly concentrations (MBCs or MFCs), MIC50 and LD50 standards are used for contrast of bioactivities. These standards are obtained with homogenous practices [17].

chronic dental contamination is painful, and most importantly, it has additionally been suggestively connected to diabetes, high blood pressure, coronary heart disease, and multiple sclerosis later in existence. The pain cans be worsened by warmness, cold, or sweet food and drinks. Remedy regularly prevents in addition infection of the teeth shape. Early remedy is less painful than remedy of significant decay. Dental caries might likewise make terrible breath also foul tastes. Done exceedingly advanced cases, spoiling camwood spread from the tooth rot to encompassing delicate tissues which might prompt a edentulous mouth. Though recent reports show the antibacterial activity of *P.guajava* and *T. chebula* against the cariogenic bacteria, its antibacterial and antifungal activity with different solvent extracts are screened latest reports display the antibacterial activity of *P.guajava* and *T. chebula* towards the cariogenic bacteria, its antibacterial and antifungal hobby with unique solvent extracts are screened in this study. Knowing the the truth that little literature is available on the anticariogenic belongings of *A. aspera* and *M. elangai*, that investigation is concentrated around surveying those plant extracts for different solvents. Hence, to those display investigation, What's more, the lion's share of Corps parts don't stay in their starting work areas once their common. *S. mutans*, *C. Albicans* are those microorganisms what's more contagious strains chosen Similarly as focus creatures from contaminated patients What's more screened utilizing hexane, ethyl acetate, ethanol Furthermore methanol extracts of abandons of *p. Guajava*, dried tree grown foods of *T. Chebula*, roots of a. *Aspera*, what's more stays about *M. elengi*. When those antimicrobial property of the plant extracts is screened under in vitro condition against oral pathogens, in vivo trials might be conveyed out for the medication for dental caries Toward outer requisition on the caries tooth rot or Concerning illustration a preventive mouth flush[18].

1.3.2. Medicinal Plants and Their General Usage

The medical plants which are referred as the herbs or herbal medicines in pharmacologically for active plants, which is remain as the dominant form of the medications in the development countries. Over the three fourth among earth's inhabitants Influenced by principally on raw plant produces to meet their regular health care requirements[19].

(Beaux, 1999) [20]. The collected plant resources used as fresh in direction to gain the extract from the entire plant or behalf of it, which includes flowers, leaves or root fruits. In case of forested procedures, typically the bark, roots and additional parts are applied. Carminatives like ginger, pieces and coriander are also regularly other as fresh or desiccated resources. Like cranberry juice, (*Vaccinium macrocarpon*) and bearberry (*Arctostaphylos uva-ursi*) where reported in different guides of phytotherapy to delight or treat urinary tract contaminations while species such as garlic (*Allium sativum*), tea tree (*Melaleuca alternifolia*) and lemon balm (*Melissa officinalis*), are labeled as broad-spectrum antimicrobial activities.

Plants have a high number of benefits that can be much applicable to developing the best medicinal purposes. The extracts from these plants can be very useful in dealing with a number of pathogens and other high-end diseases. The extracts from the plants also need to be taken with care. This is because some plants apart from containing some better medicinal value to the human beings, it is also important to note that there are some plant extracts that contain some rather dangerous substances which may be hazardous to the human life. Therefore, the plant extracts should be done with extreme care and this will enable the production of high-end medicinal substances that will benefit the people and deal with pathogens [21].

Therefore, various methods can be used to extract and test some of the plants if they are viable to produce the required dental carrier's pathogen carriers. The methods that are applied in the determination and success of this research are analyzed fully below:

In Uganda and South Africa, many persons in the rustic areas obtain their strength teaching and strength care from physicians of outdated medicine. In the Eastern Cape Province, of South Africa, *Elephantorrhiza elephantine*, *Hermannia incana*, *Pelargonium reniforme*, *Alepidea amatymbica* and *Bulbine latifolia* are the plants suggested most regularly for the action of diarrhoea by both outdated healers and rural inhabitants. Leaves

bark and Roots are the communal parts of plants used, though decoctions and distillations are the main approaches of groundwork [22]. few plant extracts through great healing value are the branch bark decoction of *Albizia gummifera*, which is recycled in the organization of venereal illnesses (Buwa and Van Staden 2006), parting of *Glyphaea brevis*, which are macerated in water and are used to treat intestinal diseases and hepatitis and oil extracts of the roots, seeds and stalk barks of *Monodora myristica*, Which would use to cure scabies, helminthiasis, intestinal sickness What's more dysenteric syndromes [23]. Large portions meets expectations encountered with urban decay because of deindustrialization, engineering concocted, government lodge utilized Concerning illustration universal music need aid Right away constantly approved through logical examination Toward seclusion of bioactive compound to regulate utilize for drugs. To delegate test, drug disclosure starting with medicinal plants prompted those seclusion about promptly pills for example, such that morphia from opium, cocaine, codeine, digitoxin and quinine, some from claiming which need aid at present being used [24]. All the more as of late a drug, *β -methoxypsoralen*, need been generated starting with the plant *Ammi majus* (bishop's locoweed), which might have been news person by egyptian medicinal specialist on kickshaw vitiligo a skin state described by the passing for paint. This medication is currently used to treat psoriasis and other skin disorders.

1.3.3. Active Components of Plant Extracts

The beneficial medicinal effects of works materials typically result from the combination of secondary coil coil products present in industrial plant s. These chemical Intensify need aid mostaccioli auxiliary metabolite for example, alkaloid, steroids, tannins, and phenol synthetic compound, which are synthesised and saved over particular separating alternately altogether parts of the plant [25]. Generally, goodbye would the positive position stockpiling site for wanted xi mixes. Tree grown foods likewise hold An substantials al add up for dynamic ingredients, Also Therefore need aid regularly expended Concerning illustration juice through oral organization on acquire those fancied exacerbates. Different parts from claiming plants that might be concentrated for restorative mixes are roots, flying parts, flowers, seeds, come barks, and so forth throughout this way; observing and stock arrangement of all instrumentation may be enha [26]. Plant life optional metabolites would utilized Similarly as those foundation for those yield from

claiming profitable engineered substance mixes, for example, pharmaceuticals, greasepaints, or more as of late nutraceuticals [27]. These auxiliary metabolites would generally see as voltage wellsprings for new drugs, anti-microbial medication, bug powder and herbicide [28]. This may be due to their living suggestion Furthermore possibility distinction wellbeing effects, for example, such that antioxidant, anticancer, anti-aging, anti-atherosclerotic, antimicrobial and justifying exercises.

1.4. Essential Oils

An essential oil is naturally obtained through the process of distillation. The oil contains basic characteristics of the plant such as the odors of the plant from which it was extracted. Oil can be classified as being essential if it contains the volatile chemical compounds from the mother plant. Moreover, oil is essential if it contains the essence of “the plant's fragrance-the characteristic fragrance of the plant from which it is derived.

Essential oil is a focused hydrophobic liquid containing volatile aroma compounds from flowers. The blessings of essential oils are their flavor concentrations and their similarity to their corresponding resources. Most of the people of them are fairly stable and comprise herbal antioxidants and herbal antimicrobial agent as on citrus culmination [29]. These aromatic or volatile oils are obtained from aromatic plant materials, including flowers, roots, bark, leaves, seeds, peel, fruits, wood, and whole plants [30]. Many of these essential oils are used for aromatherapy used to create a sense of body relaxation.

1.4.1. Common uses of *Rosmarinus officinalis* and *Mentha longifolia*

Mentha longifolia and *Rosmarinus officinalis* are culinary spices that are used widely. Due to their tonic, carminative, astringent and antispasmodic properties have been used in the traditional medicine. They are the oldest herbs to be referred to as medicinal herbs. These herbs were utilized a few centuries back to enhance memory and mental capacity. Rosemary is best known for boosting the human body functioning. Rosemary has essential dynamic parts, for example, hostile to cancer-causing, mitigating and antioxidant [31]. These segments have a three-pronged assault against diseases and furthermore pathogens which may harm the uprightness of our body or undermine our body invulnerable framework.

The cell reinforcement segments consolidate together and shape a line of the guard behind the resistant arrangement of the body. Rosemary has an awesome measure of these capable mixes, for example, caffeic corrosive, rosmarinic corrosive, carnosol and betulic acid. Rosemary removes and furthermore, unstable oil from rosemary have been critical in advancing menstrual stream and utilized as abortives. The concentrates of the rosemary plant are generally gotten as corrective fixings. The moisturizer of rosemary plant is utilized to forestall hairlessness and to animate hair development. It is likewise used to enhance the absorption procedure and improving the blood flow in our bodies particularly in the head and brain [32].

Rosemary is likewise utilized as an antimicrobial operator. The powdered leaves of rosemary are utilized as a part of tick repellent. The powdered leaves are a viable characteristic bug. Rosemary oil likewise has checked antiviral, antifungal and antibacterial highlights. Once more, rosemary oil is likewise dynamic against the meat ruining microscopic organisms. The rosemary plant can be effortlessly injected into oil and afterward utilized for skin disturbances, for example, joint pain and dermatitis. At the point when utilized remotely, rosemary oil is imperative for the speed mending of wounds and wounds [33]. At the point when utilized inside, rosemary is added to sustenance as a cooking zest. At the point when added to tea, it shapes mellow tea of the rosemary leaves and it is imperative in battling ailments when tasted.

Rosemary is utilized as a part of boosting temperament and expelling pressure. The rosemary fragrance is known for clearing the psyche, mindset change and assuaging worry for the individuals who have pressure hormonal awkwardness and unending unevenness. The plant is topically connected or even expended in some sort of balm of the rosemary abandons, it has comparable impacts. Fragrant healing additionally uses the rosemary oil for the same purpose [34].

Mint on the other hand is used in the procedure known as aromatherapy, a medical form of therapy used to induce relaxation. It has however not been proven to heal any form of illness. Additionally, mint has been proven to be an effective pesticide. They have the natural ability to deter pests such as certain insects and arthropods. Some of the effects include; inhibition of the digestion process, repelling mechanism and also stunting of the growth of the organism.

Physio-Chemical Properties- Essential oils have several common physical properties like characteristic fragrances and high refractive indices. they're in the main optically

active and immiscible with water, however sufficiently soluble to impart their feature fragrance to water. Factually, the aromatic waters are dependable on this moderate solubility. vital oils are but soluble in ether, alcohol and natural solvents.

Chemical materials- Plant vital oils are generally the complex mixture of herbal compounds, each polar and nonpolar compound. The major constituents in essential oils are terpenes (monoterpenes and sesquiterpenes), their oxygenated derivatives (aldehyde, ketones, esters, oxides, lactones, ethers, etc), and phenolic compounds.

[36] Investigated *Uncaria tomentosa* is measured a medicinal plant used across periods with peruvian inhabitants as an alternative behavior for many diseases. Several microorganisms typically inhabit the human oral cavity and in certain circumstances can develop etiologic agents of illness. The goal of the existing study was to assess the antimicrobial activity of different attentions of *Uncaria tomentosa* on changed straining of microorganisms isolated in the human oral cavity. Micropulverized *Uncaria tomentosa* were established in vitro to regulate MIC on nominated microbial strains. The verified strains were oral clinical isolates of, *Staphylococcus* spp, *Streptococcus mutans*, *Pseudomonas aeruginosa* and *Candida albicans*. The tested attentions of *Uncaria tomentosa* reached from 0.25–5% in Mueller-Hinton agar. Three out of a hundred *Uncaria tomentosa* inhibited 12% of Enterobacteriaceae isolates, 54% of *S. mutans* and 86% of *Staphylococcus* spp. The tested concentrations did not current inhibitory effect on *P. aeruginosa* and *C. albicans*.

Rosmarinus officinalis (Rosemary) is primarily known for its medicinal value. It is a spice herb that belongs to the family of *Lamiaceae* family. More research has been done on this plant due to latest discoveries about its anti-inflammatory and antimicrobial purposes. Extracts from this plant have been tested and found to be useful in the process of inhibiting the growth of microbes such as bacteria. It has immense benefits in terms of its medicinal and aromatic value. Rosemary plant belongs to the family of *Lamiaceae*. It's an herb found mostly in the asia and the mediterranean places. Traditionally, this plant has been used in tradoitional medicines and even in the cosmetics.

Further, this plant extract has been used in flavouring of food. Essential oil extracted from the plant has been used in the past as a powerful antibacterial, anti-mutagenic and antioxidant. Research has established that the biological activities of this plant are correlated with the chemical properties and qualities of the plant. Due to the ecological differences of my countries, chemical profiles of this plant might be different depending on

the ecological conditions and the countries. Thus, the essential oils that are collected from different countries and at different times may have different chemical profiles and properties.

1.5. The aim of the study

The aim of the current investigation was to analyze the chemical composition of a hydrodistilled essential oil of *Rosmarinus officinalis* and *M. longifolia* plants collected from the Northern Iraq by GC/MS system in order to determine the essential oil composition. And to study the antimicrobial activities of essential oils *Rosmarinus officinalis* and *Mentha longifolia* to know if they have antibacterial or antifungal activity on the microorganism obtained from the dental plaque, also to determine beneficial effect of those essential oils. This was done by using the agar well diffusion method for determination of the bactericidal activity and susceptibility and to determine the Minimum Inhibitory Concentration of the oils used. It is aimed that if these oils may be affect the pathogen or bacteria on the teeth or dental disease.

2. MATERIAL AND METHODS

2.1. Plant Material

In this study *Mentha longifolia* and *Rosmarinus officinalis* plants were used and *Mentha* leaves were collected from north of Iraq, Sharbazher area which is located in Sulaimanyah city. The collected plants were putted in shadow places until drying, then essential oil extracted.



Figure 2.1. *Mentha longifolia* habitus

The leaves of the plant was extracted from the College of Science garden at Sulaymaniah University in Iraq. After collection, the plant was identified authenticated by the Taxonomist of the department of botany in the college. Isolation of the essential oil, the leaves of plant was air dried and then finely ground.



Figure 2.2. *Rosmarinus officinalis* Habitus

2.2. Extraction of Essential Oils

The essential oils are obtained from plants (*Rosmarinus officinalis* and *Mentha longifolia*) from the aerial parts were hydrolysed for 3 hours. This was done through the use of Clevenger-type apparatus. These distillates of the essential oil then collected.

For the uncooked cloth, there are exceptional extraction techniques. but, on business scale, it's far normally extracted via physical approach, which include water distillation and bloodless techniques. New techniques of essential oils extraction are entering the mainstream of aromatherapy, offering new choices in oils never before available. With the brand new labels of CO₂ and exceptional critical CO₂, at the side of the traditional “steam” and hydro” distillations, 'absolutes', and 'bloodless urgent', a touch education for the aromatherapy enthusiast can cross a long manner in vital oil selection. The techniques of extraction of critical oils are described underneath.

The Clevenger equipment turned into known as its inventor, Joseph Franklin Clevenger, which observed in 1928. Few models are existing. The most not unusual one, is a bit of particular glassware, as may be visible above the spherical backside flask. The flask, of variable size, contains water which is boiled in addition to the plant to be

extracted. The steam rises inside the meeting to a condenser (out of photo), and the condensate falls into the small burette on the proper. Oil floats on the water, which for its part is step by step back to the heated flask through the diagonal conduit. After 2 hours of extraction, the oil quantity accumulated within the burette can be immediately measured. once in a while, the Clevenger equipment gives better yields than hydrodiffusion. numerous factors can provide an explanation for this phenomenon. particularly, the packing of the plant fabric in the hydrodiffusion column now and again creates pockets which are poorly uncovered to steam, and therefore not properly extracted. in addition, the Clevenger equipment makes use of cohobation: the hydrosol isn't always recovered right here, it's miles as an alternative returned to the extractor. therefore, compounds in solution in water are distilled again, and as water becomes saturated, those compounds start to accumulate within the essential oil section. The Clevenger apparatus is therefore considered to be the maximum representative of the “absolute” content material in volatile compounds [37].

On the other hand, this type of extraction is rather scarcely applied at large scale, and the yield is generally overestimated compared with what can be expected in an extraction plant.



Figure 2.3. Essential oils used in the study.

2.2.1. Conventional or Traditional Methods on the Essential oil Extraction.

There are conventional and Traditional Methods for the extraction of the plant chemicals like as; Hydrodistillation (HD), Steam distillation (SD, Enfleurage, Maceration, Cold pressing, Solvent extraction

2.2.1.1. Hydrodistillation (HD)

This has been the main method acting of flavour origin. This is also the official monetary standard method for extracting essential oils for timber ascendance. In this standard method the distillate function is closely defined veggie products, according to the reference method indicated in the standard is done with steam distillation, collecting the distillation product in xylene.

During hydrodistillation the essential oil portion form an azeotropic premix ture with H₂O. Most of the essential oils do not mix well with water in the liquid phase so after contraction, they are separated by decantation. The distillation period can take from 15 to 30 minutes. The extraction period influence not only the yield but also the extract composition. Hydrodistillation can be achieved by one of the two method acting:

- **Clevenger distillation** – extracted material should be immersed in the water after that boiled.
- **Steam distillation** - steam passes over a bed of the material to be extracted.

In both approaches the vapours of the volatile mechanisms are carried by the steam to a condenser. On concentration water-rich and oil-rich layers are shaped. These are separated by decantation. During both forms of hydrodistillation the sample is exposed to temperatures near to 100°C, which can lead to variations or changes in 'thermolabile' mechanisms. Prolonged heating in interaction with water can lead to hydrolysis of esters, polymerisation of decomposition or aldehydes of other mechanisms.

Hydrodistillation at elevated pressures is used with plants flora whose essential oils necessary rock oil are difficult to extract excerpt. However due to the high temperatures temperature used, the danger of decomposition is even higher. Hydrodistillation at reduced pressure is better because lower temperatures are used.

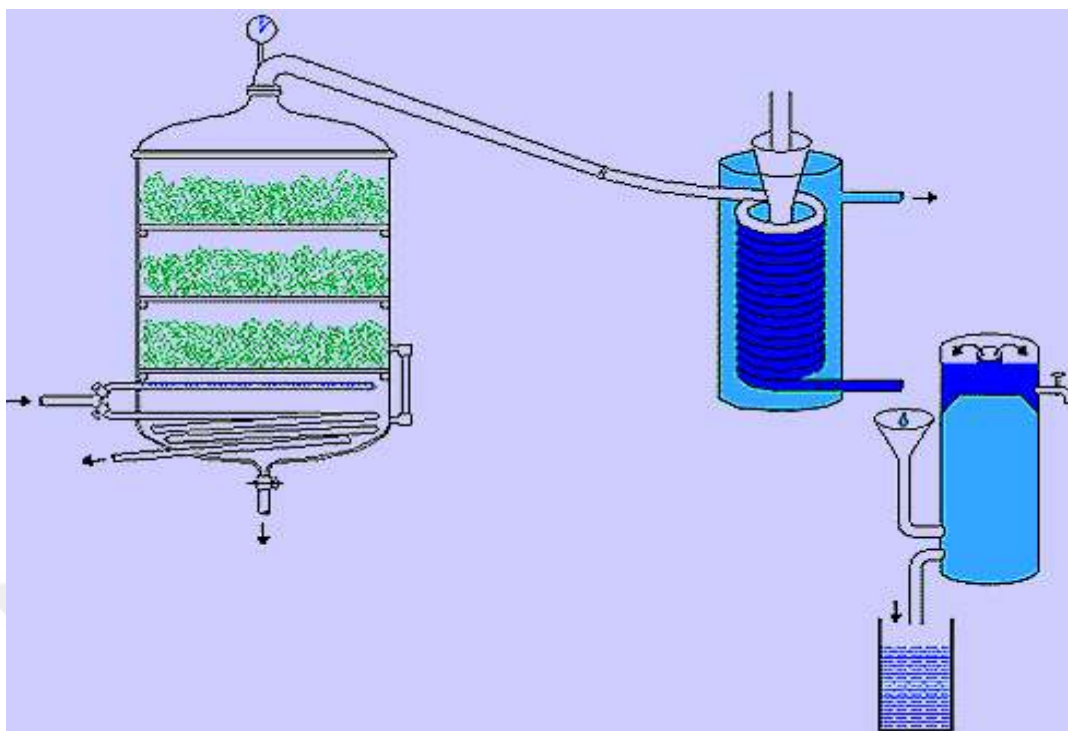


Figure 2.4. Schematic diagram of a steam distillation apparatus[37].

2.2.1.2. with organic solvents at ambient pressure

Origin through organic dissolving agents is mainly used in the perfumery and beautifying businesses. In this technique, the fewer polar of the portion present tense in the herbs (the supposed oleoresins) are extracted together with the requirement oils. Approaches involving dis-result removal are mainly difficult to control. Many plant materials want some degree of commination earlier dealing with a solvent. This abrasion is often escorted by hotness and may lead to volatile exit and chemical modification. Green plant has a very senior high quantity of piss and it is difficult to obtain an appropriate dissolver to excerpt the part from the aqueous prison cellular telephone. Even when a very high-speeding blending is used, the partition equilibrium may be slow and repeated extractions necessary to obtain a satisfactory yield. Descent may be improved by using dry material. But when drying is used some putrefaction can occur, and aromatic cloth from natural sources differ widely in their physical and chemical prop , particularly in their volatility and solubility, so the selection of the result may determine the success of the extraction. The florist gearing broker should be considered when selecting a dis-dissolvent for commercial uses: solvent power (selectivity); mutual foe ; boiling temperature - this should be first gear in social guild to facilitate removal of the solvent from the merchandise

Liquid CO₂ has numerous advantages over most conservative organic fertiliser solvents, namely: non inflammability; because it is gaseous under ambient conditions, it is easily removable; colourless and without aroma or taste; Extracts obtained by this method natural covering song a broader spectrum of volatilities than do those obtained by hydrodistillation, which confers to the oil colour the absolute character; Extracts are free of rest from the inception solution. In the subcritical state of matter, liquid state Carbon dioxide, behaves as a non-polar solvent, with temperature between -Cinque quintet °C and 3unity °C, and pressing sensation between 5 and 74 legal professions. Under pattern working conditions (temperature 0°-decade °C, air pressure L -80 bar) it is a selective solvent, dissolving mainly non polar and slightly polar component part with molecular weights up to about 400 [38]. Factor such as chlorophyll, carotenoid and alkaloid are virtually insoluble in liquid CO₂. Water solubility is 0.1% (w/w) at 20 °C. The relative solubilities in liquid CO₂ of some course of instruction of compound typically nowadays in herbs and other plant materials are summarized in the tabular array below. It is seen from this mesa that virtually all the useful flavor components are extracted.

2.3. GC – MS Analysis of the Essential oils

The essential oils were analysed with GC-MS system and the composition of the essential oils were determined. The GC - MS analysis has performed in University of Basra College of Agriculture Laboratory of GC MS.

2.3.1. GC- MS Conditions

Essential oils samples of 0.1 mL were exposed to analysis by capillary gas chromatography, by Gas Chromatography – Mass Spectroscopy GCMS-QP2010. Helium was used as carrier gas, the flow through the column was 1 mL/min. The Column Oven Temp. :40.0 °C Injection Temp. :280.00 °C Injection Mode :Split Flow Control Mode :Pressure Pressure :49.5 kPa, Total Flow :34.0 mL/min. Column Flow :1.00 mL/min Linear Velocity :36.1 cm/sec Purge Flow :3.0 mL/min Split Ratio :30.0. Carrier Gas Saver :OFF, Splitter Hold :OFF, Ultra] IonSourceTemp :200.00 °C , Interface Temp. :280 °C, Solvent Cut Time :2.50 min. Detector Gain Mode :Relative Detector Gain :0.69 kV +0.10 kV. Group 1 - Event 1-- Start Time: 3.00min, End Time: 30.00min, ACQ Mode: Scan

Event Time: 0.30sec, Scan Speed: 1666 Start m/z: 20.00 End m/z: 500.00. For the identification of the compounds, retention times and MS libraries were confirmed with commercially available standard compounds.

2.4. Antimicrobial Activity Studies

2.4.1. Sampling of Microorganisms

Sampling is the process of picking experimental subjects from a group of organisms for the purpose of research. In this case, the different types of bacteria were picked from the teeth of the patients with dental problems. The samples were then taken to the microbial labs for testing using the antimicrobials such as the Rosemary and the *Mentha* essential oils. Sample collecting is the first step in any researches which related to identification or any microbiology fields; in this study the samples were collected from those patients that they had dental plaque from teeth.

The swap was taken in aseptic condition, then each sample was cultured on Macconkey, blood and sabouraud dextrose agar then immediately transported to the microbiology lab in Sulaimaniyah University because of contamination then incubated in 37° for bacteria and 28° for 48 hours for yeast, 72 samples were collected from three different hospitals such as (Shekhan hospital, Shorash Hospital and Ali Kamal Hospital), all samples were collected taken from those patients in different ages between (15 to 50), to find chronic bacteria.

2.4.2. Microbial Collections

Seven microorganisms were used to evaluate the antibacterial properties, which it includes one-gram negative bacteria and five gram-positive bacteria, and one fungal filament such as *Streptococcus mutans*, *Escherichia coli*, *Streptococcus Sanguis*, *Staphylococcus aureus* *Lactobacillus acidophilus*, *Rothia mucilaginosa* and *Candida albicans*. The microorganisms originally obtained from Microbiology Laboratory College of Science, Sulaimanyah University, Iraq.

2.5. Microbial Identification

The development of a wide range of digestive organ diseases and bacteria for instances, the *helicobacteriosis*, dental carriers and oral *candidiasis* largely depends on the type of food that one eats and what gets into the mouth. Maintenance of oral health and the general well-being is largely the indicator of the life that an individual leads and the quality of life. This study identified some microorganism in the dental cavity of the individuals. The most commonly identified bacteria to be identified is the lactic acid bacterium *streptococcus mutans* and the yeast *Candida albicans*. The bacteria, *S. mutans* plays an important role in during the pathogenesis of the human dental carriers. This bacteria has been identified as not only responsive for the metabolization of the lactic acid found in the dental enamel but is also responsible for in the synthesizing the extracellular polysaccharides, this is mainly a dextran and forms a significant component of plaques. Thus it further aids in reinforcing the carcinogenicity of the carbohydrates that has been taken in. distributed of carriers in the cavities ins not only due to the increased intake of sweets, sweetened drinks and beverages and fast food, studies have established that there exists resistance of the bacteria *S. mutans* to the antibacterial agents that is used mainly as oral care products. With a high number of intake of oral care products, it is not surprises therefore that there is also a surge in the dental carriers amongst the individuals. Researchers have established that this is the leading of carriers as compared to taking sweetened beverages. In the industrialized states, dental carries has a high prevalence among school-aged children as it stands currently at 60-90% which is comparatively high as compared to the developing states.

Further, *C. albicans* has been established by researchers to afflict 40% of healthy human beings across the world. The continued use of antibiotics and cellular immune deficiencies is responsible for the distribution and the development of candidiasis in the human cavity. Such studies in the past has shown that the application of antimicrobial substance when performing oral hygiene is not always justified. The reason for this fact is that *C. albicans* tends to biofilms and cover the tolerant cells. If this bacteria is not treated in the early stages, it has the often leads to a generalized process that has serious and detrimental consequences to dental cavities of an individual. In the recent times, one of the ways to deal with candidacies has been through the use of propolis alongside the use of lavender and sage by individuals. Further, the cloves and cinnamon has been used by some

individuals and its influences are well documented. With different studies done on the effects of cloves, garlic, liquorice, lavender and sage.

2.6. Gram Stain and Chemical Test

The gram staining, also named Gram's technique, is the technique of staining applied to differentiate and categorize the bacterial species into two huge sets (gram-negative and gram-positive). Gram-positive bacteria need a dense mesh-like cell wall prepared of peptidoglycan (50–90% of cell cover), and as a consequence are stained elaborate by crystal violet, while gram-negative bacteria have a solvent layer (10% of cell envelope), so do not recall the purple stain and are counter-stained flushed by safranin.

There are Four steps to determine the gram staining's:

1. Applying a principal stain (crystal violet)
2. The addition of iodide
3. Rapid decolorization with ethanol
4. Counterstaining with safranin

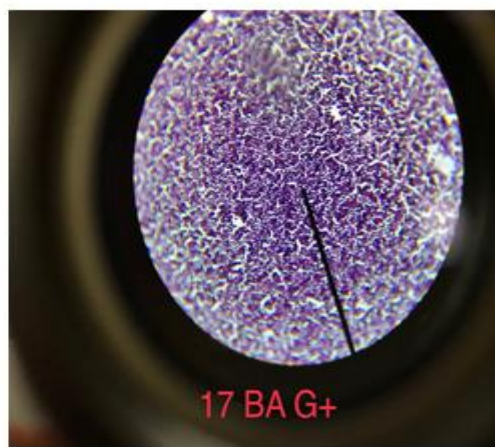


Figure 2.6. Gram stain preparation

2.6. VITEK 2 Analysis

The bacteria in the study were identified using VITEK 2 automated microbiology system. This method is used in the identification of microorganism. This system of microorganism identification works under some principles. Its automated and makes use of the growth based technology in its analysis. This system of analysis exists in three formats, VITEK 2 compact, VITEK 2 and VITEK 2 XL, all this formats only differ in their capacity

to carry cards and precipitates and their degree of the automation. The reagents card that is used in this system has 64 well, each having each on test substrate. Substrates can be used to measure various metabolic activities such as increase or decline in acidity or alkalinity, the growth of substances that impairs growth, and enzyme hydrolysis. Oxygen transmission is guaranteed in the system, this is through an optically clear film that is situated on both sides of the card. Using an optically clear film aids making sure that it's sealed, this ensures that there no any contact with organism-substrate. The 64 cards used in the experiment has pre-inserted tube that is used for the process of inoculation. This cards has unique bar codes that contains individual product type information, the lot number, a unique identifier, used to connect with the sample either before the experimentation begins or after.

2.6.1. A reagent card only exists in four types

1. The GN class – this is used to identify gram-negative fermenting and the bacilli that is non-fermenting
2. The GP class- used to identify the gram positive cocci and the bacilli that is non-fermenting
3. The YST class- this is used to identify the yeast and other yeast like organism
4. BCL- this is used to identify the gram-positive and the bacilli that forms bacilli

2.7. Microorganisms and Culture conditions

Antimicrobial assays were performed on seven species of Microorganisms maintained in Microbiology Laboratory in College of Science, the strains were isolated from human oral cavity from dental plaque, were used: yeast *Candida albicans* Sabourate Dextrose Agar was used for cultivating at 28 °C where incubated, but five type of bacteria's was cultivated on blood agar at temperature 37c.

2.7.1. Agar-well diffusion method

Antimicrobial activity of various extracts was determined by the agar well diffusion method. In this method, pure isolate of each microbe was sub-cultured on the molar hinton

agar (MHA) which is specific media, each microorganism at 37°C for 24h where incubated. A plate of each microorganism was taken and a minimum of 2-3 colonies were touched with a sterile loop and transferred into 9ml sterile distil water under aseptic conditions. Density of each microbial suspension was adjusted equal to that of 10^6 cells/ml (standardized by 0.5McFarland standard) and the optical density (OD) of each microbial was 0.4 – 0.5 at 600 nm which is equal to $4 - 5 \times 10^8$ CFU/ml which is used as the inoculum for performing agar well diffusion assay.

An 100µl inoculum of each test organism was range on to the MHA so as to achieve a confluent growing. The agars dishes were allowed to thirsty and well of 6mm were made by a sterile borer in the inoculated agar platters. The extracts were dissolving in 20% DMSO (dimethyl sulfoxide)for the bioassay analysis. A 100µl of each extract was pushed directly into the wells (in triplicates) of the inoculated specific media agar plates for each test organism. The plates were allowed to stable the organism for 15 min. then incubated at 37°C for 24h for bacteria 28°C for 48h for fungus. Sterile distil water served as the negative control condition and ciprofloxacin (for bacteria) and amphotericin B (for fungi) served as the positive control. The germicide activity, indicated by an inhibition geographical zone surrounding the well containing the extract, was recorded if the zone of inhibition was greater than 6mm. The experiments were performed in triplicate and the mean values of the diameter of inhibition zone were calculated.



Figure 2.7. Standard 0.5McFarland and well preparation on MHA media

The MIC is well-defined as the lowest attentiveness of extract that totally inhibits the growing of the microorganism in about 24h. The Minimum inhibitory concentration for the extracts was followed by above adapted agar well diffusion method. Two fold serial dilution of each extract was expanded by first dissolving the essential oil in 20% DMSO followed by dilution in sterile distilled water to achieve a reducing concentration range of 800 μ g/ml to 100 μ g/ml. A 100 μ l of every dilution was presented into the wells by (triplicate) in the identified media agar plates already sowed with 100 μ l of standardized inoculum (10^6 cells/ml) of the test microbial strain. All test plates were incubated aerobically at 37°C for 24 hrs and detected for the inhibition zones.

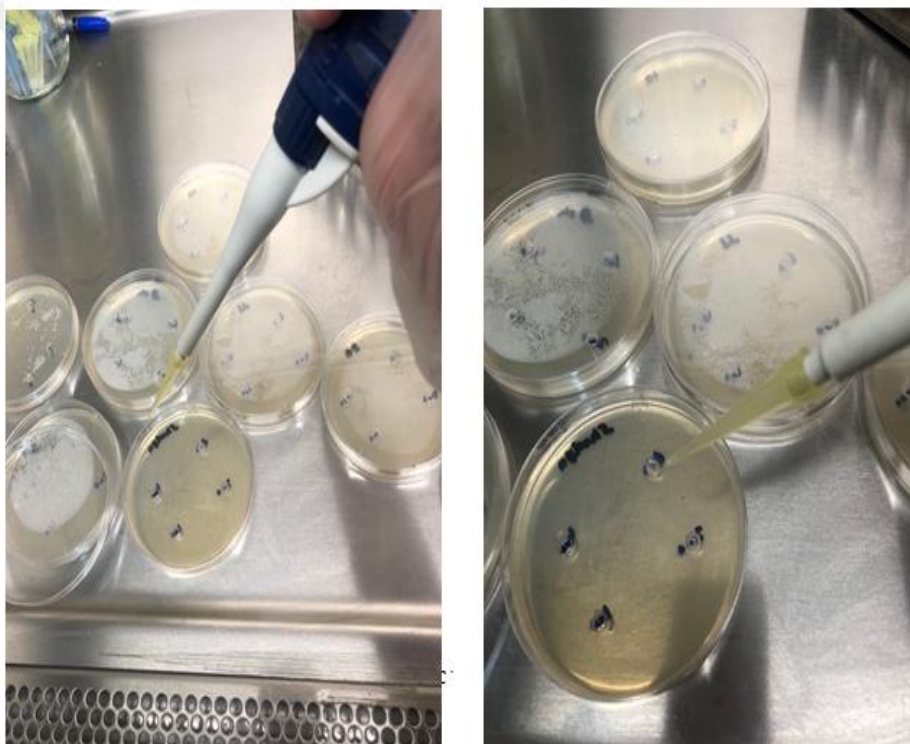


Figure 2.8. Inoculating plates with different concentration of essential oils

Generally, the success during the process of extraction of a botanical compound mainly depends on the solvent that is employed. Water has always been considered as the main solvent during the extraction of the botanical compounds from the sample plant extracts. Of recent, there has been widespread use of a solution that is composed of methanol and ethanol. The usage of the ethanol-methanol solvent is as a result of the ability of the solution to give a consistent and reliable antimicrobial activity.

3. RESULT AND DISCUSSION

3.1. Essential oil Composition

The essential oil analysis of the *Rosmarinus officinalis* and *Mentha longifolia* plants were performed with the GC- MS and the results are shown in Tables (Table 3.1). 44 and 19 components has determined and identified by using GC- MS system.

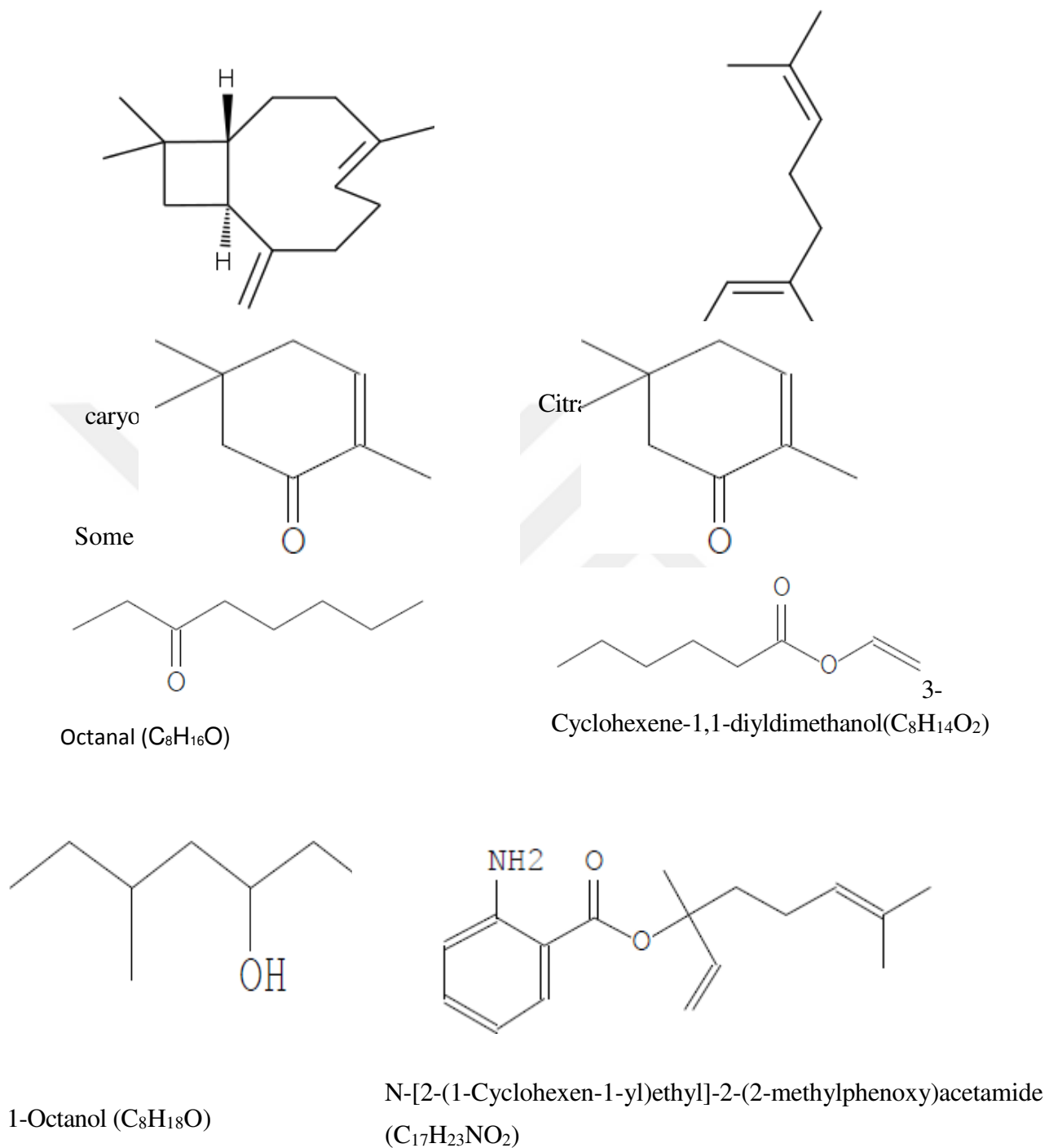
Table 3.1. Chemical Composition of Essential Oils for *Rosmarinus officinalis*.

Peak No	Retention Time	Area	Concentration %	Component Name
1	4.953	543481	0.27	Thujene
2	5.462	3204235	1.57	3-Octanone
3	5.668	739288	0.36	3-Octanol
4	6.235	8964607	4.38	D-Limonene
5	7.348	3965481	1.94	Linalol
6	8.133	13941872	6.81	Camphor
7	8.329	888877	0.43	Bicyclo
8	8.548	10556202	5.16	Bornyl acetate
9	8.648	1837606	0.90	4-Terpinen
10	8.914	3566210	1.74	α -Terpineol
11	9.050	1563117	0.76	Borneol
12	9.139	20869908	9.10	Pentadecanoic acid
13	9.514	6119969	2.99	hydroxymethyl
14	9.709	2325687	1.14	Ethanol
15	10.148	636259	0.31	3-Dimethylcyclohexylidene
16	10.210	3283802	1.60	Ionone
17	10.624	749677	0.37	Bornyl acetate
18	11.042	1322870	0.65	1-Hydroxy
19	12.156	4399262	2.15	tetramethyl
20	12.555	2709841	1.32	Caryophyllene
21	12.636	1152367	0.56	Fenchole
22	14.007	815928	0.40	α -Cedrene
23	14.314	897209	0.44	Hydrochloride
24	15.212	1499120	0.73	Citronellol
25	17.952	791360	0.39	α -Pinene
26	18.803	3400226	1.66	trimethyltricyclo
27	20.874	2.29	2.29	Pentadecanoic acid
28	22.412	1035721	0.51	etradecenal
29	22.842	2022637	0.99	Humulane
30	23.511	3567815	1.74	Ferruginol
31	23.948	11784399	5.76	20-Deoxocarnosol
32	24.379	6438667	20.37	Isocarnosol
33	24.486	1849478	0.90	Camphene
34	24.556	2273050	1.11	Isocarnosol
35	24.686	1243434	0.61	Aflatoxin d1
36	25.312	887858	0.43	p-Benzoquinone
37	26.015	106638	4.21	12-Hydroxyabieta
38	26.151	2451361	1.20	Cyclobutan
40	27.651	1695081	0.83	Tetracyclo
41	27.742	1154588	0.56	Cycloartenol acetate
42	28.106	2011283	0.98	Isocarnosol
43	28.950	11022093	4.38	Spinacene
44	29.332	6140743	3.00	Sterol
Total Percentage				97.90

Table 3.2. Chemical Composition of Essential Oils For *Mentha longifolia*

Peak No	Retention Time	Area	Concentration%	Component Name
1	6.22	1499650	1.06	Thujene
2	8.172	1373078	0.97	3-Octanone
3	9.293	1943741	1.38	3-Octanol
4	9.610	2794130	1.98	Limonene
5	10.029	4356837	3.09	1,6-Octadien-3-ol,
6	10.344	769054	0.55	Camphor
7	10.446	957971	0.68	Pinocamphone
8	11.185	89336209	63.34	Bornyl acetate
9	11.387	7720777	5.47	4-Terpinen ol
10	11.937	4855036	3.44	L terpineol
11	12.162	2046868	1.45	Borneol
12	12.382	1176022	0.83	Verbenone
13	12.553	1667527	1.18	2-Furancarboxaldehyde, 5-(hydroxymethyl)-
14	12.640	1153734	0.82	Ethanol, 2-(3,3-dimethylcyclohexylidene)
15	18.788	1592467	1.13	Ionone
16	20.857	1831292	1.30	Bornyl acetate
17	25.188	4751354	3.37	Ethanone, 1-(2-hydroxy-5-methylphenyl)-
18	26.297	6770142	4.80	3,6,10,10-Tetramethyl-1-oxa-spiro[4.5]deca-3,6-dien-2-one
19	27.827	2324192	1.51	L - Caryophyllene
Total percentage				98,35

Some Chemical Structure for Mint:



3.2. Antimicrobial Activity Results

The Ager well diffusion results obtained from this study has shown in tables and Charts. Table showed that training times (triplicate) and also the amount of the essential

oils used for the antimicrobial activity on *Streptococcus mutans*. These results were obtained by using the Agar well diffusion Method.

3.2.1. *Streptococcus mutans*

The essential oil for both rosemary and mint has been applied against *Streptococcus mutans* to obtain the result against described bacteria and find antimicrobial activity which is described in Table 3.3.

Table 3.3. The Inhibition Zones of The Essential oils obtained from the Rosemary and Mint against *Streptococcus mutans*.

Essential oil Concentration	Inhibition Zones (mm.) and Trainings.							
	<i>Rosmarinus officinalis</i>				<i>Mentha longifolia</i>			
	1 st	2 nd	3 rd	Mean	1 st	2 nd	3 rd	Mean
800µg/ml	13.5	13	13.2	13.2	15.5	15.2	15	15.2
600 µg /ml	11.4	11	11.5	11.3	13.5	13	13	13.17
400 µg /ml	9.5	9	9	9.17	11	11.3	11.5	11.57
200 µg /ml	8.1	8.2	8.2	8.2	9	9.1	9.2	9.1
100 µg /ml	-	-	-	-	-	-	-	-

It is determined that the essential oils of the Rosemary and Mint have no activity on the *S. mutant* in 100 µg //ml concentration (Table 3.3). On the other hand, they have shown also the highest antimicrobial activities on *S. mutant* (13.2 and 15.2) relatively at 800 µg //ml. concentrations for both essential oils. It is possible to say that Mint essential oils has more antimicrobial activity on the *S. mutant obtained from the patients dental plaque more than* Rosemary essential oils.

Table 3.3 shows that 100mg/ml of both the essential oils have little or rather no effect on the bacteria. However, it can be said that the inhibition zones of the essential oil used against the *S. mutant* have increased with the increasing concentrations of the oils.

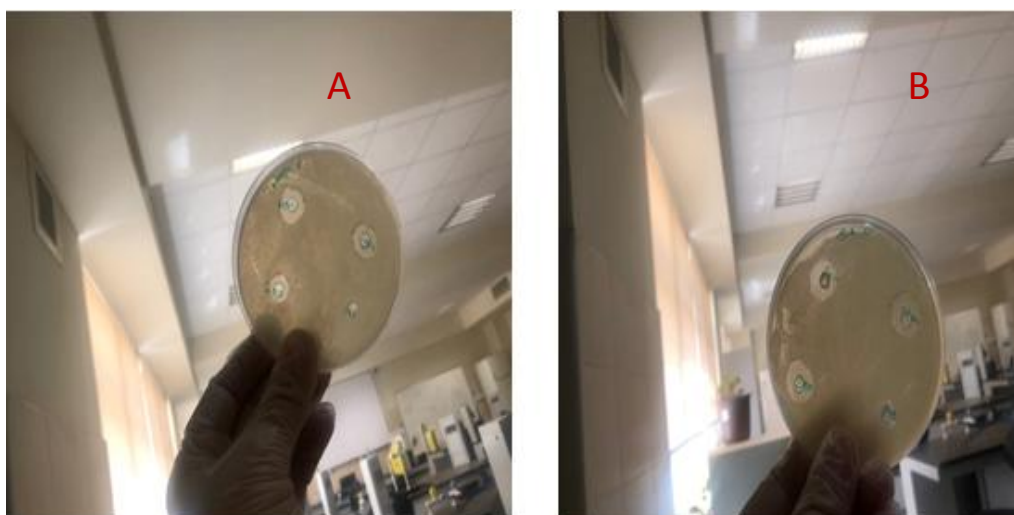


Figure 3.1. Inhibition Zones (800 mg/ml) Of the essential oils of Mint (A) and Rosemary (B) against *S. mutant*

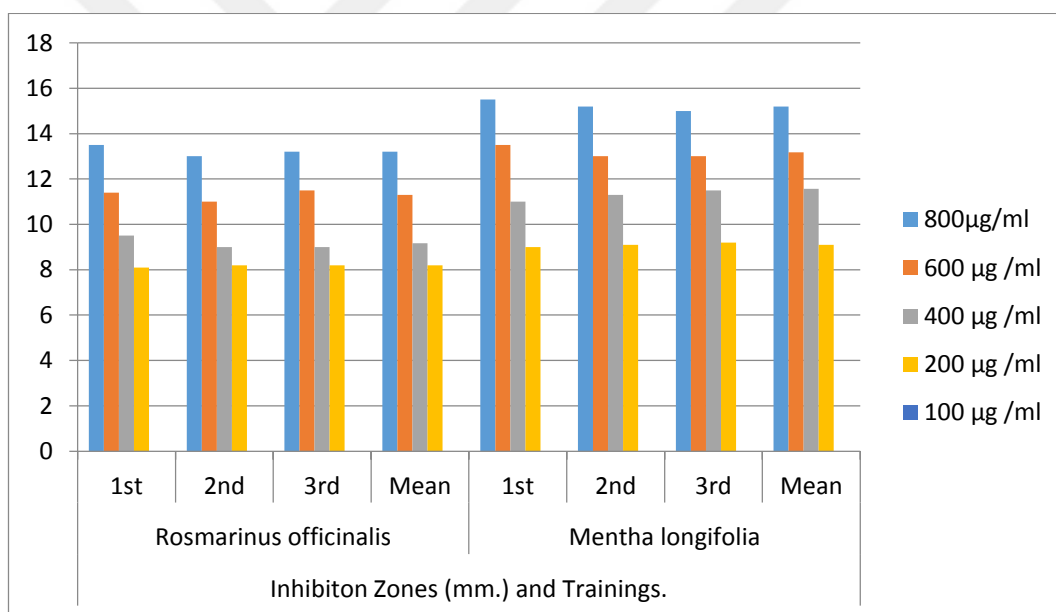


Chart 3.1. Comparison of the Inhibition Zones of the Rosemary and Mint Essential oils according to the increased concentration.

3.2.2. *Staphylococcus aureus*

Is second identified bacteria which evaluated in this study, the given bacteria found through many steps to see if extracted essential oil can have antimicrobial activity against it, the result performed is described in below table.

Table 3.4. The Inhibition Zones of The Essential oils obtained from the Rosemary and Mint against *Staphylococcus aureus*.

Essential oil Concentration	Inhibiton Zones (mm.) and Trainings.							
	<i>Rosmarinus officinalis</i>				<i>Mentha longifolia</i>			
	1 st	2 nd	3 rd	Mean	1 st	2 nd	3 rd	Mean
800 µg /ml	15	15.1	15	15.03	18	18.1	19	19.7
600 µg /ml	13	13	13.1	13.03	15.1	15.2	15.4	15.23
400 µg /ml	12	12.3	12.2	12.17	11.2	12.3	12	14.5
200 µg /ml	10.1	10	10.3	10.17	8	8.2	8	8.07
100 µg /ml	-	-	-	-	--	-	-	--

Table 3.4 shows that Mint has more effect on the bacteria *S.aureus* as compared to rosemary essential oil. Addition of more concentration of the essential oils will eventually lead to the death of the bacteria.

The antimicrobial activity for *S. aureus* dramatically increased by using 800 mg/ml of both *Rosmarinus officinalis* and *Mentha longifolia* essential oil which is shown in Figure 3.2.

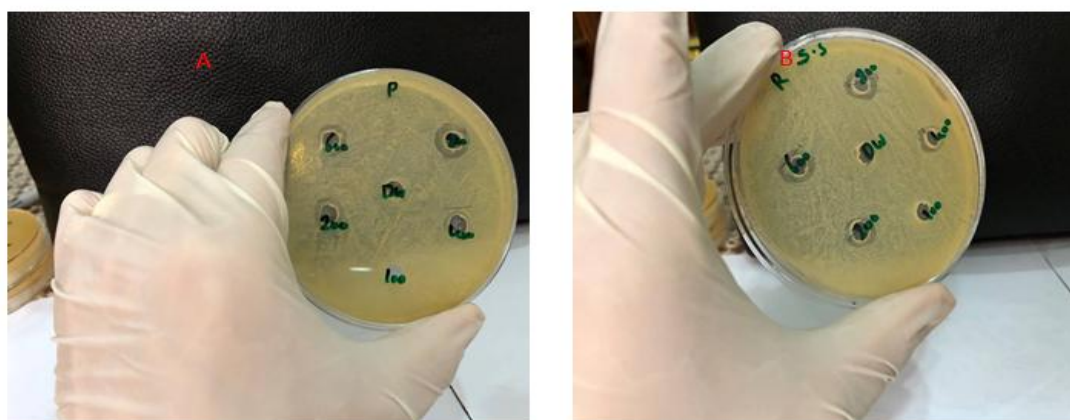


Figure 3.2. Inhibition Zones at (800 mg/ml) of the essential oils of Mint (A) and Rosemary (B) against *Staphylococcus aureus*

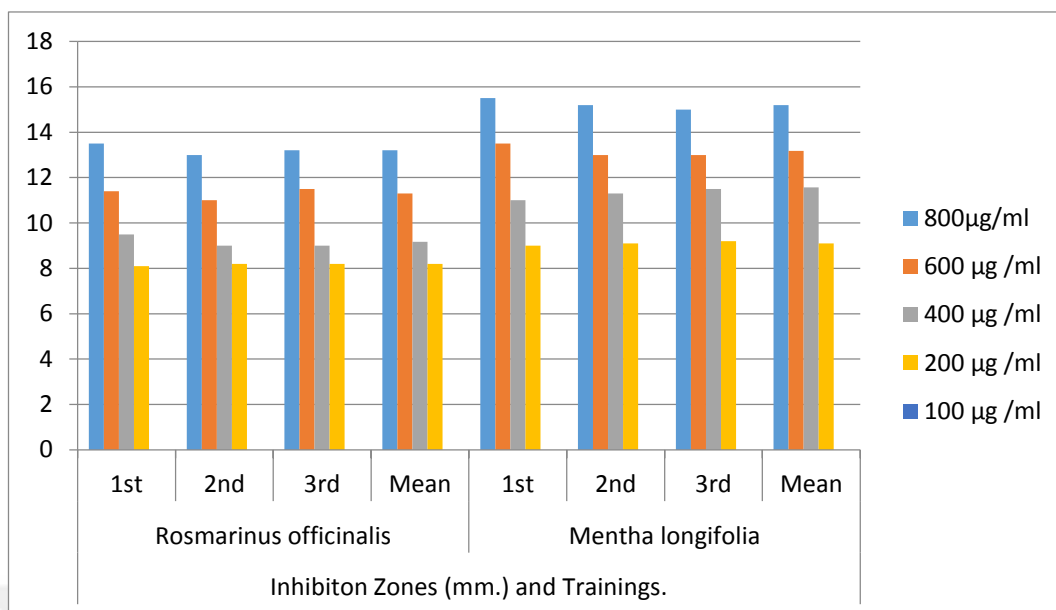


Chart 3.2. Comparison of the Inhibition Zones of the Rosemary and Mint Essential oils according to the increased concentration.

Therefore both Rosemary and *Mentha* essential oil increase the inhibition zone for the bacteria *S. aureus*. The inhibition zone increases with an increase in the amount of the essential oil used. The mean values of the inhibition zones indicate that the bacteria will eventually die with the addition of rosemary essential oil. 100mg/ml or less of both essential oils do not affect the inhibition zone of the bacteria which is described on Table 3.4 and Figure 3.2.

3.2.3. *Rothia mucilaginosa*

Rothia mucilaginosa is a gram-positive which is identified in this study and the essential oil for both rosemary and mint was used to obtain the inhibition zone against *Rothia mucilaginosa* which is explained in attached Table 3.5.

Table 3.5. The Inhibition Zones of The Essential oils obtained from the Rosemary and Mint against *Rothia mucilaginosa*

The Essential oil Concentrations	Inhibiton Zones (mm.) and Trainings.							
	Rosmarinus officinalis				Mentha longifolia			
	1 st	2 nd	3 rd	Mean	1 st	2 nd	3 rd	Mean
800 µg /ml	14.1	14	14	14.03	16.1	16	16	16.03
600 µg /ml	12.5	12.3	12	12.17	13.5	13.2	13	13.23
400 µg /ml	11	10.7	11	10.9	11.3	11.5	11.5	11.43
200 µg /ml	9.1	9.2	9	9.1	10.2	10.3	10.3	10.27
100 µg /ml	-	-	-	-	-	-	-	-

Agar well diffusion were applied for the determining of the antimicrobial activity and bacteria susceptibility, by using rosemary and mint essential oils against *Rothia mucilaginosa* to see if antimicrobial activity can have affect on described bactria or not, the result described in Table 3.5.

The results described in Table 3.5. Showed that the effects of essential oil against *Rothia mucilaginosa* bacteria. Based on the result we can notice that the antimicrobial activity of mint has did more effect when compared to rosemary essintial oil. The maximum inihbtion zone produced was found as 16.03 mm by mint and besides the rosemary also can inhibited the growth of the *R. mucilaginosa*. The maximum inihbtion zone was detected as 14.1 mm by rosemary plant oil.

In addtion both rosemary and mint can not produce antimicobial activity if the amout of essintial oil is less than or equal to 100 µg /ml. therefore the minimum inihbtion concentration for both rosemary and mint is 200 µg /ml.



Figure 3.3. The inhibition zone produced by Mint (B) and rosemary (A) for *Rothia mucilaginosa*

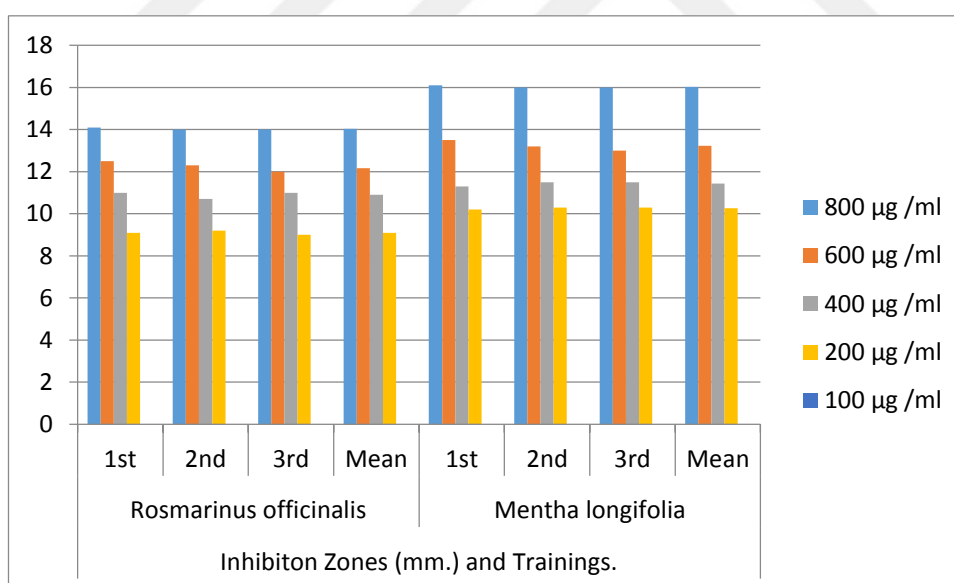


Chart 3.3. Comparison of the Inhibition Zones of the Rosemary and Mint Essential oils according to the increased concentration.

3.2.4. *Lactobacillus acidophilus*

The antimicrobial activity of the selected plants essential oils against microorganisms has also been experimented on the *Lactobacillus acidophilus* to see whether the effect of the

growth of this microorganism. The essential oil of rosemary and mint against *Lactobacillus acidophilus* has described described in Table 3.6.

Table 3.6. The Inhibition Zones of The Essential oils obtained from the Rosemary and Mint against *Lactobacillus acidophilus*

Essential oil Concentration	Inhibiton Zones (mm.) and Trainings.							
	Rosmarinus officinalis				Mentha longifolia			
	1 st	2 nd	3 rd	Mean	1 st	2 nd	3 rd	Mean
800 µg /ml	11	14	14	13	15	14.7	14.8	14.83
600 µg /ml	10.3	12.3	12	11.43	12.3	12.2	12.3	12.27
400 µg /ml	9	10.7	11	10.23	10	10	10.3	10.1
200 µg /ml	7	7.4	7.2	7.2	8	8.2	9.9	8.03
100 µg /ml	-	-	-	-	-	-	-	-

This Table has shown the inhibition zone of the *Lactobacillus acidophilus*, by the effect of the Mint and Rosemary essential oils. Mint essential oil has found more effective on this bacteria when compared to the rosemary oil. Adding the concentration of the essential oils of the two extracts will inhibit more of the bacteria.

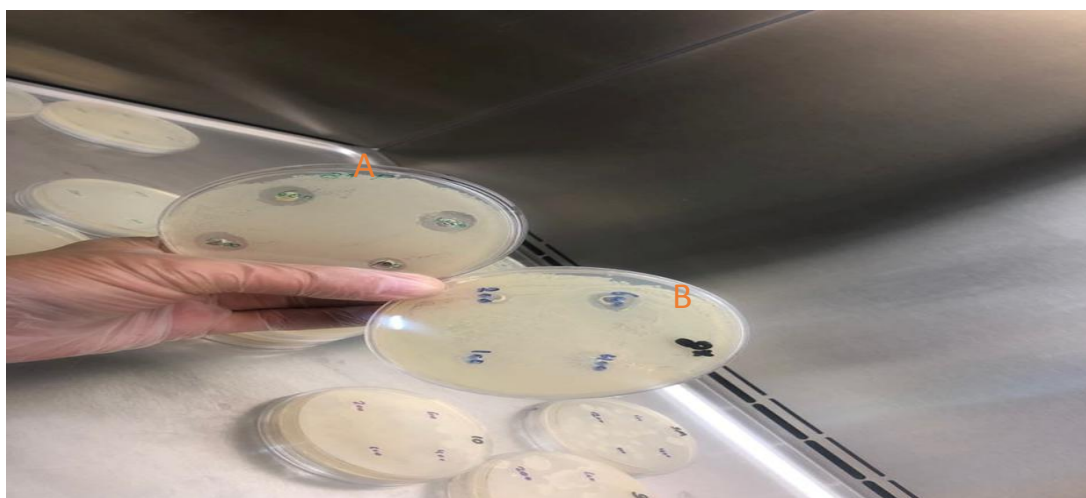


Figure 3.4. Explains the inhibition zone which is produced by rosemary (A) and mint (B).

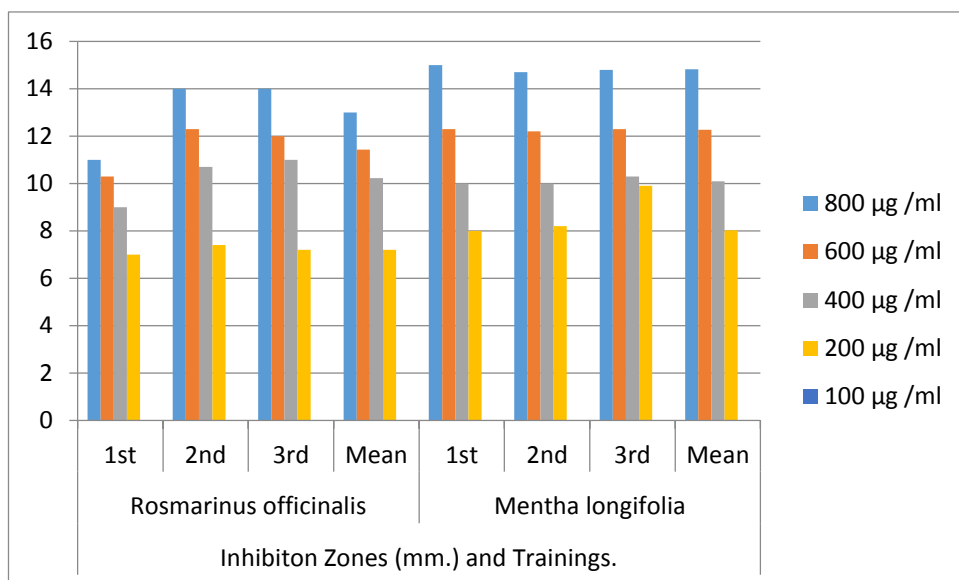


Chart 3.4. Comparison of the Inhibition Zones of the Rosemary and Mint Essential oils according to the increased concentration.

Based on results described in (Table 3.6), we can notice that both essential oil (rosemary and mint) has inhibited the growth of this bacteria. The maximum antimicrobial activities produced by both plants is about 8.5mm, and the minimum inhibition zones is 200 µg /ml and both rosemary and mint has no antimicrobial activity against *Lactobacillus acidophilus*, if the essential oils used less than or equal to 100 µg/ml.

3.2.5. *Escherichia coli*

The same techniques applied on the *E. coli*, to find the antimicrobial activities against *E. coli*, with the rosemary and mint essential oils, which is resulted in Table 3.5.

Table 3.7. The Inhibition Zones of The Essential oils obtained from the Rosemary and Mint against *E. coli*.

Essential oil Concentration	Inhibition Zones (mm.) and Trainings.							
	Rosmarinus officinalis				Mentha longifolia			
	1 st	2nd	3rd	Mean	1st	2nd	3rd	Mean
800 µg /ml	-	-	-	-	10	10.2	10.1	10.1
600 µg /ml	-	-	-	-	9.6	9.7	9.6	9.63
400 µg /ml	-	-	-	-	8.1	8	7.99	8
200 µg /ml	-	-	-	-	6.9	7	7.88	7.93
100 µg /ml	-	-	-	-	-	-	-	-

Table 3.7 explains that rosemary essential oil had no microbial activity against *E.coli*, whereas the mint essential oil increasingly inhibited the growth of this bacteria, at the low level. The maximum inhibition zone produced by mint essential oil is 10.2 mm by using 800 µg /ml of essential oil, and the minimum inhibition concentration is 200 µg /ml.

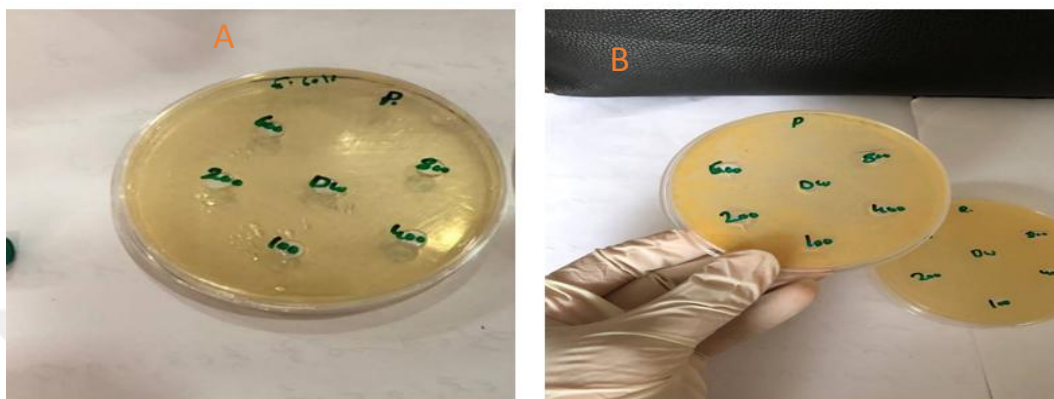


Figure 3.5. Explains the inhibition zone which is produced by rosemary (A) and mint (B) against *E. coli*.

The essential oils of the rosemary and mint used against *Staphylococcus sanguis* has shown low antimicrobial activity and there were no more difference between both oil. Table 3.7 describes the result for proposed experiments.

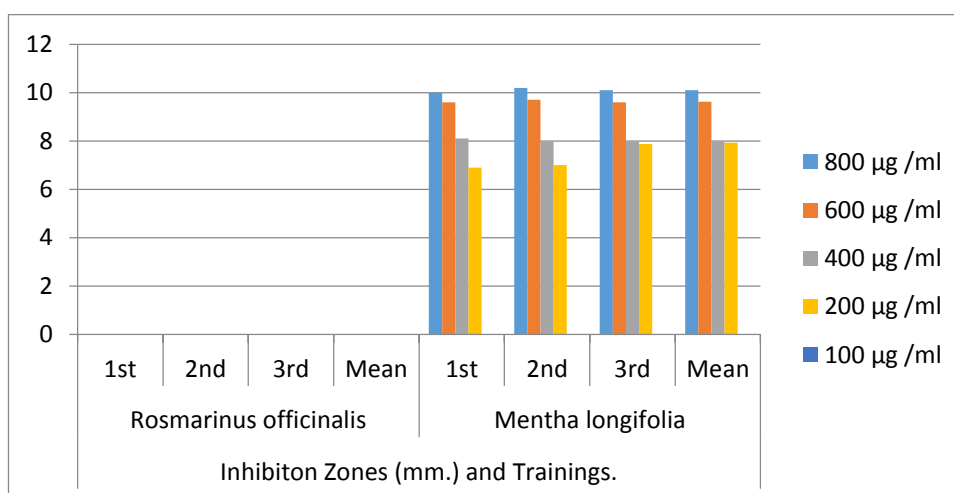


Chart 3.5. Comparison of the Inhibition Zones of the Rosemary and Mint Essential oils according to the increased concentration.

3.2.6. *Streptococcus sanguis*

The *S. sanguis* is the last bacterium which is identified in this study and the same procedures has been applied against *S. sanguis* to find out the essential oil for each rosemary and mint can affect or produce the inhibition zone for this bacteria or not which the result is explained in attached Table 3.8 .

Table 3.8. The Inhibition Zones of The Essential oils obtained from the Rosemary and Mint against *S. sanguis*.

Essential oil Concentration	Inhibiton Zones (mm.) and Trainings.							
	<i>Rosmarinus officinalis</i>				<i>Mentha longifolia</i>			
	1 st	2 nd	3 rd	Mean	1 st	2 nd	3 rd	Mean
800 µg /ml	12	12.2	12.3	12.2	11.7	11.5	12	11.73
600 µg /ml	10.1	10	10.5	10.2	10.3	10.3	10.3	10.3
400 µg /ml	9	9.2	9.3	9.1	9	9.4	9.2	9.2
200 µg /ml	8	8.5	9	8.5	7	7	7.1	7.03
100 µg /ml	-	-	-	-	-	-	-	-

Table 3.8 has showed that the comparison the antimicrobial activity between both oils and training results, also mean of the trainings and differences among the different concentration of the essential oils against *S sanguis*. It can be said that the essential oils of the both oils has no more activity against this bacteria and also the data shows that there was minimal difference between the effects caused by two essential oils.

The maximum inhibition zone inhibited by both essential oils is about 6.2 mm, besides the minimum inhibition concentration (MIC) for both rosemary and Mint is 200 µg /ml.

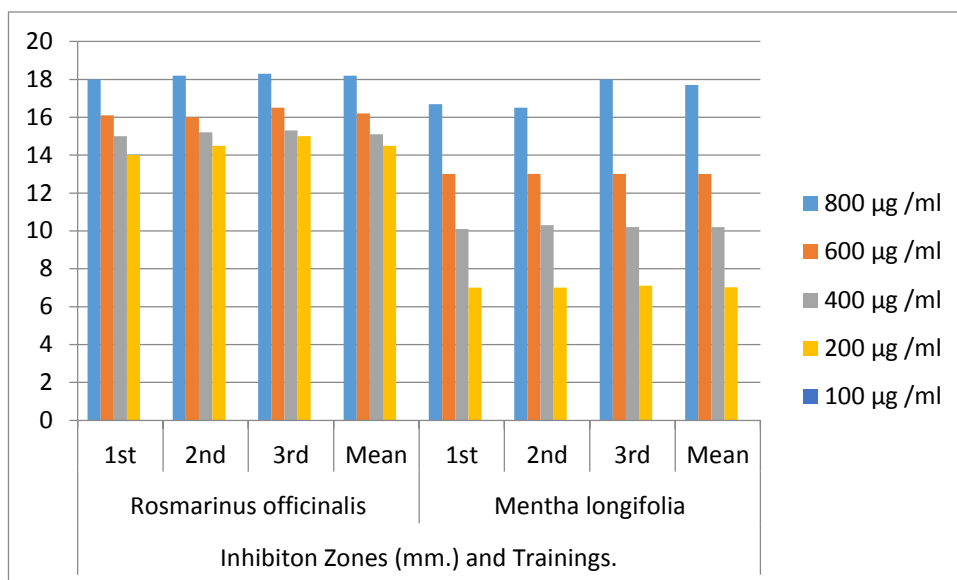


Chart 3.6. Comparison of the Inhibition Zones of the Rosemary and Mint Essential oils according to the increased concentration.

The charts indicate that the inhibition zone of *S. sanguis* increases with the addition in the concentration of rosemary and *mint* essential oils. Adding more of the rosemary essential oil will eventually kill the bacteria.

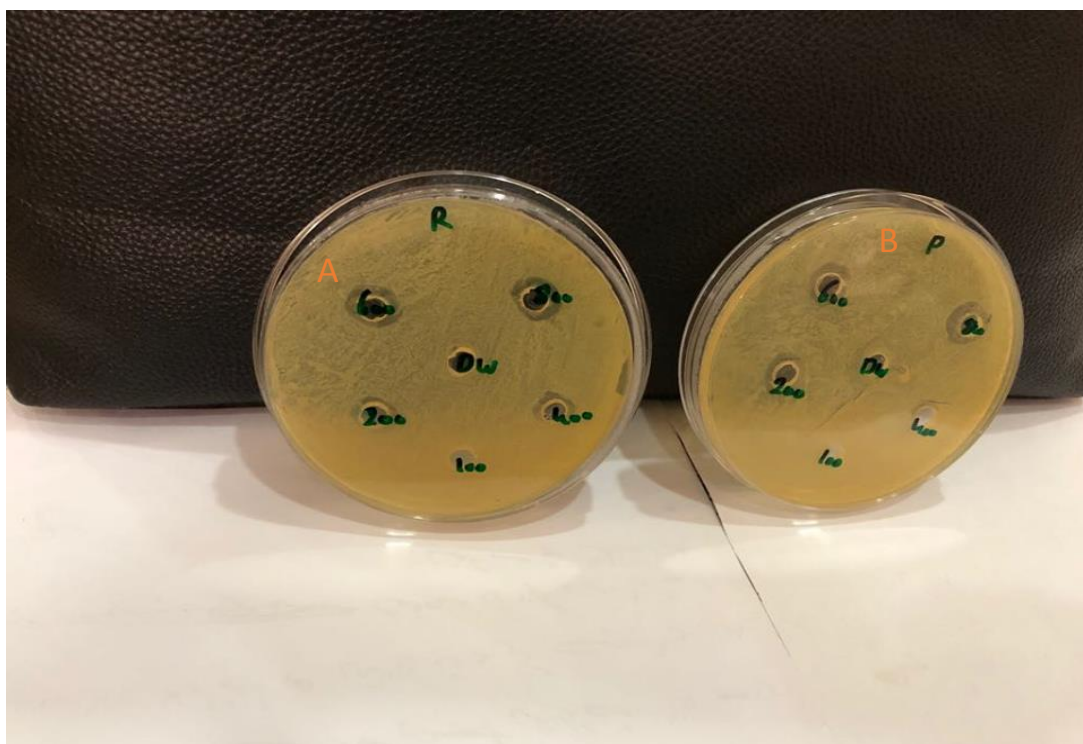


Figure 3.6. Explains the inhibition zone which is produced by rosemary (A) and mint (B).

3.2.7. *Candida albicans*

The last microorganisms has been evaluated in this study was *Candida albicans*, which is the most famous fungus that grows in humans plaque, the result of the extracted essential oils used against *Candida albicans* has declared in Table 3.9.

Table 3.9. The Inhibition Zones of The Essential oils obtained from the Rosemary and Mint against *Candida albicans*.

Essential oil Concentration	Inhibiton Zones (mm.) and Trainings.							
	Rosmarinus officinalis				Mentha longifolia			
	1 st	2 nd	3 rd	Mean	1 st	2 nd	3 rd	Mean
800 µg /ml	11.1	11	11	11.03	15	15	15.1	15.03
600 µg /ml	10	10.2	10	10.07	14	14.2	14	8.07
400 µg /ml	9.1	9.2	9.3	9.2	11	11.3	11.2	11.17
200 µg /ml	8.7	8.2	8.3	8.4	9	9	9.1	9.03
100 µg /ml	-	-	-	-	-	-	-	-

Result explained in Table 3.9 displays the result obtained by using rosemary and Mint essential oils on the *Candida albicans*. The results showed that mint essential oils have affected the growth of the *C. albicans* more than the rosemary oil. Also, it has been said that the increased amount of the essential oils has increased the inhibition zones of the *C. albicans*. The maximum ranges of using essential oils have shown maximum inhibition against *Candida albicans* as 11.03 mm zone, when compared mint essential oils which is the maximum inhibition zone produced by mint is 15.03 mm , and the minimum inhibition concentration for both extracted essential oils also was 200 µg /ml.

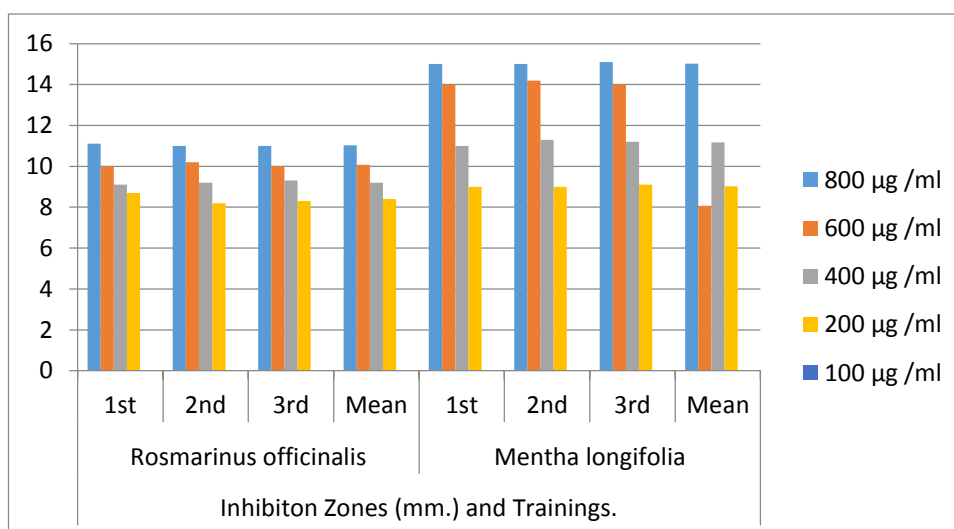


Chart 3.7. Comparison of the Inhibition Zones of the Rosemary and Mint Essential oils according to the increased concentration.

It is possible that the inhibition zone increased with increasing the amount of the essential oil used. The mean values of the inhibition zones indicate that the while rosemary essential oil has shown middle antimicrobial activity, mint essential oil was shown more activity on the *C. albicans*.

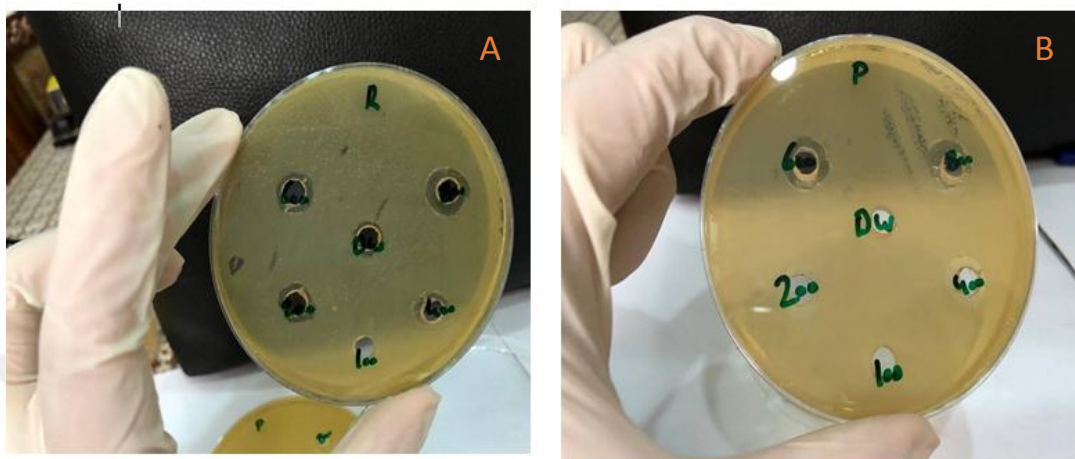


Figure 3.7. Explains the inhibition zone which is produced by rosemary (A) and mint (B).

The minimum inhibitory concentration (MIC) of a microbial test is determined by the lowest concentration of the antimicrobials like essential oil and other chemicals that inhibits or deters the growth of a microorganism. It is obtained during the experiment by observing the minimum concentration that affects the growth of the bacteria. The essential oils of Rosemary and Mint oil, in the 100 μ g/ml amount, has not shown any antimicrobial activity on the growth of any of the microorganisms tested. However 200 μ g/ml essential oil concentration, is the minimal inhibition amount that showed minimum inhibition the studied bacteria and yeast *Candida albicans*. Therefore, according Agar Well diffusion method Min. Inhibition Concentrations of both rosemary and mint plant essential oil were determined as 200mg/ml.

3.3. Discussion

As a result of the recent discussions that are based on discerning the pharmacological significance of plants and their chemicals, there has been a lot of discoveries on the new usages of these plant industrial benefits. Further, the reviews have led to the acceptance of plant extracts in providing a solution to the current challenges that are being experienced in the dentistry industry. The oral disease challenge, which led to the ultimate rise of this

discussion happen to be experienced in the whole world. The challenges include; Increased failure of antibiotics in getting rid of bacteria, financial problems amongst patients in most of the developing countries and unexpected reactions on patients by the antibacterial agents that are administered to the patients.

Dental wellbeing plays a very crucial role in the success of a person. A person who is orally has got very high chances of succeeding in life. The wellbeing of an individual usually leads to a person making positive and correct life decisions. The decisions that are usually affected by the state of a person's being include the type of nourishment a person settles on, prosperity level of a person, the discourse of an individual and finally an individual's satisfaction.

Rosmarinus officinalis is widely found in the lands of Aegean and Mediterranean regions of Turkey. The antimicrobial activities of the essential oils obtained from *R. Officinalis* were determined by minimum inhibitory concentration (MIC). The results indicated that the tested bacteria were sensitive to the essential oils and partially to the methanolic extracts. The antimicrobial activities of the essential oils against the tested bacteria differed, depending on location and seasonal variations [39].

This research is designed in a manner that it gives room for the antimicrobial activities of sampled oils that are regarded as being special in a bid to determine whether the antimicrobial activities are antibacterial or antifungal. Furthermore, the research also aims at showing the level of antibacterial susceptibility. In addition to the depiction of the antimicrobial activity, the research design will also show the initial screening of the plant sample extracts.

In the disc diffusion method that was settled on pathogenic bacteria obtained from the dental plaque that put on an agar plate and essential oils of Rosemary and Mint were applied on these microorganism, *S. mutant*, *S. aureus*, *Rothia mucilaginosa*, *Lactobacillus acidoplus*, *S. sanguis*, *E-coli* and *Candida albicans* yeast. Essential oil of rosemary and Mint has inhibited the growth of the bacteria at different ratios. It has been determined that increased amount of the essential oils has increased the growth of the microorganisms in negative means. In general, the essential oil of the mint has inhibited the growth of the microorganism higher than the rosemary oil. Minimal concentration of essential oil (100mg/ml) applied on the microorganism have not inhibited the growth of the microorganisms tested and also the 200 mg/ml concentrations has lowest antimicrobial

activity and the higher concentrations of the rosemary and mint have higher antimicrobial activity on the selected pathogen microorganisms.

There would be challenges when in the process of checking on the antibacterial activities. During the extraction of the essential oil from the sampled plant extracts there would be a challenge in the acquisition of a uniformed flow of the essential oils when they on an aqueous platform. This problem will be as a result of the oils under testing possessing viscosity levels that vary. Over and above, there would also be the challenge of the possibility of all the oil components having the potential of diffusing via agar. Also, there would be the problem of identifying the viable bacteria after there has been an incubation with solution entailed of agar and the oil essentials.

As a result of the above, well dissemination was put into practice in this test of determining the base inhibitory centralization of synthetic antimicrobial specialists. Well, dissemination was deemed to be appropriate for this exercise because of some reasons. The reasons include: The process is an inexpensive one, minimal time required for the accomplishment of the task and finally the provision of a clean and safe environment to conduct the test. The clean and secure testing environment is made possible via either immunization that is done to the agar plates or the pouring of a liquid to the petri dish which has to be vaccinated.

Upon the incubation of the plate, if there emerges an area where regardless of the bacteria sprouting it cannot be visible, that zone will be termed as an inhibition zone. The extractions from the plant samples have indicated that there has been an inhibition regarding the growth of the bacteria that is being studied. As a result of the observation, a recommendation has been brought forth on the conduction of a detailed and extensive study of both the nature and the quantity of the antibacterial principles that in one way or another entailed in all of the plant extracts that are bound to be studied.

There has been experienced a norm break in the recent past. In the past, a majority of the people had been using antibiotics such as penicillin and erythromycin when treating dental caries whereas nowadays people are using medicinal plants for the same. Besides the penicillin and erythromycin, the dental fraternity had also been using some other modern methods of dental caries protection. The modern methods relied upon include use of varnishes and mouthwashes. The varnishes and mouthwashes bring along with them a lot of side effects to the dental caries patients. Besides the ailments, the drugs also retail at

very high prices at the pharmacies hence making them out of reach for most people who are residing in developing countries.

As per the current investigation, the plant extracts under study were all of them prepared via water and a solution of organic solvents which would act as the solvents. The reason for settling on water and the organic solution was because of the need to ensure that all the plant extracts that were being tested in this case dissolve on the solvents as per their polarities. However, records indicate that there has been a minimal use the leave extracts of *P. guajava*, roots of *A. aspeca*, dried fruit of *T. chebula* and a stick of *M. elengi* in their raw form in depicting the difference of the antibacterial activity against pre-determined bacterial strains.

The study above has shown that an unpolished extract of *P. guajava*, an ethanol sample extract of *T. chebula* and also finally an extract of *A. aspeca* have got considerable actions against *S. mutans*. Furthermore, the possibility of the extracts to act as an adjuvant in a biofilm which is usually considered as the natural locality for the bacteria that are responsible for the formation of caries. The above coupled with appropriate oral hygiene and the control in the usage of fluorides when making dentifrices and other products that are meant to take care of peoples' oral system for instance mouthwashes.

It's important to note that the few kinds of literature that are available in regards to these plant sample extracts, the plants' antibacterial activity was assayed in comparison with *S. mutans*. Additionally, all the extracts that were availed for the use of this study were given a clean bill of health by the authorized body which is the U.S. Food and Drug Administration. Also, when the data that is available is closely looked into, concerning the methodology that is used during the studying of the anti-microbial activities that take place I plants, there can be an achievement of the most diverse outcomes.

Though the information from the clinical studies available does not possess entire relevance towards the control of caries, the safe usage of the plant extracts towards the curing of varied human diseases show that their application will be appropriate for the caries control. It's also important to note that both the toxic and allergic potentialities of the plant extracts were not included in this study. This automatically implies that no final verdict can be made in this study as regards to the toxic and allergy levels of the extracts. Future studies should focus on the same in a bid to prevent the occurrence of diseases that are termed as periodontal.

Rosemary (*Rosmarinus officinalis* L.), that belongs to family Labiate, could be a common dense, evergreen, aromatic bush big in several components of the globe, the contemporary and dried leaves are oftentimes employed in ancient Mediterranean culinary art as an additive. they need a bitter, astringent style, that enhances a good style of foods. A herb tea can even be made up of them. they're extensively employed in change of state, and a definite mustard smell offers off whereas they're burned, therefore, they usually are wont to flavor foods whereas roasting. There are many studies on the antimicrobial activity of secondary metabolites in recent years, but to our knowledge, fewer comparative studies on antimicrobial activity including against human clinical isolates of the essential oil of *R. officinalis* as well as its main components (1,8-Cineole and α -Pinene) have been reported [40].

In the essential oil of Rosemary obtained on hydro-distillation was analyzed by gas chromatography–mass spectroscopy (GC–MS). 22 components, representing 97.41% of the total oil, were identified. The major components were 1,8-Cineole (26.54%), α -Pinene (20.14%), Camphor (12.88%), Camphene (11.38%) and β -Pinene (6.95%), respectively [41].

Dental caries, as per the report from the World Health Organization show that whereas the incidences of dental caries in industrialized countries are reducing, there has been a surge of dental caries in the developing nations. Moreover, the report further alleges that dental caries affects 60% to 90% of school going children. This report should act as a wake-up tool to all the relevant bodies that are in one way or another. The school children, whom the report indicates that they are the most affected will have a hard time concentrating on their class work. The failure to focus in class will mean that they won't grasp the concepts that they are being taught as it is required to be. As a result of the failure to concentrate in class and further failure by the students in their exams, the lives of the school going children will have been jeopardized. The jeopardy comes up as a result of them not getting any meaningful activity to engage in hence a big loss to the country's economy. The results obtained from these study has shown that the essential oils or the plant of the Rosemary and mint has antibacterial activity on the dental pathogen microorganism at different ratios. The results showed that this plant and its essential oils can be used as additive for the tooth paste and other requirements used for those purpose.

It is reported that, In general, *Rosmarinus officinalis* L. essential oil showed greater activity than its components in both antibacterial and anticancer test systems, and the

activities were mostly related to their concentrations [42]. This result is also determined in this study, In both essential oils, Rosemary and Mint..

Antibacterial activity of *Glycyrrhiza glabra* against oral pathogens applied some essential oils against dental plaque to see the affective of extracted plants, the study motivated on bacteria known to be complicated in the etiology of oral and dental illness. Anti-Adhesion Activity of Crude or Entire Plant Extracts, Cranberry, *Vaccinium macrocarpon* (Ericaceae), has been documented for its beneficial properties on human health. Wood spirit extracts of the roots of magnoliopsid genus *cuspidatum* (Polygonaceae), typically utilized in Korean Peninsula to stay oral health, were shown to decrease the viability of *S. mutans* and *S. aureus*, likewise as inhibit saccharose dependent adherence, water-insoluble glucan development, glycolytic acid production and acid tolerance. The authors projected that repressing effects is also mediate by the group action of alkaloids, phenolics and sterol/terpenes within the extract [43].

4. CONCLUSION

The aim of the above tests was to study the antimicrobial activities of some essential oils to know they have antibacterial or antifungal activity, also to determine beneficial effect of those essential oils that used. This was done through the agar diffusion assay. Antimicrobials such as rosemary have a pungent, pine-like aroma. The smell resembles that of eucalyptus or rather the tea tree. The inhibition zone of these essential oils varies based on the different types bacteria used in the test. For instance from the above tests, we can determine that rosemary essential oil had the most effect on the bacteria *S. aureus*.

The mean value for the inhibition zone was 8.48 mm that indicates that more addition of the rosemary and mint essential oils would lead to the eventual death of the microorganisms. However 100mg/ml of the rosemary oil had little or no effect on the bacteria. Efficiencies of various essential oils are compared by analyzing the concentrations required to inhibit the growth of target organisms. Generally, minimum growth inhibitory concentrations (MICs), minimum lethal concentrations values are used for comparison of bioactivities. These values are obtained with standardized methodologies.

The minimum concentration for the inhibitory levels as well as the minimum bactericidal concentration were determined using standard measurements. The main aim of standardizing these measurements was to get a more accurate value for the levels of inhibitory values when both rosemary and *Mentha* essential oils were used.

The above test on the effect of the antimicrobials on the different bacteria. The results were tabulated and charts drawn from them. The test uses different levels of concentration of the essential oils. The results show that with addition of the essential oils, the inhibition zones of the different bacteria increases. For instance, when 100mg/ml of rosemary essential oil is used, the inhibition zone of *S. sanguis* is not affected. However, adding more of the rosemary essential oil increases the inhibition zone of the bacteria.

The majority of the essential oils are fairly stable and contain natural antioxidants and natural antimicrobial agent as on citrus fruits. These aromatic or volatile oils are obtained from aromatic plant materials, including flowers, roots, bark, leaves, seeds, peel, fruits, wood, and whole plants. The examples of some common aromatic plants and their uses.

From the charts, we can deduce that the bacteria will eventually die with addition of the rosemary essential oil. The results further showed that the essential oils have different effects on the different bacteria. For instance, the mean values indicate that rosemary essential oil has the most effect on the *S. aureus* bacteria while it has the least effect on *E. coli*. However addition of the concentration of the essential oils has an increase in the inhibition zone of the bacteria.

The table and the charts also show that the *Mentha* essential oil had more effect on the different types of bacteria as compared to the rosemary essential oils. *Mentha* essential oil had the most effect on the bacteria *S.aureus* with a mean value of 19.7. This was an indication that continuous addition of the *Mentha* essential oil would eventually lead to the death of the bacteria *S aureus*. Moreover, the essential oil caused an inhibitory effect on the bacteria *E coli*. On the other hand, the rosemary essential oil displayed no results when applied on the bacteria *E coli*.

The different antimicrobials have different inhibition effects on the bacteria based on different factors such as the plant extracts and the concentration of the essential oils. These antimicrobials mainly inhibit the growth of these microbes such as bacteria by penetrating the walls of the organisms and disrupting key cell functioning and eventually they lead to the death of the bacteria.

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CIRRUCULUM VITAE

Profile Summary

I am able to work on my own initiative or as part of a team. I am a self-motivated, flexible, enthusiastic and hardworking individual with knowledge skills in Laboratory and Business Management. I thrive on meeting new challenges. I wish to show my skills in teaching and research.

Key Skills

- Microbiology Laboratory
- Multilingual : Kurdish, Arabic and English
- Great Organization Skills

Education

- 2013–2014 B.Sc, Soran University, First Class Honor's, Soran.Specialized in Microbiology department
- 2007–2008 Higher Secondary, Salahadin Secondary School for girls, First Class, Sulaimanyah.

Experience Vocational

- 2018-2019

Sulaimanyah University /Faculty of Science / Biology department

- 2017–2018 Assistant Researcher, Soran University, Soran. Taking lab lectures; Also doing some other tasks for example Working in university Resources, Giving university details to the student, example scientific debate, Help Lecturers Especially while they give exam to the students.

- 2010–2011 Teacher, Soran School, Soran.

Teaching given curriculum to year 2010 and year 2011, Organizing students and course material; Supervising and Setting Exams; Marking student exam papers.

➤ 2008–2009 Travel Agent, Travel Company, Erbil.

Booking ticket for clients; Organizing files and documents; Customer Services;

Filling forms and sending them to Baghdad to the French Embassy.

Languages

Kurdish Mother tongue

English Conversationally fluent

Interests

- Reading - Writing

- Chess - Swimming

- Football

