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In-vitro Antioxidant Activity and GC/MS Studies on the Leaves of *Mentha piperita* (Lamiaceae) from Morocco

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ABSTRACT
The present study was to evaluate the *in vitro* antioxidant activity and chemical composition of essential oil of *Mentha piperita* from Morocco. *Mentha* species from the Lamiaceae family are widely distributed in Morocco and commonly used as herbal tea, flavoring agent and medicinal plant. In this stud y, the essential oils of *Mentha piperita* collected in the region of Meknes (Morocco) were obtained by hydro-distillation of the leaves and analysed by gas chromatography equipped with flame ionisation detector (GC-FID) and gas chromatography coupled to mass spectrometry system (GC/MS) for their chemical composition. The antioxidant activity of essential oils against DPPH radical was determined in vitro by treated with different concentrations of essential oil and vitamin C as standard antioxidant compound. The percentages of DPPH inhibition and IC_{50} were recorded. Thirty compounds were identified in leaves oil representing 58.61% of the total oil composition. The yield of essential oil of *Mentha piperita* was 1.02% and the major compound in the leaves was: Menthone (29.01%) followed by menthol (5.58%), menthyl acetate (3.34%), menthofuran (3.01%), 1,8-cineole (2.40%), isomenthone (2.12%), limonene (2.10%), α-pinene (1.56%), germacrene-D (1.50%), β-pinene (1.25%), sabinene (1.13%) and pulegone (1.12%). The radical scavenging activity (% inhibition) of the essential oil from *Mentha piperita* was the highest (81.09± 1.21%) at the concentration of 150µg/ml and the IC_{50} values of these plant extracts were 53.67µg/ml.

Keywords: *Mentha piperita*, GC/MS, Antioxidant activity, Menthone.

INTRODUCTION

Mentha piperita, (Fam. Lamiaceae) is the species found in Morocco. The leaf essential oil of *M. piperita* has been reported in varying details from Russian [1], India [2], Greece [3] and from Yugoslavia. [4] Medicinal plants have been used for centuries as remedies for human diseases because they contain chemical components of therapeutic value. [5] According to the World Health Organization (WHO) in 2008, more than 80% of the world's population relies on traditional medicine for their primary healthcare needs. [6] Essential oils and their components are gaining increasing interest because of their relatively safe status, their wide acceptance by consumers, and their exploitation for potential multi-purpose functional use. [7] Essential oils are valuable natural products used as raw materials in many fields, including perfumes, cosmetics, aromatherapy, phototherapy, spices and nutrition. [8] Also the essential oils are used in traditional medicine for their antiseptic action, are constituted 1% of plant secondary metabolites and are mainly represented by terpenoids, phenypropanoids or benzenoids, fatty acid derivatives and amino-acid derivatives. [9] Plant essential oils and their components have been known to exhibit biological activities, especially antimicrobial [10], antifungal [11-12], antibacterial [13-15], antimycotic [16] and antioxidant activities. [17] Essential oils were used in ancient Rome, Greece and Egypt and throughout the Middle and Far East as perfumes, food flavours, deodorants and pharmaceuticals. [18] Essential oils have many therapeutic effects, which include vasodilatation, irritation, hyper secretion, hyperperistaltism, the stimulation of heart muscle, and they said the distribution of drugs and antiseptics. [19] The essential oils which were utilised centuries ago in cosmetics usually show interesting biological features. The oils also help increase the flow of digestive fluids, improve digestion and eliminate gas and stomach cramping. [20] The family of Lamiaceae contains an extremely wide variety of aromatic plants mainly in temperate countries. Among this rich array of plants yielding essential oils, the genus of *Mentha*, includes 20 species that spread all over the world. Multiple studies have been reported on the chemical composition of

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the essential oils of *M. piperita* belonging to different regions in the world. [21] Infusion, decoction, and distillated water of the aerial parts of *Mentha* species have been used for centuries as tonics, carminative, digestive, stomachic, antispasmodic, and anti-inflammatory agents in Iranian Traditional Medicine. [22-23]

Morocco is blessed with a rich source of aromatic flora, many of which have not been previously investigated for their chemical constituents and biological potentials. This flora constitutes a rich source of potential spices or flavoring, ingredients of formulae intended for pharmaceutical administration, and for perfumery.

The goal of this study was to investigate the chemical composition and in vitro antioxidant activity of essential oils of leaves of *Mentha piperita* collected in the region of Meknes from Morocco.

MATERIAS AND METHODS

Chemicals and standards

All solvent were of analytical grade, unless otherwise specified. Hexane solution, anhydrous sodium sulfate, series of alkanes (C_4- C_{28}) standards and 2, 2- diphenyl-1-picrylhyrazyl radical (DPPH, RADACO Society) were obtained from Faculty of Sciences, Sidi Mohamed Ben Abdellah University, Fez, Morocco.

Vegetal material

The leaves of *Mentha piperita* were collected during Mars 2010 in the region of Meknes from Morocco. The climate is semi-humid with strong continental influence having an annual average temperature of 20°C. The plant was identified by Dr. Elhoussine Derwich and was then isolated from the other specimen and was deposited in Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah. Fez, Morocco.

The amount of oil obtained from each plant material was calculated as:

Oil (% v/w) = observed volume of oil (ml)/ weight of sample (g) × 100

Preparation of extract

The essential oils were extracted by hydro-distillation using an apparatus of Clevenger type. The extraction took 3 hours for mixing 250 g of plants in 1600 ml of distilled water. After filtration the solvent is eliminated by pressure distillation reduced in rotary evaporator and pure oil was stored at 4°C in obscurity till the beginning of analysis. The essential oils yield is demonstrated by the oil quality (in ml) obtained for 100 g of dried leaves.

Gas chromatography (GC) analysis

The essential oils from leaves of *Mentha piperita* were analysed by gas chromatography (GC-FID) and gas chromatography–mass spectrometry (GC/MS) using a CP-SiL- 5 CB column in Unity of GC/MS and GC, Regional Center of Interface, Sidi Mohamed Ben Adellah University, Fez, Morocco.

The GC (TRACE GC-ULTRA, S/N 20062969, Thermo-Fischer) analysis equipped with flame ionisation detector (GC-FID), Varian capillary column Test Report CP 7770 (CP-SiL- 5 CB; 50m length, 0.32mm of inside diameter, 0.45mm outside diameter and film thickness 1.20µm). Column temperature was initially kept at 40°C for 2 min and then gradually increased to 260°C at 5°C/min rate and finally held for 10 min at 260°C. The temperature of the injector was fixed to 250°C and the one of the detector (FID) to 270°C. The debit of gas vector (Nitrogen) was fixed to 1ml/min. The volume of injected specimen was 0.5µl of diluted oil in hexane solution (10%). The percentage of each constituent in the oil was determined by area peaks.

Gas chromatography-Mass Spectrometry (GC/MS) analysis

The identification of different chemical compounds was realised by gas phase chromatography (TRACE GC-ULTRA, S/N 20062969, Thermo-Fischer) coupled with mass spectrometry (PolarisQ, S/N 210729, Thermo Fischer) (GC/MS). The utilised column was Varian capillary column Test Report CP 7770 (CP-SiL- 5 CB; 50m length, 0.32mm of inside diameter, 0.45mm outside diameter and film thickness 1.20µm). The column temperature was programmed from 40 to 260°C for 5°C/min. The temperature of the injector was fixed to 250°C and the one of the detector (PolarisQ) to 200°C. Ionisation of the sample components was performed in electron impact mode (EI, 70 eV). The debit of gas vector (Helium) was fixed to 1ml/min. Transfer line temperature was 300°C. The mass range from 40 to 650 amu was scanned at a rate of 2.9scans/s. The volume of injected specimen was of 1µl of diluted oil in hexane solution (10%). The constituents of essential oils were identified in comparison with their retention indices, calculated in relation to the retention time of a series of lineary alkanes (C_4- C_{28}) with those of reference products and in comparison with their retention indices with those of the chemical components gathered by [24] and in comparison with their spectres of mass with those gathered in a library (NIST-MS Search Version 2.0).

Screening for antioxidant activity

The synthetic anti-oxidant, such as 2, 2-diphenyl-1-picrylhyrazyl (DPPH), was used as preservatives in foods and food packaging. This anti-oxidant was used to delay the deterioration of food flavours and odours and increase the shelf life of many foods. [25] However, interest is growing internationally for herbal products, such as essential oils, to replace the synthetic anti-oxidants based on their emerging deleterious side effects. For example [26], revealed that when butylhydroxyanisole (BHA) is administered in the diet of rats it induced papillomas and squamous cell carcinomas in their fore-stomach. One of the essential oils that have demonstrated significant potential as a replacement for the synthetic anti-oxidants based on its preservation effects is rosemary. [27]

The DPPH scavenging activity of the extracts from *Mentha piperita* was measured according to the procedure described by [28], with some modifications. Radical scavenging activity of plant essential oils against the stable DPPH radical was determined spectrophotometric ally. The colorimetric changes (from deep-violet to light-yellow), when DPPH is reduced, were measured at 517 nm on a UV/visible light spectrophotometer. The antioxidant activities of essential oils were measured in terms of hydrogen donating or radical scavenging ability, using the stable radical DPPH. Forty microliters of various concentrations (10, 25, 50, 75, 100 and 150µg/ml) of the essential oils in dimethyl sulphoxide (DMSO) as well as vitamin C (as standard antioxidant compound) were put into appropriate tubes and 4 ml of 0.004% methanolic solution of DPPH was added to each tube to give final concentrations (10, 25, 50, 75, 100 and 150µg/ml). Tests were carried out in triplicate. Absorbance measurements commenced immediately. The decrease in

absorbance at 517 nm was determined after 1 h for all samples. Methanol was fixed to zero of the spectrophotometer. Absorbance of the DPPH radical without antioxidant, the control, was measured. Special care was taken to minimize the loss of free radical activity of the DPPH radical stock solution.

Radical scavenging activity was expressed as percentage inhibition of DPPH radical and was calculated by following equation [29]:

% inhibition= (Absorbance of control-Absorbance of sample /Absorbance of control) × 100.

Extract concentration providing 50% inhibition (IC_{50}) was calculated from the graph plotted inhibition percentage against extract concentration.

RESULTS AND DISCUSSION

Phytochemical screening

The compounds of *Mentha piperita* from Morocco are listed in order of their elution on the CP-Sil 5 CB column (Fig. 1). In total, thirty volatile constituents, representing 58.61 % of the total composition, were identified in the leaves oils (Table 1). The most abundant components found in the leaf oil were menthone (29.01%) followed by menthol (5.58%), menthyl acetate (3.34%), menthofuran (3.01%), 1, 8-cineole (2.40%), isomenthone (2.12%), limonene (2.10%), α-pinene (1.56%), germacrene-D (1.50%), β-pinene (1.25%), sabinene (1.13%) and pulegone (1.12%). The essential oils yield of *Mentha piperita* collected from region of Meknes (Morocco) was 1.02%. It is relatively higher than other plants industrially exploited as a source of essential oils: *Artemisia herba-alba* (0.59%), *Artemisia absinthium* (0.57%) and *Artemisia pontica* (0.31%) [30], Thymus (1%) [31], Lavender (0.8-2.8%), Menthe (0.5-1%), Néroli (0.5-1%) and Laurel (0.1-0.35%) [32], Artemisia (0.65%) [33], Tetraclinis (0.22%) [34], *Citrus aurantium* (0.003%) [35] and *Nepeta macrosiphon* (0.1%). [36] In this study the yield is low to those of *Laurus Nobilis* and *Juniperus phoenicea* essential oils analyzed in Morocco by [37-38], which the yield was 1.86% and 1.62% respectively. Furthermore, the yield, obtained from leaves of *Mentha piperita, foeniculum vulgare* and *Lavandula hybrida* from Turkey was 2.5, 4.5 and 6.1%) respectively. [39] The chemical compositions of essential oils of *Mentha piperita* are presented in Table 1.

The chemical compositions revealed that this leaves had compositions similar to those of other *Mentha piperita* essential oils analyzed in Serbia by [11], which the major component was menthol (37.4%), menthyl acetate (17.4%) and menthone (12.7%). Menthol and menthone were the main components of *M. Piperita.* [10] Menthol (64.0%), menthyl acetate (9.2%) and menthofuran were dominant in *M. piperita* study in Italy by [40]. Also, menthanol (36.24%) and menthone (32.42%) were the major compounds of the *M. piperita* essential oil study Iran [12]. Menthone (44.1%), menthol (29.5%), menthylacetate (3.8%) and menthofuron (0.9%) were take major compounds of *M. piperita* from Turkey. [41] Contrary it's different to the composition of essential oil of leaves of *M. piperita* study in Korea which the major component were linalyl acetate (28.2%), menthol (33.4%), 1,8-cineole (46.1%), limonene (64.5 and 94.2%), and p-menth-2-en-ol (34.5%) [17] and it's different to the composition of essential oil of *M. arvensis* study in India by [16] which de major compounds were: menthol (71.40%), p-menthone (8.04%), iso-menthone (5.42%) and neo-menthol (3.18%). α-Terpene (20.11%), pipertitinone oxide (17.10%) and trans-carveol (19.48%) were the main components of the oils of *M. Piperita.* [13] The chemical composition of *M. piperita* essential oil study in Iran, contained α-terpinene (19.7%), isomenthone (10.3%), trans-carveol (14.5%), pipertitinone oxide (19.3%), and b-caryophyllene (7.6%) as the major compounds. [42] Intensive research on the chemical characteristics has been conducted on this species. [43-45] Previous reports [46-47] on the composition of its essential oil showed that pulegone was the main constituent, and its percentage ranged from 25 - 92%. The leaves essential oil of *M. piperita* has been reported in varying detail. [48-50]

The essential oil content shows variations in plants of different geographical origin and also in different part of the tree: [51]; studied the composition of *Juniperus phoenicea* oil collected from the Portugal, Spain and Greece, they reported that the yields and the total oil obtained were (0.41% and 98.3%), (0.66% and 99%) and (0.58% and 88%) respectively and the composition is characterized by a high content of α-pinene (34.1%, 53.5% and 41.8%), β-phellandrene (19.2%, 5.9% and 3.5%) and β-caryophyllene (0.22%, 1.0% and 0.5%). In our studies on the chemical composition of fresh leaves *of Mentha spicata* from Italy [43], considerable differences were observed in the essential oil composition between low and high-Friuli: 24 compounds have been identified in the essential oil of *Mentha spicata* from low-Friuli. The monoterpenoids represent 80% of the total oil content. Carvone (3302µg/g) and limonene (964µg/g) are the most prominent components. 29 compounds have been identified in *Mentha spicata* from high-Friuli. The monoterpenoids represent 90.4%. The major components are carvone (7273 µg/g), and limonene +1.8 cineole (889 µg/g). [52], Studying of essential oil variations in leaves of *Mentha* species, the data indicated that was significant difference between essential oil yields in leaves of mint species. Furthermore, the essential oils, obtained from flower, leave and stems from basil (*Ocimum basilicum L.)* from Mersin province (Bu¨yu¨keceli-Gu¨ lnar) in Turkey contained: estragole (58.26%, 52.60% and 15.91%), limonene (19.41%, 13.64% and 2.40%) and p-cymene (0.38%, 2.32% and 2.40%). [53] In our studies on the chemistry of Uruguay [54], considerable differences were observed in the essential oil composition between *Mentha rotundifolia* and *Mentha pulegium*: Piperitenone (80.8%) and pulegone (73.4%) and the total constituents identified are 93.5% and 99.3% respectively.

Determination of antioxidant activity

The free- radical scavenging activity of *Mentha piperita* essential oils evaluated using the DPPH method is presented in Table 2. The model of scavenging stable DPPH free radicals can be used to evaluate the antioxidative activities in a relatively short time. The absorbance decreases as a result of a color change from purple to yellow as the radical is scavenged by antioxidants through donation of hydrogen to form the stable DPPH-H molecule. [55] The effect of antioxidants on DPPH radical scavenging was thought to be due to their hydrogen-donating ability. Antioxidant activities of essential oils from aromatic plants are mainly attributed to the active compounds present in them. This can be due to the high percentage of main constituents, but also to the presence of other constituents in small quantities or to synergy among them. In this study, the antioxidant activities of essential oils of *Mentha piperita* compared with vitamin C as a reference

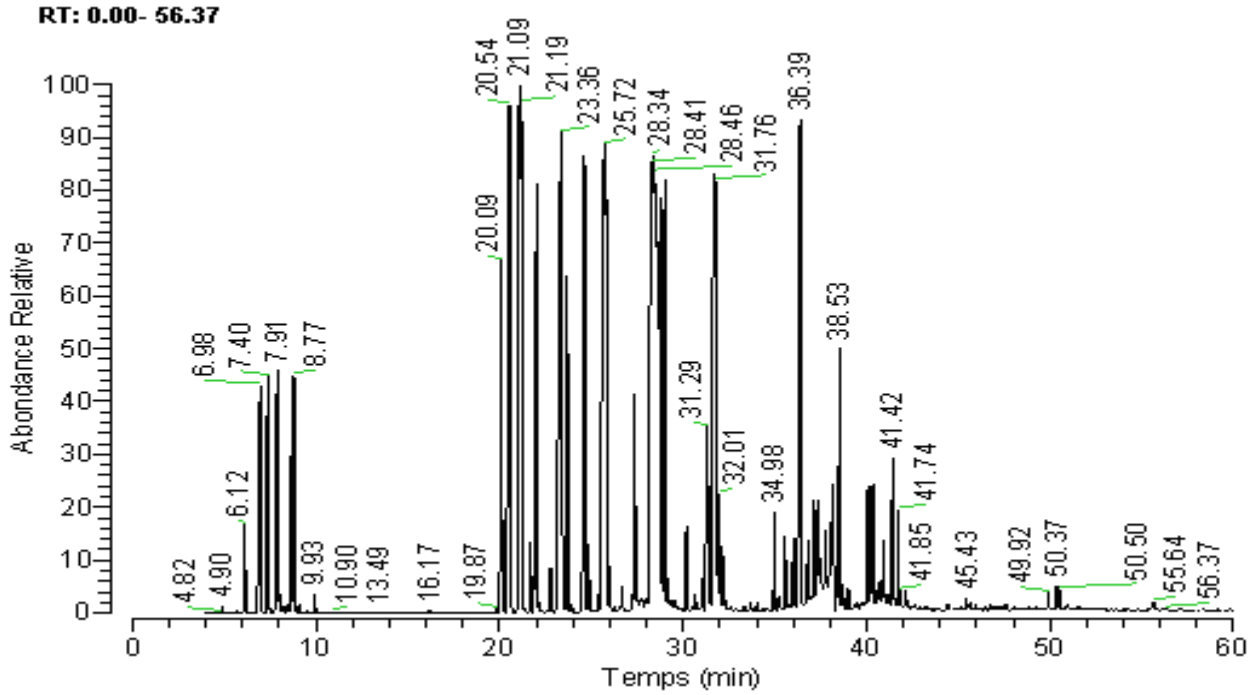

Fig.1: Chromatogram of *Mentha piperita*

Table 1: Chemical composition of leaves of essential oils of *Mentha piperita* from Morocco

*RI	Constituents	**Area (%)	*** Mass range (m/z)	Method of identification
486	Menthyl acetate	3.34	(74),43,74,15,42,59,31,29,44,14,28	RI, GC/MS
896	Sabinene	1.13	(136),93,41,91,77,79,39,27,69,94,43	RI, GC/MS
933	β-Pinene	1.25	(136),93,91,69,39,77,92,79,53,41,27	RI, GC/MS
942	Camphene	1.09	(136),93,79,91,77,41,121,67,27,107,39	RI, GC/MS
947	α -Pinene	1.56	(136),93,91,39,121,77,92,79,43,41,105	RI, GC/MS
957	Myrcene	1.07	(136),41,93,69,39,27,53,79,77,67,91	RI, GC/MS
968	1-Octen-3-ol	0.04	(128),57,72,29,41,55,27,85,58,39,43	RI, GC/MS
975	Cis-ocimene	0.04	(136),93,41,79,39,91,77,92,27,80,53	RI, GC/MS
997	α-Terpinene	0.03	(136),93,91,136,121,77,92,79,43,41,105	RI, GC/MS
1051	β-Terpinolene	0.02	(136),93,121,91,136,79,77,105,39,41,107	RI, GC/MS
1081	Linalool	0.01	(136),71,41,43,93,55,69,80,39,121,27	RI, GC/MS
1058	1,8-Cineole	2.40	(154),43,93,81,71,69,84,68,108,41,55	RI, GC/MS
2545	Isomenthone	2.12	(354),55,43,41,57,69,56,83,81,113,97	RI, GC/MS
1017	Limonene	2.10	(136),68,93,39,67,41,27,53,79,94,92	RI, GC/MS
1157	Piperitone	0.02	(152),82,110,39,41,27,95,137,109,54,152	RI, GC/MS
1137	Borneol	0.01	(154),95,41,110,93,55,67,139,121,96,69	RI, GC/MS
1136	Terpinen-4-ol	0.01	(154),71,111,93,43,86,41,69,55,68,154	RI, GC/MS
1141	Menthofuran	3.01	(150),108,150,79,109,39,77,41,91,51,53	RI, GC/MS
1146	Menthone	1.08	(154),112,41,69,55,43,56,70,27,39,139	RI, GC/MS
1147	Menthone	29.01	(154),112,41,69,55,43,56,70,27,39,139	RI, GC/MS
1163	Menthol	5.58	(155),71,81,95,55,41,82,69,123,96,67	RI, GC/MS
1165	Neomenthol	0.50	(156),71,95,81,41,55,43,69,82,138,57	RI, GC/MS
1170	Piperitone oxide	0.07	(168),69,55,41,97,72,43,71,139,126,39	RI, GC/MS
1175	α-terpineol	0.01	(154),59,93,121,136,81,43,68,95,67,41	RI, GC/MS
1220	pulegone	1.12	(152),152,81,67,109,82,41,137,69,95,55	RI, GC/MS
1223	piperitenone	0.01	(150),150,107,135,82,109,108,122,91,121,79	RI, GC/MS
1271	Linalyl acetate	0.03	(196),93,43,41,69,80,121,68,55,71,79	RI, GC/MS
1441	Cadinene	0.40	(204),161,189,204,105,91,133,119,95,41,55	RI, GC/MS
1493	β-caryophyllene	0.05	(204),93,133,91,41;79,69,105,107,120,77	RI, GC/MS
1514	Germacrene D	1.50	(204),161,105,91,41,119,79,81,93,77,27	RI, GC/MS
Total Identified Constituents (%)			**58.61%**	
Yields (%)			**1.02**	

**** RI: Retention indices was determined by GC-FID on a CP-SIL- 5 CB column***
*****Area: was determined by GC-FID***
****** Mass range (m/z) was determined by mass spectrometry (PlarisQ).***

antioxidant compound were determined by the method of DPPH radical scavenging assay and the results are summarized in Table 2.

All experiments were carried out in triplicate. Data were expressed as means ± SD. It was found that the essential oils of *Mentha piperita* analyzed showed good antioxidant capacities compared with vitamin C (standard antioxidant compound). The results from Table 2 indicate that the radical scavenging activity (% inhibition) of the essential oil from *Mentha piperita* was the highest (81.09± 1.21%) at the

concentration of 150µg/ml. It was noticed that the scavenging activities of the essential oils were increased with the increased of the essential oils concentrations. All the tested samples showed lower DPPH radical scavenging activity when compared with the standard. It is clear from the data that the concentration of 150 ppm of *Mentha piperita* essential oil gave a percentage inhibition of DPPH (81.09± 1.21%) nearly of the same concentration of vitamin C which was 90.13 ± 1.78. The highest IC_{50} was noticed in vitamin C (38.12µg/ml). *M. piperita* essential oils were able to reduce the stable, purple-colored radical DPPH into yellow-colored DPPH reaching 50% of reduction with IC_{50} of 53.67µL/mL. In this study, the antioxidant activity of essential oils of *Mentha piperita* collected from region of Meknes (Morocco) was characterised by IC_{50} (53.67µg/ml), it is relatively low than other *M. piperita* study in India which the IC_{50} was (273µg/ml). [56] Contrary, the IC_{50} obtained from this work was relatively higher than other plants of menthe: *M. pulegium* (0.57 µg/ml) [57], *M. piperita* (13.32µg/ml), *M. spicata* (87.89µg/ml), *M. longifolia* (24.07µg/ml) and *M. rotundifolia* (21.71µg/ml) [58] and *M. spicata* (1.14µg/ml). [59] The different antioxidant activities observed, may be ascribed to different chemical constituents and localities geographic. On the other hand, antioxidant activity of *M. piperita* has previously been reported. [60-63]

Table 2: Scavenging effect (%) of *Mentha piperita* essential oils as well as vitamin C on DPPH at different concentrations

	Concentration (µg/ml)	% Inhibition of DPPH	IC_{50} (µg/ml)
Mentha piperita	10	30.01 ± 1.08	53.67
	20	40.87 ± 0.15	
	40	58.23 ± 1.01	
	60	61.01 ± 0.29	
	100	79.12± 1.25	
	150	81.09 ± 1.21	
Vitamin C	10	32.02 ± 0.75	38.12
	20	52.12 ± 1.01	
	40	71.02 ± 0.05	
	60	82.17 ± 1.19	
	100	87.25 ± 0.15	
	150	90.13± 1.78	

Data are given as means ± SD. Vitamin C were used as positive controls for antioxidant

In this study, the antioxidant activity could due to the chemical composition of the essential oil, as the essential oil contained mainly monoterpene hydrocarbons. Indeed, these compounds are known to possess a weak antioxidant activity [64-66, 67] showed the presence of a significant antioxidant potential of essential oils rich in hydrocarbon monoterpenes. The most powerful scavenging compounds were reported to be monoterpene ketones (menthone and isomenthone) and 1, 8-cineole. [62] The other hand the difference in DPPH radical scavenging activity between the essential oils of *M. piperita* L and others essential oils of others plant is attributable to the chemical composition of each essential oil. Also, oils used in the present study had chemical components such as Menthone (29.01%) followed by menthol (5.58%), menthyl acetate (3.34%), menthofuran (3.01%), 1,8-cineole (2.40%), isomenthone (2.12%), limonene (2.10%), α-pinene (1.56%), germacrene-D (1.50%), β-pinene (1.25%), sabinene (1.13%) and pulegone (1.12%)**,** which have probably imparted antioxidant properties to the essential oils. *M. piperita* essential oils contained monoterpenes and oxygenated terpenes. Moreover, trying to correlate the observed activity with the chemical composition of the oils, it is noteworthy to cite the work of [68], who studied the antioxidant activity of 98 pure essential oils chemical components and showed that monoterpene hydrocarbons had a significant protective effect, with several variants due to the different functional groups. Furthermore, some researchers show that some essential oils rich in non phenolic compounds also have antioxidant potentials. [69] Antioxidant properties of essential oils from many plants have also been of great interest to the food processing industry, since their possible use as natural additives has emerged from a growing tendency to replace synthetic antioxidants with natural ones.

The present study has been concerned with determining the chemical composition characteristics and in vitro antioxidant activity of essential oils extracted from the leaves of *Mentha piperita*, collected in the Meknes region of Morocco**.** The chemical analyses, by GC/MS, GC-FID, have allowed us to identify around 58.61% of the total volatile products for *M. piperita* and the yield of essential oils was 1.02%. Thirty volatile compounds were identified and the major constituent in leaves was menthone (29.01%) followed by menthol (5.58%), menthyl acetate (3.34%), menthofuran (3.01%), 1, 8-cineole (2.40%), isomenthone (2.12%), limonene (2.10%), α-pinene (1.56%), germacrene-D (1.50%), β-pinene (1.25%), sabinene (1.13%) and pulegone (1.12%). This yield of the plants essential oil that has been studied was important. In addition, the essential oils extracts reveal a very important antioxidant activity, confirmed by radical scavenging activity (% inhibition) at the concentration of 150µg/ml. It is important to note that the antioxidant activities of the studied essential oils are due essentially to its abundance of the monoterpene hydrocarbons and also to the overall chemical constituents contained is this oil. Essential oils of *M. piperita* and their active components, analyzed showed good antioxidant capacities compared with vitamin C (standard antioxidant compound). *M. piperita* can be used as an easily accessible source of natural antioxidants.

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