Chemical composition of essential oil extracted from *Ocimum basilicum* L. Growing in south Syria

Dr. Bahira Zahraa*

Abstract

Essential oil of *Ocimum basilicum* L. leaves were collected using hydro distillation by Clevenger apparatus. Components of the essential oil was analyzed by using Gas chromatography–mass spectrometry techniques. The analysis showed that the major components of essential oil were Methoxy chavicol (81.15%) and Linalool (15.13%). Which possesses a vital and antioxidant activity, and therefore can be used in pharmaceutical and food applications.

Keywords: Essential oil, *Ocimum basilicum*, Methoxy chavicol, Lanilool, GC-MS.

* Department of Chemistry, faculty of science, Damascus University

التركيب الكيميائي لزيت الأساس المستخلص من أوراق نبات الريحان *Ocimum basilicum* L. المنتشر في جنوب سوريا

د. باهره زهراء*

الملخص

تم الحصول على الزيت العطري لأوراق نبات الريحان *Ocimum basilicum* L. باستخدام طريقة الجرف بالبخار بجهاز استخلاص الزيوت العطرية كليفينجر (Clevenger). وتم تشخيص مكونات الزيت العطري باستخدام تقنية الكروماتوغرافيا الغازية وطيف الكتلة. وقد أظهرت التحاليل بأن المكونات الرئيسة للزيت العطري هي: ميتوكسي تشافيكول (Methoxy chavicol) بنسبة 81.15% ، واللينالول (Linalool) بنسبة 15.13%، والتي تمتلك فعالية حيوية ومضادة للتأكسد، ومن ثَمّ يمكن استعمالها في تطبيقات صيدلانية وغذائية.

الكلمات المفتاحية: زيت الأساس، نبات الريحان، ميتوكسي تشافيكول، لينالول، الكرومونوغرافيا الغازية وطيف الكتلة.

* قسم الكيمياء– كلية العلوم– جامعة دمشق

Introduction:

The consumption of natural resources has increased substantially, mainly due to the recent consumers' trends. This current concept is mentioned in recent studies, which report several bioactivities on different fruit tissues [1,2]. Furthermore, most natural products have low toxicity and comply with sustainability principles [3].

Medicinal plants have been playing a vital role on the health and healing of man since down of human civilization. In spite of tremendous development in the field of allopathic medicines during the 20th century, plants still remain one of the major sources of drugs in modern as well as in traditional system of medicine [4,5].

Infectious diseases are still a major threat to public health, despite the tremendous progress made in human medicine. Their impact is particularly large in developing countries due to the relative unavailability of medicines and the emergence of widespread drug resistance [6]. Contrary to synthetic drugs, antimicrobials of plant origin are not associated with many side effects and have an enormous therapeutic potential to treat many infectious diseases [7].

Essential oils are defined as any volatile oils that have strong aromatic components and that give distinctive odour, flavour or scent to a plant. These are the by-products of plant metabolism and are commonly referred to as volatile plant secondary metabolites. Essential oils are found in glandular hairs or secretory cavities of plant-cell wall and are present as droplets of fluid in the leaves, stems, bark, flowers, roots and/or fruits in different plants. The aromatic characteristics of essential oils provide various functions for the plants including: attracting or repelling insects, protecting themselves from heat or cold; and utilizing chemical constituents in the oil as defense materials. Many essential oils have other uses as food additives, flavorings, and components of cosmetics, soaps, perfumes, plastics, and as resins. Typically, these oils are liquid at room temperature and get easily transformed from a liquid to a gaseous state at room or slightly higher temperature without undergoing decomposition [8].

Lamiaceae (*syn. Labiatae*) herb family includes one of the richest essential oil-bearing plant family, consists of more than 252 genera and 7000 species in the vicinity of plant kingdom [9]. *Lamiaceae* family is known for the wealth of species with medicinal properties, which have been used since early times and many of these species are common in Mediterranean region. Many species of *Lamiaceae* have long history of uses in culinary spices and folk medicine. For example, *Ocimum basilicum*, oregano, rosemary, sage and thyme are typical seasonings in the Mediterranean region [10].

Ocimum basilicum L. (sweet basil) belongs to the family *Lamiaceae*, distributed throughout the tropical and subtropical regions of Asia, Africa and Central and South America [11]. Secondary metabolites from *Ocimum* species possess exceptional biological activity and have antimicrobial [12,13] and antioxidant [14,15], bactericidal [16] repellent [17], anticonvulsant [18], chemo preventive and radioprotective effects [19]. The chemical composition of essential oils of *Ocimum* species has been well studied. As prevalent components many basil essential oils contained monotherpene derivatives (camphor, limonene, 1,8-cineole, linalool, geraniol) and phenylpropanoid derivatives (eugenol, methyl eugenol, chavicol, estragole, methyl cinnamate) [20,21].

The present study therefore, determined the hydro-distilled essential oil constituents of the *Ocimum basilicum* L. leaves by GC/ MS.

Materials and Methods:

Plant material:

Leaves of *Ocimum basilicum* L. used in this study were collected in the morning in June 2019 from plant growing in the Bloudan near Damascus city, and authenticated by the taxonomist of Department of Botany. The dirt was removed with tap water. The aerial parts were cut to smaller pieces by scissors to increase the efficiency of the extraction and thereby increasing the yield to be obtained.

Extraction of the Essential oil:

The fresh leaves (100 g) were subjected to hydro distillation for sex hours using a Clevenger-type apparatus, according to the literature [22]. The sample was added to distilled deionizer water (0.5 L) in a 1 L round bottomed flask and heated to boiling, after which the essential oil was evaporated together with water vapor and finally collected in a condenser. The resulting product was then dried over anhydrous Na_2SO_4. Pale yellow colored essential oil was obtained in the yield of (0.87% v/w). The oil was then kept in a sealed dark glass vial at 4 ºC until required.

GC-MS analysis of essential oil:

Qualitative analysis was performed using an Agilent 6890 N gas chromatograph (GC) equipped with Agilent 5973 mass selective detector (MSD), Agilent Auto sampler 7683 and Agilent DB-5MS capillary column (30 m, 0.25 i.d., 0.25 µm film thickness) (Agilent Technologies, Santa Clara, CA, USA). The MS detector was operated in electron impact (EI) mode at 70 eV with interface tempera-ture of 280 °C; the scan range was 50–550 amu. The injection port temperature was set at 250 °C. GC was performed in split less mode; carrier gas was helium at a constant flow rate of 1 mL/min. The column temperature was programmed as follows: an initial temperature of 60 °C increased to 280 °C at rate of 3 °C/min. The injection volume was 1.0 µL.

Identification of Components:

The components were identified by comparing their relative retention times and mass spectra with those of standards, NIST/NBS Wiley library data of the GC/MS system, and literature data [23]. The results were further confirmed by comparing the elution order of the compounds with their relative retention indices (relatives to C8-C20 on the DB-5MS column) on non-polar phases as reported by Adams (2007).

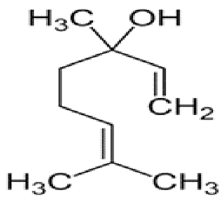
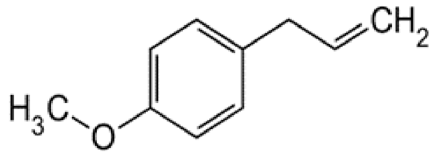
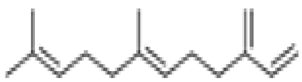
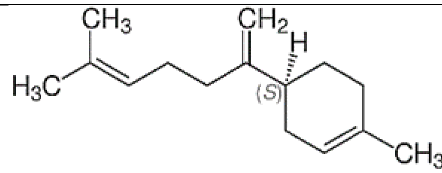
Results and Discussion:

Hydro distillation of the *Ocimum basilicum* L. leaves afforded light yellow oil with yields of 0.87% (v/w, on the fresh weight basis).

Chemical composition of *Ocimum basilicum* L. leaves essential oil GC-MS analyses of the oil led to the identification of 15 different compounds, representing 99.29% of the total volatile oil composition and represent three different groups of hydrocarbons namely; monoterpene hydrocarbons, oxygenated monoterpenes and sesquiterpene hydrocarbons. The identified compounds, together with the retention indices (RI) of the compounds are shown in Table (1) and fig (1). The main chemical compounds detected in the essential oil were Methoxy chavicol (81.15%), Linalool (15.13%). Of the remaining components, the contents of α -Pinene (0.14%), Myrcene (0.1%), 1,8-Cineole (0.34%), Borneol (0.15%), Neral (0.18%), β-Elemene (0.19%), β -Caryophyllene (0.16%), β -Bergamotene (0.18%), α -Himachalene (0.10%), β-Farnesene (0.41%), and α –Bisabolene (0.76%).

Table 1. Quantities (area %) of components of essential oil fresh leaves *Ocimum basilicum* L.

No. Peak	RI	Compounds	Molecular formula	Area (%)
		Monoterpene Hydrocarbons		**0.33**
1	933	α -Pinene	$C_{10}H_{16}$	0.14
2	974	Sabinene	$C_{10}H_{16}$	0.09
3	991	Myrcene	$C_{10}H_{16}$	0.10
		Oxygenated Monoterpenes		**97.16**
4	1032	1,8-Cineole	$C_{10}H_{18}O$	0.34
5	1096	Linalool	$C_{10}H_{18}O$	15.13
6	1167	Borneol	$C_{10}H_{18}O$	0.15
7	1195	Methoxy chavicol	$C_{10}H_{12}O$	81.15
8	1244	Neral	$C_{10}H_{16}O$	0.18
9	1274	Geranial	$C_{10}H_{16}O$	0.21
		Sesquiterpene hydrocarbons		**1.80**
10	1386	β-Elemene	$C_{15}H_{24}$	0.19
11	1417	β -Caryophyllene	$C_{15}H_{24}$	0.16
12	1432	β -Bergamotene	$C_{15}H_{24}$	0.18
13	1456	α -Himachalene	$C_{15}H_{24}$	0.10
14	1471	β-Farnesene	$C_{15}H_{24}$	0.41
15	1570	α –Bisabolene	$C_{15}H_{24}$	0.76
	Total			**99.29**

 **Linalool**	 **Methoxy chavicol**
 **β-Farnesene**	 **α –Bisabolene**

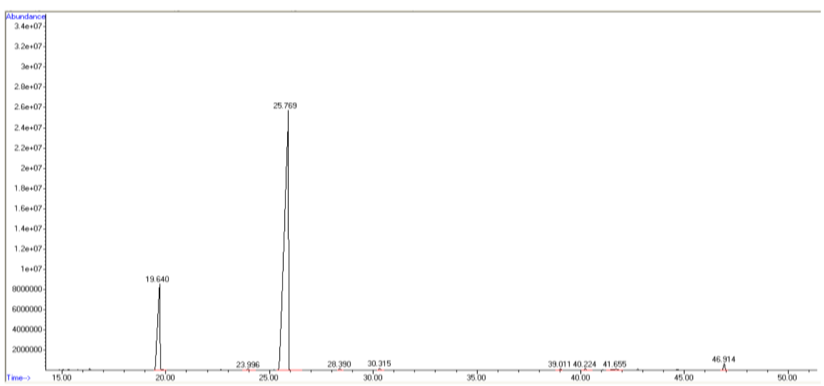


Fig 1. GC/MS chromatogram of essential oil fresh

Ocimum basilicum **L. leaves**

Oxygenated monoterpenes were the predominant chemical group (97.16 %), followed by the sesquiterpenes hydrocarbons (1.80 %). While the monoterpenes Hydrocarbons (0.33 %) and oxygenated sesquiterpenes were absent.

Essential oils composition, from the *Ocimum basilicum* L. leaves, has been widely studied. Many studies have reported the effect of cultivation site on the components of the essential oil of *Ocimum basilicum*. For example, methoxy chavicol presents as the highest main content in the Nigerian *Ocimum basilicum* (60.30%) [24]. where it was considered as a main component for Um-Ruaba and Pakistan in a percent about 70% and 87.30%, respectively [25]. Moreover, the site of cultivation has an effect not only on the percent of the composition but also on the type of the main constituents. Linalool, for an instant, is the major component in *Ocimum basilicum* essential oils from North-eastern Brazil (42.5%) [26], Greek (43.1%) [27], Egypt (44.18%) and Turkey (45.70%) [25].

By surveying the data reported we found a great diversity of essential oil composition, which was affected by many factors such as geographical origin, tissue explored, date of harvest, genetic factors [28].

Conclusion:

In this study, the chemical composition of the essential oil from *Ocimum basilicum* L. leaves from south of Syria was investigated. The contents of essential oil were in good agreement with the literature data. Some differences in abundances and distribution of their constituents were observed. The differences in the chemical composition of the essential oil analyzed were explained as a consequence of differences in growing and agroclimatic conditions. The obtained result showed that were rich in compounds which are responsible for biological activities. Further studies of examined *Ocimum basilicum* L. is required to determine their biological activities and applicability as food additives

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