NSD
NATURAL SCIENCE & DISCOVERY
ISSN: 2149-6307
Lycia Press LONDON UK

- High Lights

- Turmeric Curcuminoid Polyphenolics as Antioxidant and Anticarcinogenic Agents
- Composition of the essential oil of two Salvia taxa (Salvia sclarea and Salvia verticillata subsp. verticillata)
- Non-Ionizing Radiation around Tanning Beds
- Identification of Essential Oils from the Four Umbelliferae from Turkey
- The analysis of solid waste and effluent water management in Diyarbakir and Batman districts

International Journal of
Natural Science and Discovery
Open Access Scientific Journal
Jun 2015, Vol.1, No.3

www.natscidiscovery.com

Natural Science and Discovery (www.natscidiscovery.com) is an international open access, peer-reviewed scientific research journal that provides rapid publication of articles in all disciplines of Natural science such as Physics, Mathematics, Chemistry, Biology, Engineering, Nanotechnology

The policy of top priority of NSD is to put forward and highlight medical innovations and inspiring patents

NSD offers an exceptionally fast publication schedule including prompt peer-review by the experts in the field and immediate publication upon acceptance.

The editorial board aims at reviewing the submitted articles as fast as possible and promptly including them in the forthcoming issues.

This journal is published under ethical publishing policy of international scientific ethical and publication rules. NSD supports the Open Access Initiative. Abstracts and full texts (HTML and PDF format) of all articles published by NSD are freely accessible to Researchers, Scientist, the Public and other users to view, download and share, immediately upon publication

Founder: Lycia Press
Concessionaire and Founding Editor : Zafer AKAN (Assoc. Prof. Dr.)
Publisher: Lycia Press, LONDON UK

Address: Lycia Press Inc., 4th Floor 86-90 Paul Street, EC2A 4NE, London, UK.
Phone: +44 0 203 322 3097
Email: press [at] lycians.com
Website: www.lycians.com

Instruction for Authors

- NSD Publications uses CrossCheck's iThenticate software to detect instances of similarity in submitted manuscripts. In publishing only original research, NSD is committed to deterring plagiarism, including self-plagiarism. Your manuscript may be screened for similarity to published material.
- Dear Authors, please load just these three file to manuscript submission system
- Title Page Sample
- Manuscript Sample
- Copyright Transfer Form

- **Manuscript Preparation:**
- **1.Cover letter**
- a- A statement that the manuscript has been read and approved by all the authors.
- b- Approval of all the authors regarding the order in which their names have appeared.
- c- That each author confirms the manuscript represents honest work.
- d- The name, address, and telephone number of the corresponding author who is responsible for communicating with other authors about revisions and final approval.
- e- The letter should give any additional information that may be helpful to the editor, such as the type or format of the article. If the manuscript has been submitted previously to another journal or in another language, it is helpful to include the previous editor's and reviewers' comments with the submitted manuscript, along with the authors' responses to those comments. Submitting previous evaluatory review of another journal accelerates the review process.
- f- For accepted manuscripts, the authors are requested to fill and sign the journal's cover letter to express their consent for its publication.
- g- To reproduce published material, to use illustrations or tables or report information about identifiable people, the author should submit a copy of the permission with the manuscript to the journal.
- **2.Top Ethic Committee Approval**
- Inclusion of the approval letter from the relevant Ethics Committee or Institution's Review Board regarding the research protocol and the rights of the subjects (if applicable to the study)
- **3.Top Consent Form**
- Attach a copy of the consent form to the letter, if applicable. Consent forms would be evaluated by the Ethics Committee and then signed by the participant.
- **4.Top RCT or NCT Registration**
- Emailing the letter denoting registration of RCTs or NCTs in domestic or international databases (The trial's registration number needs to be mentioned, too).
- **5. Manuscripts submitted in English**, must be type written, double-spaced, on good quality A4 paper, or paper of similar format. Authors are requested to reserve margins of at least 2.5cm all around the paper. Original drawings of photos, tables and figures should be furnished together with the manuscripts.
- **6. Manuscripts should be kept to a minimum length** and should be subdivided into labeled sections (Title page, Abstract, Keywords, Introduction, Materials and Methods, Results, Discussion, Conclusion, Acknowledgement, and References).
- **7. A title page is to be provided** and should include the title of the article, authors' names with full first name (with degrees), authors' affiliation, suggested running title and corresponding author. The affiliation should comprise the department, institution (usually university or company), city and state (or nation). The suggested running title should be less than 50 characters (including spaces) and should comprise the article title or an abbreviated version thereof. For office purposes, the title page should include the name and complete mailing address, telephone and fax number, and email of the one author designated to review proofs.
- **8. An abstract no longer than 250** words for reviews and research articles is to be provided as the second page. Abstract should be structured as objective(s) (including purpose setting), materials and methods, results, and conclusion.
- **9. A list of 3-8 keywords**, is to be provided directly below the abstract. Keywords should express the precise content of the manuscript, as they are used for indexing purposes. Provide abbreviations and nomenclature list in an alphabetical order and non-standard abbreviations contained in the manuscript (excluding references) with definitions after the keywords. Use abbreviations sparingly and only when necessary to save space, and to avoid repeating long chemical names or therapeutic regimes. In a figure or table, define the abbreviations used in a footnote.
- **10. Tables in limited numbers** should be self- explanatory, clearly arranged, and supplemental to the text. The captions should be placed above.
- **11. Figures should be utilized** only if they augment understandability of the text. The captions should be placed below. Drawings and graphs should be professionally prepared in deep black and submitted as glossy, black and white clean Photostats. Professionally designed computer generated graphs with a minimum of 300 DPI laser printer output is preferable. Color photographs are welcomed.
- **12. The same data** should not be presented in tables, figures and text, simultaneously.
- **13. NSD uses Vancouver referencing Style**. References in limited numbers and up-to-dated must be numbered consecutively in order of citation in the text (number in parentheses). Print surnames and initials of all authors when there are six or less. In the case of seven or more authors, the names of the first six authors followed by et al. should be listed.
- Please check all references with EndNote referencing System. Please check out and Download Vancouver Endnote Style.

Instruction for Authors

- **TYPE OF ARTICLES**

- **Editorial :**
- Editorial is Opinion piece, policy statement, or general commentary, typically written by staff of the publication (The similar value "article-commentary" is reserved for a commentary on a specific article or articles, which is written by an author with a contrasting position, not an editor or other publication staff.)
- **Letters to the Editor** about a recent journal article :
- Letters referring to a recent article in this journal must be received within three months of its publication. For example, a letter referring to an article published in the January issue must be submitted online no later than March 31st. Letters submitted after the allowed time will not be considered.
- The text, not including references, must not exceed 700 words. A maximum of three authors and 10 references are allowed. Neither tables nor figures are allowed.
- Letters to the Editor NOT referring to a recent journal article :
- Original research that is of interest but does not fulfill all the requirements needed for publication as a full-length manuscript can be submitted as a letter to the editor. The letter must have a title and a maximum of three authors.
- The text, not including references, tables, figures or legends must not exceed 700 words. No more than 10 references and either one table or one figure are allowed.
- Word Count Limit: Letters should contain 500 - 700 words, maximum number of references is 10, maximum Number of illustrations/Tables is 1.
- **Original :**
- The content of the paper must justify its length. For reports of original investigative work, traditional division into sections is required: Title, Keywords, Addresses and which author address for correspondence, Structured abstract, Background, Objectives, Materials/Patients and Methods, Results, Discussion, References and Acknowledgements, Legends for display items (Figures and Tables).
- Research articles should contain 2500 - 3500 words, maximum number of references is 35, maximum Number of illustrations/Tables is 5.
- **Review Article:**
- Review Articles should contain 3500 - 4000 words, maximum number of references is 50, maximum number of illustrations/Tables is 5. In a review article both abstract and text of the manuscript, include following items:
- 1) Context: Include 1 or 2 sentences describing the clinical question or issue and its importance in clinical practice or public heath.
- 2) Evidence Acquisition: Describe the data sources used, including the search strategies, years searched, and other sources of material, such as subsequent reference searches of retrieved articles. Explain the methods used for quality assessment and the inclusion of identified articles.
- 3) Results: Address the major findings of the review of the clinical issue or topic in an evidence-based, objective, and balanced fashion, emphasizing the highest-quality evidence available.
- 4) Conclusions: Clearly state the conclusions to answer the questions posed if applicable, basing the conclusions on available evidence, and emphasize how clinicians should apply current knowledge.
- **Hypothesis:**
- Hypothesis should not exceed 2000 words with a structured abstract of 200 words maximum. Hypothesis should comprise sections of Background, Objectives, Materials & Methods, Predicted Results with not more than 2 tables or figures and up to 20 references
- **Brief Report :**
- Brief Reports should contain 1000 - 2000 words with a structured abstract of 200 words maximum. Short reports should comprise sections of Background, Objectives, Materials & Methods, Results and Discussion with not more than 2 tables or figures and up to 20 references.
- **Short Communication :**
- Short Communication, follow the instructions for original articles, except that the total word number of the main text (excluding references, tables and figure legends) is limited to 2000 with no more than 2 figures and/or tables and no more than 15 references. An abstract, not exceeding 150 words, should be presented at the beginning of the article.
- **News :**
- News should contain 1000 - 2000 words with a structured abstract of 200 words maximum. News should comprise sections of Background, Objectives, Materials & Methods, Results and Discussion with not more than 2 tables or figures and up to 20 references.

- **Submission and Review Process :**
- Manuscripts must be written in English (use consistently either British or American spelling) and must be submitted online. To submit, go to http://natscidiscovery.com Full instructions for submission are detailed on submission system.

Instruction for Authors

- **C. General Consideration**:

- **1.Peer review process:** All submissions will be reviewed anonymously by at least two independent referees. All manuscripts will be acknowledged upon presenting to the Journal office, provided that all stated requirements are met. Authors are encouraged to suggest names of two expert reviewers, but selection remains a prerogative of the Editor. The whole review process depends on receiving referees comments and revising the manuscripts based on these comments to the author. On receipt of the revised article from the author, and after final approving by referees, the letter of acceptance is issued to the author. Authors have the right to communicate to the editor if they do not wish their manuscript to be reviewed by a particular reviewer because of potential conflicts of interest. No article is rejected unless negative comments are received from at least two reviewers.
- **2.Conflicts of interest:** Authors should disclose, at the time of submission, information on financial conflicts of interest or other interests that may influence the manuscript. Authors should declare sources of funding for the work undertaken.
- **3.The Journal's Policy on Plagiarism:** Any practice of plagiarism will not be tolerated by the journal regarding submitted manuscripts. Non-identifiable quoted segments of articles or close paraphrases from other author/s or even submitting the author's previously published work are known as the act of plagiarism by this journal unless proper use of quotations or paraphrasing with decent citation or referencing are in place. Heavy use of one or a couple of articles is discouraged, even if paraphrased fully. Advertent practice of plagiarism will abort reviewing process or later submission to this journal. All submitted articles will evaluate by iThenticate software belonged to cross check for stop any plagiarism and improve publication quality.
- **4. Ethical consent:** All submitted articles involving human experiments should be performed only in accordance with the ethical standards provided by the responsible committee of the institution and in accordance with the Declaration of Helsinki (as revised in Edinburgh 2000), available at http://www.wma.net/en/30publications/ 10policies/b3/index.html. Papers describing animal experiments can be accepted for publication only if the experiment conforms the National Institute of Health Guide (National Institute of Health Publications No. 80-23, Revised 1978) for the care and use of Laboratory Animals for experimental procedure. Authors must provide a full description of their anesthetics and surgical procedures. All manuscripts reporting the results of experimental investigations involving human subjects should include a statement confirming the informed consent was obtained from each subject or subject's guardian. All animal or human studies should be used after approval of the experimental protocol by a local ethics committee
- **5.Acknowledgements:** Contributors: In acknowledgement section, name people for their contributions or their permission to reproduce their published material, to use their illustrations or provide information about them- try to fully name people who have helped from the conception of the idea to adoption of the hypothesis, to finalization of the study, etc., earnestly.Statement of financial support: Aside from the title page, state any financial or other relationships that might lead to a conflict of interest.
- **6.Copyright:** Please complete copyright form and send via email to editor. Download NSD Copyright Form
- **7.Disposal of material:** Once published, all copies of the manuscript, correspondence and artwork will be held for 6 months before disposal.
- **8.Creative Commons License**
- This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.
- **9.Once a manuscript** is accepted for publication it will be provided with a registered DOI number following the acceptance decision. Manuscripts accepted for publication by the MSD will be published as ahead of print articles prior to the printing date of their scheduled issue. Corresponding author will be provided with a PDF Proof by the publisher once the production process of an accepted manuscript is over.
- **10. Briefly Sections of NSD article:**
- Sections of article should insert into just one word document and uploaded to NSD submission system as manuscript document. Title page will detach from manuscript by NSD editors and manuscript will forward to referees without title page due to double blinded review rules.

Instruction for Authors

- **Brief Section of NSD**

- **1-Title Page Section**
- Article Type:
- Title of Article:
- Name Surname of Author1, Name Surname of Author2, …
- 1Author Name Surname, Affiliation, e-mail address
- 2Author Name Surname, Affiliation, e-mail address
- *Corresponding Author :
- Author Name Surname, Affiliation, Address, Phone, Fax, E-mail address,
- Corresponding Author should upload all file

- **2-Manuscript Section**
- Abstract (Objective: Methods: Results: Conclusion: "200-250 words and Key words)
- Introduction, Material and Methods, Statistics, Results, Discussion, Conclusion Acknowledgement, References.

- **3-Table and Figures Section**
- Tables and Legends, Figures and Legends should be inserted end of the references

- **Article Processing Charge**
- NSD is a non-profit Scientific Journal Platform; however, it uses professional services such as Language Editing, DOI, domain and hosting, iThenticate Plagiarism or similarity detection Detection Software. All of these professional services are used for all the article processes and an inevitable cost arises with this.

- Unfortunately, like most open journals, fees of the publication with NSD are charged to Authors. Payment is under the responsibilities of corresponding Author(s). NSD does not charge any fee during the submission period. However, after the peer-review process, a non-refundable charge (100 USD) for each accepted manuscript must be paid by the author(s) via NSD's official PayPal account. An invoice will be sent for each accepted manuscript to corresponding author(s).

- Following with completion of payment procedure, the galey proof and acceptance letter of article will be send to authors for last check.

- Preperation of articles in PDF and HTMLformat is covered by Lycia Press Inc. (www.lycians.com) and Article Processing Charges paids to Lycia Press Inc. (www.lycians.com)

Natural Science and Discovery, 2015; 1(3)

Contents

Review Article

1 Turmeric Curcuminoid Polyphenolics as Antioxidant and Anticarcinogenic Agents
Ozlem Tokusoglu, Alkan Simsek, Murtaza Parvizi, Dilvin Eymen
Natural Science and Discovery, 2015; 1(3): 56-61

Original Article

2 Composition of the essential oil of two Salvia taxa (Salvia sclarea and Salvia verticillata subsp. verticillata) from Turkey
Sükrü Hayta, Gulden Dogan, Ebru Yuce, Eyup Bagci
Natural Science and Discovery, 2015; 1(3): 62-7

3 Non-Ionizing Radiation around Tanning Beds
Bahriye Sirav, Nesrin Seyhan
Natural Science and Discovery, 2015; 1(3): 68-73

4 Identification of Essential Oil Composition of Four Umbelliferae from Turkey
Sükrü Hayta, Gulden Dogan, Azize Demirpolat, Eyup Bagci
Natural Science and Discovery, 2015; 1(3): 74-9

5 The analysis of solid waste and effluent water management in Diyarbakir and Batman districts
Nilgun Onursal, Ali Riza Kul, Deylem Onursal
Natural Science and Discovery, 2015; 1(3): 80-4

http://www.natscidiscovery.com
OPEN ACCESS JOURNAL
ISSN: 2149-6307

NSD
Natural Science and Discovery
2015; 1(3): 56-61

Review Article

Turmeric curcuminoid polyphenolics as antioxidant and anticarcinogenic agents

Ozlem Tokusoglu[1]*, Alkan Simsek[2], Murtaza Parvizi[3], Dilvin Eymen[1]

Abstract

In this review content, it has been described the botanical and the chemical properties of turmeric (Curcuma longa), and its curcuminoid polyphenolic structures and antioxidant and anticarcinogenic influences on various cell proliferation and apoptosis. Besides it was emphasized the innovative anticarcinogen complex as boron-curcumin, and the safety evaluation with turmeric curcumin and the dose and toxicity in consuming for animals and human.

Keywords: Turmeric, Curcuma longa, Antioxidant, Anticarcinogenic.

Introduction

Turmeric (Curcuma longa) is extensively consumed as a spice, food preservative, colouring food and agent and it is cultivated in India, South East Asia and China and other countries (Figure 1). Turmeric is a medicinal plant extensively used in Ayurveda, Unani and Siddha medicine as home remedy for various diseases (1). Dried turmeric powder is also utilized in sub-continental cooking and is the main ingredient in all forms of "curry" preparations. The wild turmeric is called C. aromatica and the domestic species is called C. longa. Turmeric has been described as C. longa by Linnaeus and its taxonomic profile is as follows (1)

Class	Liliopsida
Subclass	Commelinids
Order	Zingiberales
Family	Zingiberaceae
Genus	Curcuma
Species	Curcuma longa

Curcuma longa, a perennial herb and member of the Zingiberaceae (ginger) family, grows to a height of 3-5 feet with a tropical climate. It has oblong, pointed leaves and funnel-shaped yellow flowers (2) (Figure 1). Dried turmeric plant is the source of the spice, the ingredient that gives curry powder and has characteristic yellow-orange color (Figure 1).

It has stated that turmeric spice is an antioxidant, anticarcinogenic and has hepatoprotective, anti-inflammatory, and antimicrobial properties. Besides, its utilizing in cardiovascular disease and gastrointestinal disorders. Current review has focused on turmeric's phenolic antioxidants as anticarcinogen agents

Figure 1: Turmeric (*Curcuma longa*) plant (left) and turmeric root and powder (right) (Anonim,2015)

Received: 14-12-2015, **Accepted** 15-12-2015, **Available Online**: 15-12-2015
1 Celal Bayar University, Engineering Faculty, Dept of Food Engineering, 45140,Manisa, Turkey
2 Karşıyaka Nabil Nalbant ASM, Başiskele, 41090, Kocaeli,Turkey
3 Manisa Public Hospital, Şehitler District, Manisa, Turkey
*Corresponding Author: Ozlem Tokusoglu. E-mail: tokusoglu@natscidiscovery.com

Bioactive Constituents of Turmeric and Main Component Curcumin

Turmeric spice includes 6.3% of total protein, 5.1% of total fat, 69.4% of carbohydrate and 13.1% of moisture. The main bioactive component of turmeric is curcumin (diferuloylmethane) as 3-4% and remain is essential oils including □-phellandrene (1%), sabinene (0.6%), cineol (1%), borneol (0.5%), zingiberene (25%) and sesquiterpines (53%) in the structure (3). Curcumin is responsible for the yellow color and comprises three derivative containing curcumin I (94%), curcumin II (6%), and curcumin (III) (0.3%) (3). the melting point of curcumin is176-177 □C and turns to reddish-brown salt with alkali agents. Turmeric is soluble in ethanol, acetic acid, ketone and chloroform. Figure 2 shows the chemical composition of curcumin and its keto-enol structure (3,4).

Curcumin can exist in at least two tautomeric forms, keto and enol. It is stated that the enol form is more energetically stable in the solid phase and in solution (Figure 2).

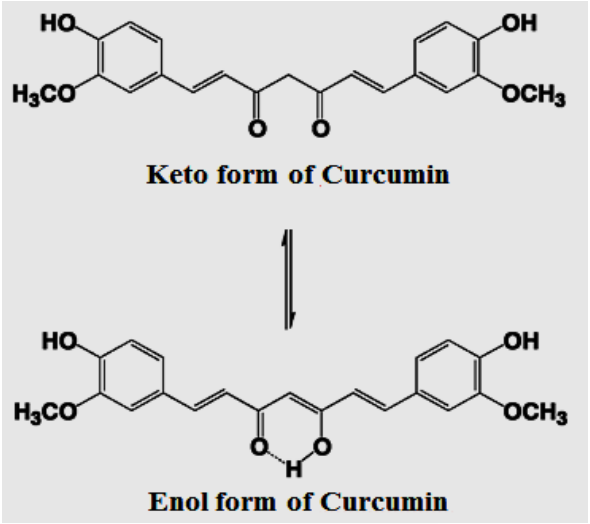

Figure 2. The Chemical Structure of Curcumin (4)

The chemical structures of curcumin derivatives as curcumin I, curcumin II demethoxycurcumin, and curcumin III bis-demethhoxycurcumin are given in Figure 3. Curcumin is the principal curcuminoid of spice turmeric, is a member of the ginger family (Zingiberaceae) and the other two curcuminoids are desmethoxycurcumin and bis-desmethoxycurcumin (Figure 3).

The curcuminoids are polyphenols and are responsible for the yellow-orange color of turmeric. Turmeric powder is yellow pigmented and has numerous curcuminoids that include curcumin (77%), demethoxycurcumin (17%), and bisdemethoxycurcumin (3%). Curcumin is a polyphenol (1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6- heptadiene-3,5-dione).

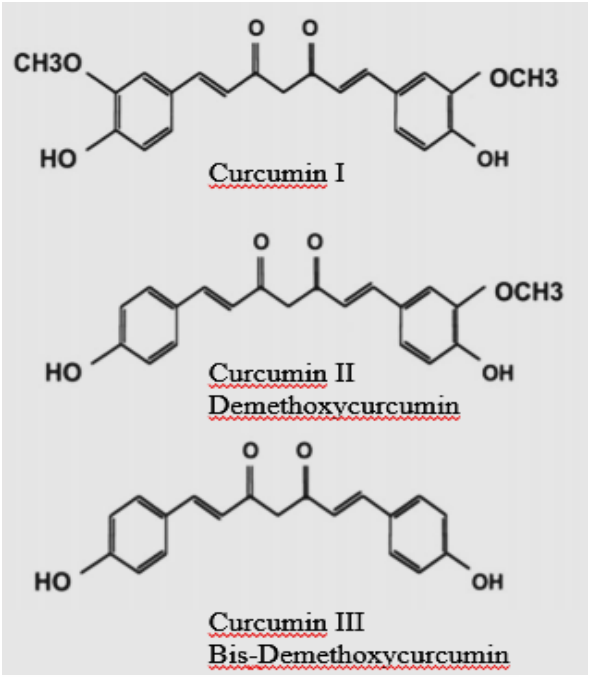

Figure 3. Curcumin Derivatives in Turmeric (5)

Health Effects of Curcumin

Curcumin is brightly yellow coloured and may be used as a food colouring. As a food additive, its E number is E100. In ayurvedic medicine, it has been used for various disorders including asthma, bronchial hyperactivity, coryza, cough, sinusitis, allergy, anorexia, and hepatic diseases (6).

It has been reported that many positive health on anti-infectious (7), anti-oxidant (8), anti-inflammatory (9,10), hepatoprotective (11), cardio protective (12), thrombosuppressive (13), anti-arthritic symptoms (14). It has been reported that curcumin suppresses the type II diabetes symptoms, reduces blood cholesterol, prevents LDL oxidation, inhibits platelet aggregation, suppresses thrombosis and myocardial infarction, supresses rheumatoid arthritis and multiple sclerosis symptoms and Alzheimer (15). It has been most importantly determined that curcumin has chemo preventive, and anti-carcinogenic properties (16).

Antioxidant Effects of Curcumin

Through a variety of assay systems *in vitro* and *in vivo* researches shown that curcumin and related compounds have great antioxidative activities. It is stated that, not only the phenolic hydroxyl (OH) groups of curcumin are most important in its antioxidative property but also the OH groups in the curcumin derivative bis (3,4-dihydroxycinnamoyl)-methane and also possible role of β-diketone moiety in the curcumin structure (17-24). According to studies, the presence of an ortho alkoxy group seems to potentiate the antioxidant activity, as does an additional hydroxy group as in bis (3,4-dihdroxy)cinnamoyl methane (24). It is reported that water-soluble and fat-soluble extracts of turmeric and its curcumin component exhibit strong antioxidant activity, comparable to ascorbic acid (vitamin C) (25).

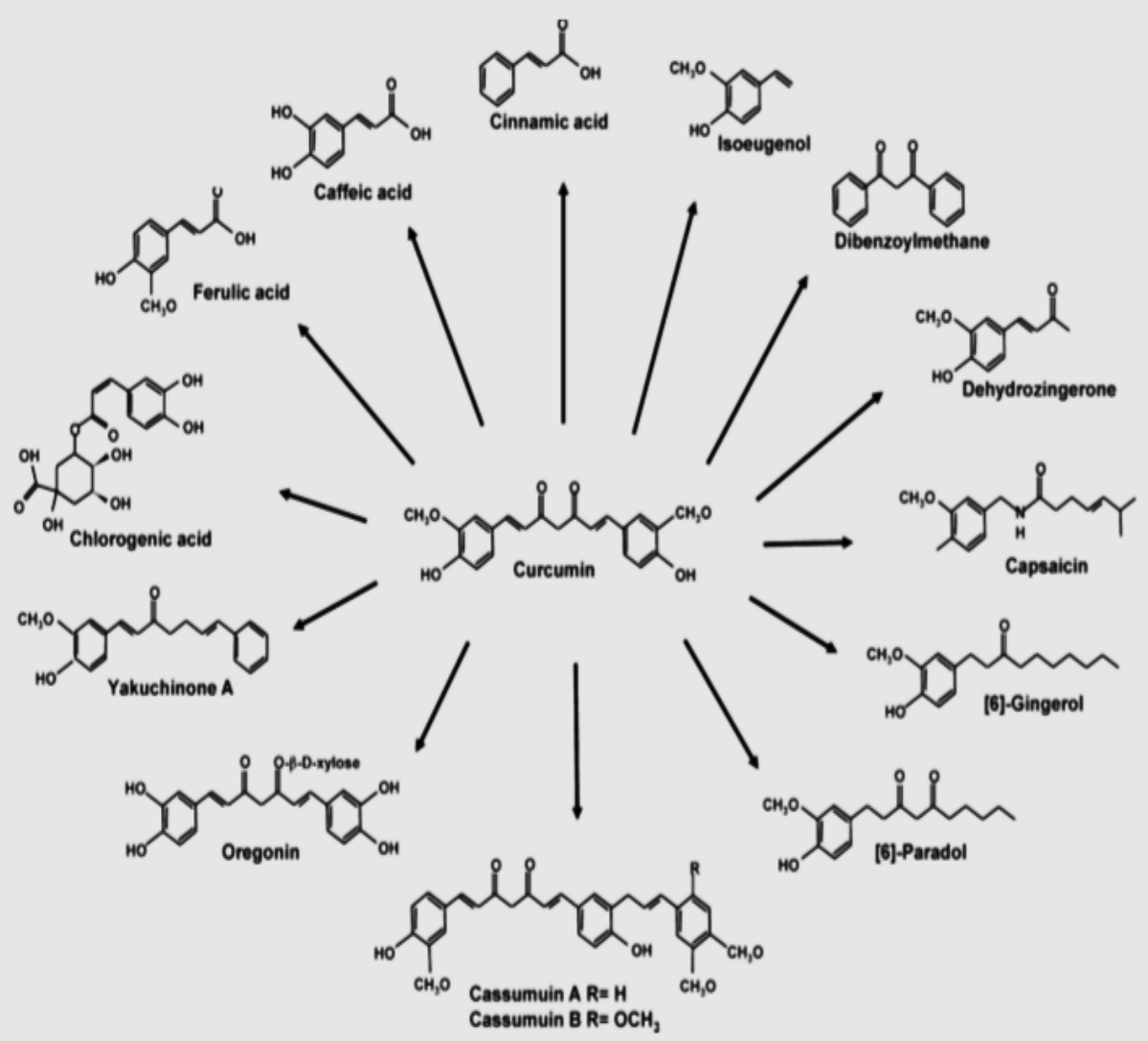

Figure 3. Curcumin analogues from mother structure (19)

Figure 3 shows a number of naturally occurring bioactive compounds having some structural similarity to the curcumin molecule, or at least having a pharmacophore including one aryl function with 3,4 substitution, either a methoxylated phenol or catechol (Figure 3). These compounds include ferulic acid, cinnamic acid, caffeic acid, chlorogenic acid, capsaicin, gingerol, paradol, zingerone, eugenols) or in two aromatic rings (e.g., oregonin, nitric oide synthase--iNOS inhibitör, dehydroguairetic acid, yakuchinones, cassumunins). The same chromophore is responsible for both the antioxidant and prooxidant properties of curcumin and its analogues that may be owing to the its radical-generating or hydrogen bond donor-acceptor properties.

Anticarcinogenic effects of curcumin

The extensive studies suggested that curcumin has the great potential in the prevention and treatment of cancer. *In vitro* and *in vivo* preclinical and clinical studies shown that curcumin has positive effects in the cancer treatment (15)

Curcumin has been shown to promote apoptosis in certain cancer cell lines and to inhibit telomerase activity, an important factor in tumorigenesis. One possible mechanism for the induction of tumor cell death is through the generation of reactive oxygen intermediates.

The oleoresin of turmeric which obtained after the extraction of curcumin has antimutagenic properties, thought to be mediated through its antioxidant action (16). In this chemopreventive effect, the anti-inflammatory properties of curcumin are also important and it is stated due the suppression of prostaglandin synthesis.

Curcumin polyphenolic substance has antiproliferative effects (5). It is reported that curcumin suppresses the proliferation of a wide variety of cancer tumor cells containing breast carcinoma, colon carcinoma, renal cell carcinoma, hepatocellular carcinoma, T cell leukaemia, B cell lymphoma, melanoma and prostate carcinoma, acute myelogenous leukaemia, basal cell carcinoma (5).

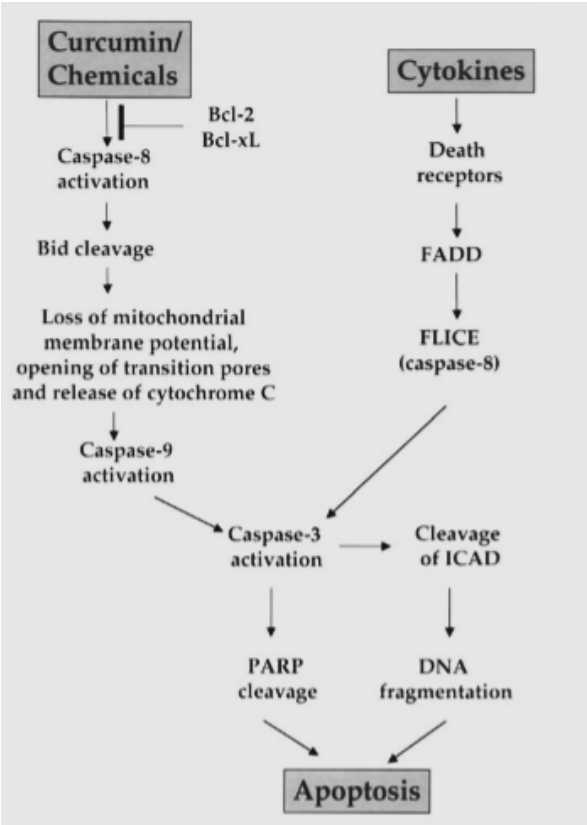

Figure 4. Curcumin Analogues from Mother Structure (5)

Besides, curcumin also inhibits the cell proliferation induced by growth factors such as IL-2-induced proliferation of PBMC, PDGF-induced proliferation of VSMC and PHA-induced proliferation of PBMC were inhibited by treatment with curcumin (26). It is stated that the suppression of cell proliferation by curcumin usually occurs through its effects on the cell cycle (27). Figure 4 shows the mechanism of apoptosis with curcumin. Moreover the suppression of proliferation, curcumin induces apoptosis in wide spectrum of cells. In this point, the apoptosis could be either mitochondria-dependent or mitochondria-independent as shown in Figure 4. It is also reported that curcumin induces apoptotic cell death by DNA-damage in human cancer cell lines, TK-10, MCF-7 and UACC-62 by acting as topoisomerase II poison (28).

Boron-Curcumin Complex

It is stated that curcumin can be used for boron quantification in the so-called curcumin method. It reacts with boric acid and gives a red coloured compound, known as rosocyanine (29). Rosocyanine is formed as 2:1 complex from curcumin and boric acid in acidic solutions. The boron complexes formed with rosocyanine are dioxaborines (1,3,2-dioxaborine). Curcumin possesses a 1,3-diketonestructure and can therefore be considered as a chelating agent.

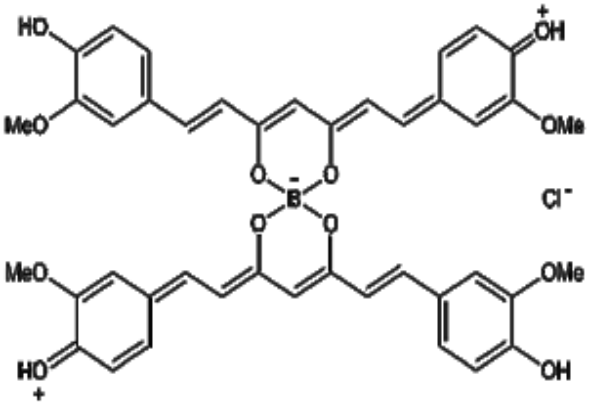

Figure 5. Curcumin-Boron Complex (Rosocyanine) (29)

It has been put forwarded that innovative synthetic strategies lead to soluble and crystallisable metal curcumin complexes (29). Also, it was described that the special emphasis is placed on the highly promising and exciting medicinal applications of metal curcumin complexes, with the three most important areas being anticancer activity and selective cytotoxicity, anti-Alzheimer's disease activity, and antioxidative/neuroprotective effects (29).

Safety evaluation with turmeric and curcumin

Based on the detailed studies, it has been stated that the safety evaluation of the rhizomes of turmeric and its alcohol extract, curcumin was performed. However, the utilization of very high doses (100 mg/kg body weight) resulted in ulcerogenic situation in animals, as evidenced by one rat study (30)

It has been reported that no pathological, behavioural abnormalities or lethality (31) and also no adverse effects were observed on growth and the level of erythrocytes, leucocytes, blood constituents such as haemoglobin, total serum protein, alkaline phosphatase, etc. in male and female Wistar rats, guinea pigs and monkeys of both sexes which were fed with turmeric at a dose of 300 mg/kg body weight (32).

Although various studies shown that no significant toxicity has been reported following either acute or chronic administration of turmeric extracts at standard doses, it was reported the average intake of turmeric by Asians varies from 0.5-1.5 g/day/person, which produces no toxic symptoms (33). Human clinical trials also indicate that curcumin has no toxicity when administered at doses of 1–8 g/day (34) and 10 g/day (35). It was also shown that there is no evidence that dietary consumption of turmeric as a spice adversely affects pregnancy or lactation, the safety of curcumin supplements in pregnancy and lactation has not been established.

Conflict of interests: We declare that we have no conflict of interests.

References

1. Chattopadhyay I., Biswas K., Bandyopadhyay U., Banerjee R.K. 2004. Turmeric and curcumin: Biological actions and medicinal applications. Review. Current Science, Vol.87 (1), 44-53.
2. Anonymous 2015. Curcuma longa. Alternative Medicine Review Monographs. 119-125.
3. Ruby A.J., Kuttan G., Dinesh B., Rajasekharan K.N., Kuttan R. 1995. Antitumor and antioxidant activity of natural curcuminoids. Cancer Lett., 94, 79-83
4. Basu A., Suresh Kumar G. 2014. Interaction of the dietary pigment curcumin with hemoglobin: energetics of the complexation. Vol 5, Food Funct. 1949-1955.
5. Aggarwal B.B., Kumar A., Bharti A.C. 2003. Anticancer Potential of Curcumin: Preclinical and Clinical Studies. Anticancer Research. 23, 363-398.
6. Ammon H.P.,Wahl M.A. 1991.Pharmacology of Curcuma longa. Planta Med. 1991,57,1–7.
7. Chan, M.M., Adapala, N.S., Fong, D. 2005. Curcumin overcomes the inhibitory effect of nitric oxide on Leishmania. Parasitol Res. 96, 49-56.
8. Sreejayan S., Rao M.N. 1997.Nitric oxide scavenging by curcuminoids. J. Pharm. Pharmacol. 49, 105-107.
9. Brouet I.; Ohshima H. 1995. Curcumin, an anti-tumour promoter and anti-inflammatory agent, inhibits induction of nitric oxide synthase in activated macrophages. Biochem. Biophys. Res. Commun. 206, 533-540. 5.
10. Dikshit M., Rastogi L., Shukla R., Srimal R.C. 1995. Prevention of ischaemia-induced biochemical changes by curcumin & quinidine in the cat heart. Indian J. Med. Res. 101, 31-35.
11. Kiso Y., Suzuki Y., Watanabe N., Oshima Y., Hikino H. 1983. Antihepatotoxic principles of Curcuma longa rhizomes. Planta Med. 49, 185-187.
12. Vishwanatha swamy a., Gulliaya s., thippeswamy a., koti b.c., manjula d.v. 2012. cardioprotective effect of curcumin against doxorubicin-induced myocardial toxicity in albino rats. indian j pharmacol. 44(1): 73–77.
13. Srivastava R. Dikshit M., Srimal R.C., Dhawan B.N. 1985. Thrombosis Research, 40(3):413-7
14. Zahidah A.F., Faizah O., Nur Aqilah K., Tatyanna K. 2012. Curcumin as an Anti-Arthritic Agent in Collagen-Induced Arthritic Sprague-Dawley Rats. Sains Malaysiana, 41(5), 591–595
15. Aggarwal B.B., Kumar A., Bharti A.C. 2003. Anticancer Potential of Curcumin: Preclinical and Clinical Studies. Review. Anticancer Research, 23, 363-398.
16. López-Lázaro M. 2008. Anticancer and carcinogenic properties of curcumin: considerations for its clinical development as a cancer chemopreventive and chemotherapeutic agent. Mol Nutr Food Res. 52(1), 103-27.
17. Sharma O.P. 1976. Antioxidant activity of curcumin and related compounds. Biochem.Pharmacol., 25, 1811-1812.
18. Wright J.S. 2002. Predicting the antioxidant activity of curcumin and curcuminoids. J.Mol Struct., 591, 207-217.
19. Anand P., Thomas S.G., Kunnumakkara A.B., Sundaram C., Harikumar K.B., Sung B., Tharakan S.T., Misra K., Priyadarsini I.K., Rajasekharan K.N., Aggarwal B.B. 2008. Biological activities of curcumin and its analogues (congeners) made by man and mother natüre. Biochemical Pharmacology. 76, 1590-1611.
20. Priyardarsini K.I., Maity D.K., Naik G.H., Kumar M.S., Unnikrishnan M.K., Satav J.G. et.al.. 2003. Role of phenolic O-H and methylene hydrogen on the free radical reactions and antioxidant activity of curcumin. Free Radic Biol Med. 35, 475-484.
21. Barclay L.R., Vinqvist M.r., Mukai K., Goto H., Hashimoto Y., Tokunaga A. et.al. 2000. On the antioxidant mechanism of curcumin: classical methods are needed to determine antioxidant mechanism and activity. Org.Lett. 2, 2841-2843.
22. Jovanovic S.V., Steenken S., Boone C.W., Simic M.G.. 1999. H-atom transfer is a preferred antioxidant mechanism of curcumin. J. Am.Chem. Soc., 121, 9677-9681.
23. Suzuki M., Nakamura T., Iyoki S., Fujiwara A., Watanabe Y., Mohri K. et.al. 2005. Elucidation of anti-allergenic activities of curcumin-related compounds with a special reference to their anti-oxidative activities. Biol Pharm Bull, 28, 1438-1443.
24. Chen W.F., Deng S.I., Zhou B., Yang L., Liu Z.I. 2006. Curcumin and its analogues as potent inhibitors of low density lipoprotein oxidation: H-atom abstraction from the phenolic groups and possible involvement of the 4-hydroxy-3-methoxyphenyl groups. Free Radic Biol Med., 40, 526-535.
25. Labban L. 2014. Medicinal and pharmacological properties of Turmeric (Curcuma longa): A review. Int J Pharm Biomed Sci, 5(1):17-23.
26. Huang H.C., Jan T.R., Yeh S.F. 1992. Inhibitory effect of curcumin, an anti-inflammatory agent, on vascular smooth muscle cell proliferation. Eur J Pharmacol 221, 381-384.
27. Chen H, Zhang ZS, Zhang YL, Zhou DY. 1999. Curcumin inhibits cell proliferation by interfering with the cell cycle and inducing apoptosis in colon carcinoma cells. Anticancer Res 19, 3675-3680.
28. Martin-Cordero C., Lopez-Lazaro M., Galvez M., Ayuso M.J. 2003. Curcumin as a DNA topoisomerase II poison. J.Enzyme Inhib.Med.Chem., 18, 505-509.
29. Wanninger S., Lorenz V., Subhanb A., Edelmann F.T. 2015. Metal complexes of curcumin- synthetic strategies, structures and medicinal applications. Chem. Soc. Rev., 44, 4986-5002.
30. Ammon HPT, Wahl MA. 1991. Pharmacology of Curcuma longa. Planta Medica 57:1-7.
31. Bhavani Shankar T.N., Shantha N.V., Ramesh H.P., Murthy I.A.S., Murthy V.S. 1980. Toxicity studies on turmeric (Curcuma longa): acute toxicity studies in rats, guinea pigs and monkeys. Indian J. Exp. Biol., 8, 73–75.

32. Sambaiah K., Ratankumar S., Kamanna V.S., Satyanarayana M.N., Rao M.V.L. 1982. Influence of turmeric and curcumin on growth, blood constituents and serum enzymes in rats. J. Food Sci. Technol., 19, 187-190.

33. Eigner D., Scholz D. **1999**. Ferula asa-foetida and *Curcuma longa* in traditional medicinal treatment and diet in Nepal. J. Ethnopharmacol., 67, 1–6.

34. Chainani-Wu, N. **2003.** Safety and antiinflammatory activity of curcumin: a component of turmeric (Curcuma longa). *J.Altern.Complement Med*., 9, 161-168.

35. Aggarwal B.B., Kumar A., Bharti A.C. **2003**. Anticancer potential of curcumin: preclinical and clinical studies. Anticancer Res., 23, 363–398.

http://www.natscidiscovery.com
OPEN ACCESS JOURNAL
ISSN: 2149-6307

NSD Natural Science and Discovery
2015; 1(3): 62-7

Original Article

Composition of the essential oil of two Salvia taxa (*Salvia sclarea and Salvia verticillata subsp. verticillata*) from Turkey

Gulden Dogan[1], Sukru Hayta[2*], Ebru Yuce[3], Eyüp Bagci[1]

Abstract

Objective: The essential oil composition of two Salvia taxa (Salvia sclarea and Salvia verticillata subsp. verticillata) analysed and yield of compositions were analysed

Material and Methods: The essential oil was extracted by hydro distillation using a modified Clevenger apparatus coupled to a 2 L round-bottom flask. A total of 100 g of fresh plant material (aerial parts) and 1 L of water were used for the extraction. Gas chromatography / Mass spectrometry (GC-MS) analysis were applied to extracts.

Results: The essential oil yields of Salvia sclarea and Salvia verticillata L. subsp. verticillata were found as 0.4 and 0.3 %v/w, respectively. Overall, thirty seven compounds which accounted for 97.9% in Salvia sclarea and seventy four constituents, which accounted for 98.6% of the total compositions of each oil are determined in Salvia verticillata L. subsp. verticillata. The spathulenol (19%), caryophyllene oxide (15.5%), linolyl acetate (11.3%) and linalool L (8.5%) were the major compounds of Salvia sclarea and the germacrene D (13.8%), spathulenol (10%) and limonene (4.5%), 1.8- cineole (4.5%) were the main compounds of the Salvia verticillata L. subsp. Verticillata

Conclusion: spathulenol was found as major compound for both *Salvia sclarea* and *Salvia verticillata* subsp. *verticillata* while, the other main components were not showed similarity

Keywords: Salvia sclarea, Salvia verticillata, GC-MS, Essential oil, Spathulenol

Introduction

The genus *Salvia* L. represents nearly 1000 species displaying a remarkable diversity in growth forms, secondary compounds, floral morphology, and pollination biology. The genus has distributed extensively in 3 regions of the world: Central and South America (500 spp.), western Asia (200 spp.), and eastern Asia (100 spp.) (1). Anatolia is a major diversity center for Salvia in Asia (2). Turkey is home to 95 *Salvia* species, 49 (52%) of which are endemic (3).

The first revision of *Salvia* in Turkey was made by Hedge (1982), who recognized 86 species, 1 hybrid and 1 doubtful species. There, he grouped the species by stamen characters and other morphological similarities. Since the publication of the Flora of Turkey, nine species have been added to the genus as new species (4-9) or new records were reported (10-12). The number of species now reaches 95, showing that Turkey is amajor centre of diversity for the genus in Asia.

Salvia sclarea L. also known as muscat sage is one of the highly demanded Mediterranean species for its aromatic properties (13-14).

S. sclarea or clary sage is widely used in cosmetic industry as well (15). Extracts of the aerial part of clary sage have a broad spectrum of effects: analgesic, antiinflammatory (16), antifungal (17) and antibacterial (18).

Salvia species heve been used in folk medicine for wound healing and in alleviating stomach, liver, and rheumatism pains and for treating the common cold in the form of infusion and decocation in various parts of the world (19,20). They and their essantial oils are used in food flavoring, pharmceuticals, and in perfumery. *Salvia* species mainly contain essantial oil and phenolics (21). Some of the phenolic compounds of plants belonging to this genus have also shown excellent antimicrobial activity, as wellas scavenging activity of active oxygen, inhibiting lipid peroxidation and antioxidant activity (22-24).

Recently, the essential oils and various extracts of plants have gained special interest as sources of natural antimicrobial and antioxidant agents because of the resistance to antibiotics that some microorganisms have acquired and the possible toxicities of the synthetic antioxidants (25,26).

Received: 07-12-2015, **Accepted** 14-12-2015, **Available Online**: 15-12-2015
1 Firat University, Science Faculty, Biology Department, Elazig-Turkey
2 Bitlis Eren University, Engineering & Architecture Faculty, Environmental Engineering Department, Bitlis- Turkey
3 Tunceli Vocational School, Tunceli Universty, Tunceli-Turkey.
*Corresponding Author: Sukru Hayta. E-mail: sukruhayta@hotmail.com

In the context of essential oil study in our laboratuary in the same family (27-29) it is aimed that to evaluate the composition of the essential oils obtained from the aerial parts of *Salvia sclarea* and *Salvia verticillata subsp. verticillata* growing wild in Turkey. The results were discussed with the *Salvia* genus pattern in means of chemotaxonomy, natural products and renewable resources.

Materials and Methods

Plant material

Salvia sclarea L. specimens were collected during to flowering stage in May, 2010, at an altitude of 1400 m, Ovacık (Tunceli-Turkey) and *Salvia verticillata* L. subsp. *verticillata* specimens were collected during to flowering stage in June, 2009, at an altitude of 1380 m, Baskil (Elazıg-Turkey). Voucher specimens are kept at the Firat University Herbarium (FUH).

Extraction of the essential oil

The essential oil was extracted by hydrodistillation using a modified Clevenger apparatus coupled to a 2 L round-bottom flask. A total of 100 g of fresh plant material (aerial parts) and 1 L of water were used for the extraction. The extraction was performed over 3 hour period. Subsequently, the hydrolate was collected and centrifuged at 10,000 rpm for 10 minutes. The organic phase was removed with the aid of a Pasteur pipette, and subsequently transferred to an black coloured vials, wrapped in parafilm and aluminum foil and 4^{o}C under refrigeration until analysis. The yields of oils were calculated on the basis of the dry mass.

Gas chromatography (GC) analysis

The essential oil was analysed using HP 6890 GC equipped with FID detector and HP- 5 MS (30 m x 0.25 mm *i.d.,* film tickness 0.25 µm) capillary column was used. The column and analysis conditions were the same as in GC-MS expressed as below. The percentage composition of the essential oils was computed from GC-FID peak areas without correction factors.

Gas chromatography / Mass spectrometry (GC-MS) analysis

GC-MS analyses of the oils were performed on a Hewlett Packard Gas Chromatography HP 6890 interfaced with Hewlett Packard 5973 mass spectrometer system equipped with a HP 5-MS capillary column (30 m x 0.25 mm id, film thickness 0.25 µm). The oven temperature was programmed from 70-240^{o}C at the rate of 5^{o}C/ min. The ion source was set at 240^{o}C and electron ionization at 70 eV. Helium was used as the carrier gas at a flow rate of 1 mL/min. Scanning range was 35 to 425 amu. Diluted oil in *n*-hexane (1.0 µL) was injected into the GC-MS.

The identification of constituents was performed on the basis of retention indices (RI) determined by co-injection with reference to a homologous series of *n*-alkanes, under identical experimental conditions. Further identification was performed by comparison of their mass spectra with those from NIST 98 Libraries (on ChemStation HP) and Wiley 7th Version. The relative amounts of individual components were calculated based on the GC (HP-5MS column) peak area (FID response) without using correction factors. The identified constituents of the essential oils are listed in Table 1.

Results and Discussion

The essential oils of the aerial parts of two *Salvia* species (*Salvia sclarea* and *Salvia verticillata* L. subsp. *verticillata)* collected from the Turkey were obtained by hydrodistillation, in 0.4% and 0.3 (v/w) oil yields respectively. Thirty seven and seventy four components were identified representing 97.9% and 98.6% of the oils, respectively. The major constituents of *S. sclarea* were spathulenol (19%), caryophyllene oxide (15.5%), linolyl acetate (11.3%) and linalool L (8.5%), whereas those *S. verticillata* subsp. *verticillata* were germacrene D (13.8%), spathulenol (10%) and limonene (4.5%), 1.8- cineole (4.5%) (Table 1). The oils were complex mixtures of non-terpenes, monoterpenes and sesquiterpenes: Totally, eighty nine components were identified in essential oils in the study.

The hydrodistilled essential oils of the aerial parts of wild-growing *Salvia sclarea* originated from two localities in Greece were analyzed by GC-MS. Sixty-six compounds, representing 93.26−98.19% of the oils, were identified. Linalyl acetate (19.75−31.05%), linalool (18.46−30.43%), geranyl acetate (4.45−12.1%), and α-terpineol (5.08−7.56%) were the main components (17). In general, we can said that there are some similarities between in Greece samples and Turkey specimens.

Twenty-eight components were identified for *S. verticillata*, constituting 98.2% of the total oil. *S. verticillata* oil was dominated by monoterpenes (64.5%). Among these monoterpenes hydrocarbons such as β-pinene (30.7%), *p*-cymene (23.0%) and α-pinene (7.6%) were reported by Pitarokili et al (30). It is interesting that although major components (β-pinene, *p*-cymene and α-pinene) of essential oils were reported by Pitarokili et al (30), those major components were detected trace amounts in our samples. On the other hand, the β-caryophyllene (13.3%), γ-muurolene (10.3%) and trans-chrysanthenol (6.1%) were the major compounds of essential oil of *Salvia verticillata* from Yugoslavia (31).

However, two dominant components in Iran, (E)-caryophyllene and α-humulene were also dominant components in all three Serbian populations, suggesting that these are generally present in *S. verticillata.* Additionally, germacrene D was the main component (48.0% and 24.6% of oil, respectively) in two populations collected from in Serbia (32).

Table 1: Constituents of the essential oils of *S. sclarea* and *S. verticillata* subsp. *Verticillata.*
RI: Retention Indices

No	Compounds	RI	*S. sclarea* (%)	*S. verticillata* subsp. *vert.* (%)
1	α–Thujone	1016	--	0.3
2	α-Pinene	1021	0.4	2.7
3	Camphene	1035	--	0.2
4	Sabinene	1052	--	0.9
5	β-Pinene	1056	--	2.8
6	β-Myrcene	1064	0.7	0.9
7	Mentha-1 (7) 8 diene	1075	--	0.2
8	δ-3-Carene	1079	--	1.3
9	α-Terpinene	1085	--	0.1
10	Benzene, 1-methyl-2	1087	--	0.2
11	*p*-Cymene	1092	--	1.1
12	Limonene	1094	--	**4.5**
13	Sabinen	1096	--	2.1
14	1.8-Cineole	1098	--	4.0
15	*cis*-Ocimene	1100	0.4	--
16	γ-Terpinene	1118	0.6	0.2
17	*cis*-Sabinenehydrate	1126	--	0.2
18	2-methyl 1-propenyl	1133	--	0.1
19	Benzene, 1-methyl-4	1140	--	0.1
20	Linalool-L	1148	**8.5**	--
21	Trans-verbenol	1180	--	0.4
22	Pinocarvone	1192	--	0.2
23	Borneol-L	1199	--	0.6
24	3-Cyclohexen-1-ol	1205	--	0.2
25	α-Terpineol	1215	4.5	0.4
26	Trans-carveol	1231	--	0.2
27	Nerol	1234	0.7	--
28	Propanol, 2-methyl-3-phenyl	1248	--	0.2
29	Linalyl acetate	1252	**11.3**	--
30	Benzeneacetaldehyde	1268	--	0.3
31	Bornyl acetate	1282	--	0.2
32	α-Cubebene	1337	--	1.9
33	Lavandulyl isobutanoate	1345	1.5	--
34	α-Ylangene	1355	--	0.4
35	α-Copaene	1360	--	1.7
36	Lavandulyl acetate	1361	3.8	--
37	β-Bourbonene	1366	--	2.0
38	β-Cubebene	1369	--	1.7
39	β-Caryophyllene	1393	1.8	1.8
40	β-Copaene	1400	--	3.8
41	Aromadendrene	1406	--	0.6
42	α-Amorphene	1410	--	0.4
43	5,9-Undecadien	1411	--	0.6
44	Trans-β-farnesene	1415	--	0.8
45	(+)-Epi-bicyclosesquiphallendrene	1422	--	1.2
46	Naphthalane	1431	--	3.1
47	Germacrene D	1435	0.7	**13.8**
48	β-Selinene	1441	--	0.4
49	Methyl ısoeugenol	1442	--	1.3
50	Bicyclogermacrene	1445	0.5	3.3
51	γ-Cadinene	1455	--	1.3
52	δ–Cadinene	1458	0.6	2.9
53	*cis*-Calamenene	1461	--	1.3
54	3,5-diene muurola	1467	--	0.5

No	Compounds	RI	*S. sclarea* (%)	*S. verticillata* subsp. *vert.* (%)
55	α-Cadinene	1470	--	0.3
56	α-Calacorene	1473	--	0.5
57	Valencene	1479	0.6	--
58	Nerolidol	1485	--	0.6
59	1,5-Epoxisalvial-4 [14]-ene	1490	2.0	--
60	Spathulenol	1495	**19.0**	**10.0**
61	Caryophyllene oxide	1498	**15.5**	1.7
62	Salvial-4 (14)-en-1-one	1504	1.0	1.5
63	Jasmone	1512	--	0.8
64	Humulene epoxide II	1514	0.7	0.2
65	Isolongifolene	1517	0.5	0.8
66	Vulgarol-B	1521	--	0.3
67	Isospathulenol	1526	1.2	--
68	t-Muurolol	1531	0.8	--
69	Epi-α-cadinol	1532	--	0.7
70	δ–Selinene	1535	1.1	0.9
71	α-Eudesmol	1540	2.2	1.7
72	Eudesma-4 [15], 7-dien-1-beta-ol	1541	0.8	1.2
73	γ-Gurjunene	1544	--	0.6
74	Cadalene	1548	1.6	0.7
75	Valeranone	1550	1.5	2.5
76	Ethanone	1555	--	0.7
77	Cyercene	1558	0.7	1.7
78	Ledene	1575	--	0.1
79	2-Heptanone	1586	0.7	--
80	Benzylbenzoate	1595	0.6	--
81	γ-Muurolene	1608	--	0.1
82	2-Pentadecanone	1631	--	1.5
83	1H-Naphtol [2,1-b] pyran	1655	7.0	--
84	Farnesyl acetone	1664	--	0.1
85	Nerolidyl acetate	1667	0.5	--
86	Pimaradiene	1695	0.6	--
87	Manoyl oxide	1716	0.6	--
88	Abietetrane	1756	0.7	--
89	Abietal	1861	1.5	--
	Total		**97.9**	**98.6**

It is possible to say that Turkey and Serbian *S. verticillata* samples has same major essential oil compounds generally.

The analysis of the essential oil composition of several *Salvia* species indicates that 1,8-cineole (eucalyptol), and borneol are its main constituents. However, several authors have documented significant species specific variations in the concentration of these compounds and/or presence of others in high concentrations (33-41). Moreover, the essential oil composition of *Salvia* species, as occurs with other medicinal and aromatic plants, is highly influenced by genetic and environmental factors (42-43).

Some species of *Salvia* from Turkey were dominated in germacrene D (27%), bicyclogermacrene (11.3%), spathulenol (10%) in *S. ceratophylla* oil; germacrene D (26.3%), bicyclogermacrene (24.1%), α-copaene (21.1%), β-cubenene (8.1%) and δ-cadinene (5%) were in *S. aethiopis* oil (27); 1,8-cineole (30.5%), camphor (21.3%) and borneol (8.50%) in *S. aucheri* var. *aucheri* oil; β–pinene (10.3%), 1,8 cineole (46.0%) and camphor (8.7%) in *S. aramiensis* oil; α-thujene (36.1%) and α-pinene (13.8%) *S. pilifera* oil (44); β-caryophyllene (18%), germacrene D (16.5%), linalool L (9.2%), caryophyllene oxide (7.3%), sclaraeol (6.6%) and linalyl acetate (6%) in *S. palaestina*; α-pinene (33.7%), germacrene D (7.5%), β-pinene (6.8%), α-humulene (6%), and viridiflorol (3.8%) in *S. tomentosa* (29) were reported essential oil from Turkey. Limonene (11.7%), 2-cyclohexen-1-ol (9.2%), trans-verbenol (7.7%) and trans-(+)- carveol (6.7%) were found to be major components in *S. kronenburgii* (45).

The major components in each of the seven species were as follows: *S. coccinea* (Z)-3-hexenal (31%), viridiflorol (19%); *S. farinacea* 1-octen-3-ol (30%) and (Z)-3-hexenal (23%); *S. greggii* 1,8-cineole (22%), borneol (17%), camphene (11%) and a-pinene (10%); S. leucantha limonene (35%) and α-pinene (17%); *S. longispicata x farinacea* 1-octen-3-ol (50%) and (Z)-3-hexenal (24%); *S. madrensis* (Z)-3-hexenal (53%); *S. roemeriana* limonene (49%) and alpha-pinene (20%); and *S. splendens* (Z)-3-hexenal (36%), 2,5-dimethoxy-p-cymene (19%) and linalool (11%) (46).

It is said that, in the comparison of major compounds of two *Salvia* essential oil with the other *Salvia* species; we can say that α/β-pinene characteristic group in *S. syriaca* (12.6% - 7.3%) (47), *S. caespitosa* (6.8% - 22%) (48), *S. blepharochlaena* (10.1% - 4%) (48), *S. pilifera* (11.2% - 1%) (48), *S. hypoleuca* (5.9% - 7.2%) (49), *S. officinalis* (3.1% - 9.8%) (50), *S. tomentosa* (33.7% - 6.8%) (29), *S. verticillata* (30.7% - 7.6%) (30) and *S. bracteata* (9.4% - 10.5%); β-caryophyllene dominated group are; *S. triloba* (11.8%) (51), *S. longipedicellata* (16.1%) (48), *S. hypoleuca* (14.6%) (49), *S. palaestina* (18%) (28), *S. verticillata* (13.3%) (30), *S. russellii* and *S. bracteata* (4.8% - 16.7%) (52); caryophyllene oxide dominated group are; *S. hypergeia* (10.7%), *S. longipedicellata* (23.3%) (48), *S. palaestina* (7.3%) (29), *S. trichoclada* (7.0%) (28); *Salvia sclarea* (15.5%) (Table 1); camphor dominated group are; *Salvia multicaulis* (13.2%) (28), *S. tricochlada* (11.3%) (28), *S. verbenaca* (7.0%) (30) and *S. bracteata* (17.8%) (52).

Conclusion

The main conclusion from the above data, particularly infraspesific differences means, might be explain that genetic and environmental factors both play a role in determining the composition of essential oils of the *Salvia* species studied. In addition, spathulenol was found as major compound for both *Salvia sclarea* and *Salvia verticillata* subsp. *verticillata* while, the other main components were not showed similarity. In addition, the results were discussed with the *Salvia* genus pattern in means of chemotaxonomy, natural products and renewable resources.

Conflict of interests: We declare that we have no conflict of interests.

References

1. Walker, J.B., Sytsma, K.J. Staminal Evolution in the Genus Salvia (Lamiaceae): Molecular Phylogenetic Evidence for Multiple Origins of the Staminal Lever. Annals of Botany. 100 (2007) 375-391.
2. Hedge, I.C. Salvia L. In: Davis PH (ed.) Flora of Turkey and the East Aegean Islands, Edinburgh; Edinburgh Univ. Press. 7 (1982) 400-461.
3. Kahraman, A., Dogan, M., Celep, F., Akaydın, A., Koyuncu, M. Morphology, anatomy, palynology and nutlet micromorphology of the rediscovered Turkish endemic Salvia ballsiana (Lamiaceae) and their taxonomic implications. Nordic Journal of Botany. 28 (2010) 91–99.
4. Celep, F., Dogan, M. Salvia ekimiana (Lamiaceae), a new species from Turkey. Ann. Bot. Fennici. 47 (2010) 63–66.
5. Donmez, A. A new Turkish species of Salvia L. (Lamiaceae). Bot. J. Linn. Soc. 137: (2001) 413–416.
6. Hamzaoglu E, Duran, A., Pınar, N.M. Salvia anatolica (Lamiaceae), a new species from East Anatolia, Turkey. Ann. Bot. Fennici. 42 (2005) 215–220.
7. Huber-Morath, A. Salvia nydeggeri Hub.-Mor. nova species Sectio Eusphace Benth. Bauhinia. 7 (1982) 181.
8. Ilcim, A., Celep, F., Dogan, M. Salvia marashica (Lamiaceae), a new pinnatisect leaved species from Turkey. Ann. Bot. Fennici. 46 (2009) 75–79.
9. Vural, M., Adıguzel, N. A new species from Central Anatolia: Salvia aytachii M. Vural et N. Adıgüzel (Labiatae), Tr. J. of Botany. 20: (1996) 531-534.
10. Behcet, L., Avlamaz, D. A new record for Turkey: Salvia aristata Aucher ex Benth. (Lamiaceae). Turk. J. of Bot. 33 (2009) 61–63.
11. Celep, F., Dogan, M., Duran, A. A new record for the Flora of Turkey: Salvia viscosa Jacq. (Labiatae). Turk. J. of Bot. 33 (2009) 57–60.
12. Kahraman, A., Celep, F., Dogan, M. A new record for the flora of Turkey: Salvia macrosiphon Boiss. (Labiatae). Turk. J. Bot. 33 (2009) 53–55.
13. Lawrence, B.M. Production of clary sage oil and sclareol in North America, Proc. Remes Recontres Int. Nyons. 4 (1994) 1-48.
14. Dweck, A.C. The folklore and cosmetics use of various Salvia species, S.E. Kintzios (Ed.), Sage. The genus Salvia, Harwood Academic Publishers, Amsterdam, The Netherlands. (2000) 1-25.
15. Szentmihalyi, E. In vitro study on the transfer of volatile oil components. J. Pramaceut Biomed. 21 (2001) 1073-1080.
16. Moretti, M.D.L., Peana, A.T., Sata, M.A. A sudy of antiinflammatory and peripheral analgesic actions of Salvia sclarea oil and its main constituents. J. Essent. Oil. Res. 9 (1997) 199-204.
17. Pitarokili, D. et al. Composition and antifungal activity on soil-borne pathogens of the essential oil of Salvia sclarea from Greece. J. Agric. Food Chem. 50 (2002) 6688-6691.
18. Gulcin, M.T. et al. Evaluation of the antioxidant and antimicrobial activities of clary sage (Salvia sclarea L.). Turk J Agric For. 28 (2004) 25-33.
19. Bayrak, A., Akgul, A. Composition of essantials oil from Turkish Salvia species. Phytochemistry. 26 (1987) 846-847.
20. Sezik, E., Yesilada, E. Essential oils in N. Krimer, & A. Mat (Eds.), Honour of Prof. Dr. K. H. C. Baser on his 50th birthday Turkey: Eskisehir: (1999) 98.
21. Baser, K.H.C., Kurkcuoğlu, M., Kırımer, N. Essential oils of Salvia species growing in Turkey. International Symposium On Essantials Oils Frankfurt. (1998) 29.

22. Hohmann, J. et al. Protective effects of the aerial parts of Salvia officinalis, Melisa officinalis and Lavandula angustifolia and their constituents against enzyme-dependent and enzyme-independent lipid peroxidation. Planta Medica. 65 (1999) 576-578.

23. Masaki, H., Sakaki, S., Atsumi, T., Sakurai, H. Activeoxygen scavenging activity plant extracts. Biological and Pharmacological Bulletin. 18 (1995) 162-166.

24. Pizzale, L. et al. Antioxidant activity of sage (Salvia officinalis and S. fruticosa) and oregano (Origanum onites and O. intercedens) extracts related to their phenolic compound content. Journal of the Science of Food and Agriculture. 82 (2002) 1645-1651.

25. Essawi, T., Srour, M. Screening of some Palestinian medicinal plants for antibacterial activity. Journal of Ethnopharmacology. 70:343-349.

26. Madhavi, D.L., Salunkhe, D.K. Food antioxidants. In. Madhavi DL, Deshpande SS, Salunkhe DK (Eds.) New York: Dekker; (1996) 267-359.

27. Bagci, E., Kocak, A. A Study on the Analysis and Evaluation of Essential Oils of Two Salvia L. (S. ceratophylla L., S. aethiopis L.) Species. Fırat Univ. J. of Sci. & Tech. 19 (2007) 435-442.

28. Bagci, E., Kocak, A. Essential oil composition of two Salvia L. (S. multicaulis Vahl. Enum. and S. trichoclada Bentham) species from east anatolian region (Turkey). Int. J. of Sci. & Tech. 3(2008a) 13-18.

29. Bagci, E., Kocak, A. Composition of essential oils of Salvia palaestina Bentham and S. tomentosa Miller Species, a chemotaxonomical approach. Fırat Univ. J. of Sci. & Tech. 20 (2008b) 35-41.

30. Pitarokili, D., Tzakou, O., Loukis, A. Essential oil composition of Salvia verticillata, S. verbenaca, S. glutinosa and S. candidissima growing wild in Greece. Flavour and Fragrance Journal. 21 (2006) 670-673.

31. Chalchat, J.C. et al. Chemical compositions of two wild species of the genus Salvia L. from Yugoslavia: Salvia aethiopis and Salvia verticillata. Journal of Essential Oil Research. 13 (2001) 416-418.

32. Krstic, L., Malencic, D., Anackov, G. Structural investigations of trichomes and essential oil composition of Salvia verticillata. Bot. Helv. 116 (2006) 159-168.

33. Ahmadi, L., Mirza, M. Essential oil of Salvia multicaulis Vahl from Iran. Journal of Essential Oil Research. 11 (1999) 289-290.

34. Baser, K.H.C., Ozek, T., Kırımer, N. The essential oils of Salvia pomifera L. Journal of Essential Oil Research. 5 (1993) 347–348.

35. Baser, K.H.C. et al. Essential oil of Salvia aytachii M. Vural et N. Adiguzel. Journal of Essential Oil Research. 9 (1997) 489–490.

36. Haznedaroglu, M.Z., Karabay, N.U., Zeybek, U. Antibacterial activity of Salvia tomentosa essential oil. Fitoterapia. 72 (2001) 829–831.

37. Holeman, M. et al. Etude chimique comparative des huiles essentielles de Salvia officinalis, S. aucheri, S. verbenaca, S. phlomoides et S. argenta. Fitoterapia. 55 (1984) 143–148.

38. Perry, N. B. et al. Essential oil from Dalmation sage (Salvia officinalis L.), variations among individuals, plant parts, seasons and sites. Journal of Agricultural and Food Chemistry. 47 (1999) 2048–2054.

39. Putievsky, E. et al. Genetic affinities and essential oil composition of Salvia officinalis L., S. fruticosa Mill., S. tomentosa Mill., and their hybrids. Flavour and Fragance Journal. 5 (1990) 121–123.

40. Sivropoulou, A. et al. Antimicrobial, cytotoxic, and antiviral activities of Salvia fruticosa essential oil. Journal Of Agricultural And Food Chemistry. 45 (1997) 3197–3201.

41. Torres, M. E. et al. Volatile constituents of two Salvia species grow wild in Spain. Journal of Essential Oil Research. 9 (1997) 28–33.

42. Dean, S., Rıtchıe, G. Antibacterial properties of plant essential oils. International Journal of Food Microbiology. 5 (1987) 165–180.

43. Piccaglia, R., Marottu, M. Characterization of several aromatic plants grow in northern Italy. Flavour and Fragrance Journal. 8 (1993)115–122.

44. Kelen, M., Tepe, B. Chemical composition, antioxidant and antimicrobial properties of the essential oils of three Salvia species from Turkish flora. Bioresource Technology. 99 (2008) 4096-4104.

45. Bagci, E., Kocak, A. Chemical composition of essential oil of local endemic Salvia kronenburgii Rech. fil. to Turkey. J. of Ess. Oil Bearing Plants. 14 (2011) 360-365.

46. Tabanca, N. et al. Microdistillation and analysis of volatiles from eight ornamental Salvia taxa. Natural Product Communications. 5 (2010) 1421-1426.

47. Flamini, G., Cioni, P.L., Morelli, I., Bader, A. Essential oils of the aerial parts of three Salvia species from Jordan: Salvia lanigera, S. spinosa and S. syriaca. Food Chemistry. 100 (2007) 732-735.

48. Demirci, B., Baser, K. H. C., Yıldz, B., Bahcecioglu, Z. Composition of essential oils of six endemic Salvia spp. from Turkey. Flavour and Fragrence Journal. 18 (2003) 116-121.

49. Nickavar, B., Mojab, F., Dolat-Abadi, R. Analysis of the essential oils of two Thymus species from Iran. Food Chem. 90 (2005) 609-611.

50. Tsankova, E.T., Konaktchiev, A.N., Genova, E.M. Constituents of essential oils from three Salvia species. J. of Essential Oil Research. 6 (1994) 375-378.

51. Delamare, A.P.L., Moschen-Pistorello, I.T., Atti-Serafini, S., Echeverrigaray Food Chemistry. 100 (2007) 603-608.

52. Dogan, G., Demirpolat, A., Bagcı, E. Essential oil composition of aerial parts of two Salvia L. (S. russellii Bentham and S. bracteata Banks and Sol.) species. Asian Journal of Chemistry. (2014) 26:24.

http://www.natscidiscovery.com
OPEN ACCESS JOURNAL
ISSN: 2149-6307

NSD Natural Science and Discovery
2015; 1(3): 68-73

Original Article

Non-Ionizing Radiation around Tanning Beds

Bahriye Sirav[1*], Nesrin Seyhan[1]

Abstract

Objective: Use of artificial tanning devices that emit UV radiation, such as tanning lamps and tanning beds, has become increasingly popular in the world. A tanning bed is a device emitting ultraviolet radiation used to produce a cosmetic tan. A number of studies have been conducted evaluating the risk of cutaneous malignant melanoma after exposure to sunlamps and/or sunbeds. Although an excess risk of nonmelanoma skin cancers might be predicted from this exposure, little epidemiologic data exist.

Material and Methods: In this study the leakage electromagnetic fields around artificial tanning devices were measured in Sun Club Beauty Salon and Solarium in Ankara, Turkey and evaluated in terms of standards.

Results: It has been observed that operators exposed to low ELF and RF fields with respect to general public and occupational exposure limits. However, global health experts have moved use of sunbeds and exposure to ultraviolet radiation (including sun exposure) to the highest risk category for causing cancer.

Conclusion: They now join agents such as tobacco, asbestos and benzene in being classed as "carcinogenic to humans" whereas before they were classed as "probably carcinogenic". Precautions should therefore be taken to minimise the exposed fields.

Keywords: Tanning beds, Radio Frequency Radiation, Extremely Low Frequency, Exposure Limits

Introduction

Solar radiation is the main source of human exposure to ultraviolet (UV) radiation, which is further subdivided into UVA, UVB, and UVC. The ultraviolet component that reaches the earth's surface comprises around 95% UVA and 5% UVB; UVC is blocked by stratospheric ozone. The use of UV-emitting tanning devices is widespread in many developed countries, especially among young women. Overexposure to ultraviolet radiation is known to cause skin cancer, make skin age and wrinkle faster, mutate DNA, and reduce the immune system. Frequent tanning bed use triples the risk of developing melanoma, the deadliest form of skin cancer. A tanning bed is a device emitting ultraviolet radiation (typically 97% UVA and 3% UVB) used to produce a cosmetic tan. Regular tanning beds use several fluorescent lamps that have phosphor blends designed to emit UV in a spectrum that is somewhat similar to the sun. Smaller, home tanning beds usually have 12 to 28 100 watt lamps while systems found in salons can run from 24 to 60 lamps, each consuming 100 to 200 watts.

Because of the adverse effects on human health of overexposure to UV radiation, including skincancer, cataracts, suppression of the immune system, and premature skin aging, the World Health Organization does not recommend the use of UV tanning devices for cosmetic reasons (1).

In fact, most tanning beds emit mainly UVA rays which may increase the risk of melanoma, the deadliest form of skin cancer. Using a sunbed without glasses may also lead to a condition known as arc eye.

The effects of extremely low frequency (ELF) magnetic and electric fields and radio frequency (RF) electromagnetic fields on the biological organisms have been investigated at Biophysics Department of Gazi University since 1990. The effects of 50 Hz, 0.2 mT – 3 mT magnetic field exposures on collagen synthesis, epilepsy, electrolytes, lipid peroxidation (MDA), Nitric Oxide (NOx), respiratory burst system (MPO), antioxidant defense system (GSH), and immune system in spleen, skin, lung, kidney, brain and plasma tissues have been evaluated and these studies indicate that ELF magnetic fields have significant effects on these tissues (2-6).

Effects of static and 50 Hz ELF electric (E) fields on free radical synthesis, antioxidant enzyme level, and collagen synthesis were also analyzed on tissues of guinea pigs, such as brain, liver, lung, kidney, spleen, testis and plasma (7-10).

The results indicate that the effects of E fields on the tissues depend on the type and magnitude of the field and exposure period.

Received: 07-12-2015, **Accepted** 14-12-2015, **Available Online**: 15-12-2015
1 Gazi University, School of medicine, Dept. of Biophysics, Ankara, Turkey
*Corresponding Author: Bahriye Sirav E-mail: bahriyes76@gmail.com

Evaluation of RFR (Radio Frequency Radiation) in a chosen pilot area, Yenimahalle Şentepe – Dededoruk Hill in Ankara, was realized first time in Turkey in 2001 by Gazi Biophysics. RF radiation at that region, which have 64 different TV and radio towers and one base station, was found 4 times higher than the permitted standards of Turkey. The base station and some of TV and radio transmitters were not included in the calculations, since their technical information were not available (11). RF at non-thermal levels could have significant effects on the permeability of blood-brain barrier (12,13). The effect of mobile phone radiation at different frequencies and strengths and the effects of radio frequency radiation on tissue hydroxyproline level were studied (14). Mobile phone exposure based RF dosimetry was determined by using FDTD method (15). The ongoing study on RFR is the effect of mobile-phone like radiation on pregnant animals and their infants. It has been recently reported that the distortion product autoacoustic emissions in infant rabbits are affected by mobile phone radiation (16). In the Biophysics Department, a Gazi Non-Ionizing Radiation Protection (GNRP) Center was founded in 2005. This Center performed studies on the biological effects of electromagnetic radiation and other studies mapping residential and workplace electromagnetic field levels since its foundation. GNRP also deals with training programmes on non-ionizing radiation, protection from non-ionizing radiation and electromagnetic fields consultancy. The Centre has also reported measurements of high electromagnetic field strengths. After these measurements, counseling and training programmes for public / workers were recommended by GNRP.

The biological effects of exposure to RF and microwave radiation have been studied extensively and have been well reviewed by several national and international bodies (17). Currently there is no study that presents the measured electromagnetic fields, especially extremely low frequency fields and radio frequency electromagnetic radiation from tanning beds. The annual rate of about 2000 deaths from skin cancer in Germany, are mainly caused by extensive exposure to solar UV radiation, demands protective measures (18).

Materials and Methods

Five tanning units have been identified in Sun Club Beauty Salon and Solarium Centre. Three of them are running. The models of devices are Ergoline Solarium, Ergoline 2 and Ergoline 600. Third one was being used while measurement, so it could not be measured. First system included 46 lamps with 160 W to burn the body and 3 lamps with 500 W to burn the face. Manufacturer mentioned in the catalog that total energy consumption is 13.7 W. Compensation is compulsory for the center due to high energy consumption. Due to this consumption, the fire risk is very high in the building where many people live and / or work there. Field-strength measurements were made in the absence of the human but at the normal location to demonstrate that the measured value was below the appropriate guideline level or vice versa. With this aim, exposed RF electric field levels were measured with EMR 300 (Narda, Pfullingen, Germany) and appropriate probes at 4 points (mentioned in the figure with square frame) around the dielectric heater in Sun Club Beauty Salon and Solarium (Fig. 1). EFA 300 (Narda, Pfullingen, Germany) was also used to measure the ELF magnetic fields at 7 points (shown in the circles in the figure).

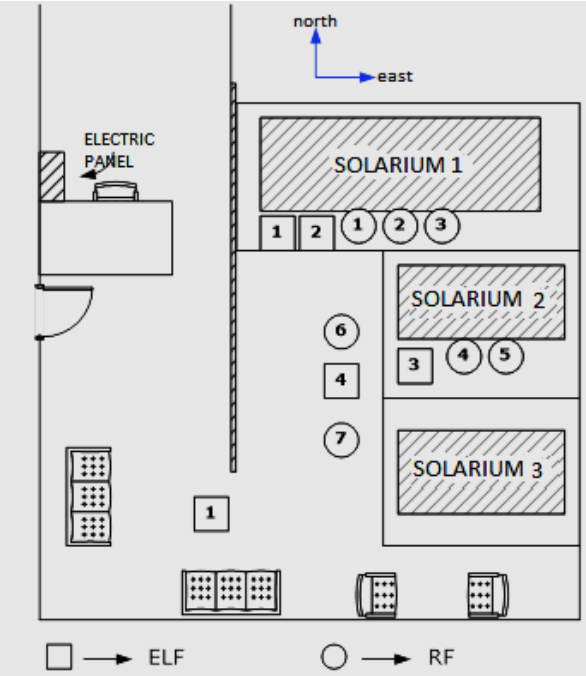

Figure 1: Electromagnetic Field Measurement points in the Solarium Center

International Commission on Non-Ionizing Radiation Protection (ICNIRP) provides a two-tier set of electromagnetic field exposure limits (19). The higher tier is referred to as Occupational while the more restrictive tier is referred to as General Population. Turkey's limits for the electric and magnetic field, which was formed by Turkish Information and Communication Technologies Authority (ICTA) in collaboration with Gazi Biophysics, are identical with the ICNIRP standards (20).

There are only differences in two points: Turkey's limits are available for only general public and the frequency range for Turkey's limits is 10 kHz–60 GHz. In this study, measurement results were compared with ICNIRP occupational and general public exposure limits mentioned Table 1 for 10 MHz – 100 MHz frequency range. Table 2 represents the occupational and general public ICNIRP 50 Hz magnetic field limits and IARC's threshold for ELF magnetic fields.

Table 1. ICNIRP Occupational and General Public exposure limits for 10-100 MHz (19)

Category	E (V/m)	H (A/m)	B (μT)
Occupational Exposure	61	0.16	0.2
General Public Exposure	28	0.073	0.092

Table 1. ICNIRP Occupational and General Public exposure limits for 10-100 MHz (19)

Category	E (V/m)	H (A/m)	B (μT)
Occupational Exposure	61	0.16	0.2
General Public Exposure	28	0.073	0.092

Table 3. Measured ELF magnetic (H) fields

No	Measurement point	Magnetic field (mG)	Frequency (Hz)
1	Solarium 1 off, inside the unit	1,09	33
2	Solarium 1 on, inside the unit	**52,08**	51
3	Solarium 1 on, in front of the unit	**9,34**	51
4	Solarium 2 on, inside the unit	**10,58**	151
5	Solarium 2 on, in front of the unit	1,94	131
6	Solarium 1,2 and 3 on, in front of the 2nd unit	0,93	51
7	Solarium 1,2 and 3 on, in front of the 3rd unit	1,05	51

Table 4. Measured RF electric fields (100 kHz – 3 GHz)

No	Measurement point	Max (V/m)	Average (V/m)	Max. Av. (V/m)
1	Solarium 1 off, room RF field	0,94	0,04	0,08
2	Solarium 1 on, around the unit	2,64	0,13	0,64
3	Solarium 2 on, around the unit	0,49	0,05	0,05
4	Solarium 1,2 and 3 on, the whole salon measurement	**5,13**	0,37	0,44

Results and Discussion

Measured ELF magnetic fields are given in Table 3. Bold values are magnetic field levels higher than IARC threshold which was announced for the threshold level for childhood leukemia (22). Other values were well below than the limits.

Measured RF electric fields are given in **Table 4**. EMR 300 measures electromagnetic fields in three mode; maximum, average and maximum average modes. According to electromagnetic field measurement techniques (19), average mode electromagnetic field levels should be used in analyzing exposure. In **Table 4,** bold value shows the maximum field level. When the average electric and magnetic field levels were compared with ICNIRP 1998 general public limits (28 V/m – 0.073 A/m) and occupational exposure limits (61 V/m – 0.16 A/m), it can be seen that people exposed to low electric fields than general public limits. First Non-Ionizing Radiation Protection Center of Turkey – Gazi Non-Ionizing Radiation Protection (GNRP) Center has been founded by Biophysics Department of Gazi University Faculty of Medicine in Ankara on July, 22, 2005. GNRP has been working on electromagnetic field measurements and counseling activities about Non-Ionizing Radiation (NIR) since its foundation. One of the most important activities of GNRP was Sun Club Beauty Salon and Solarium measurement.

The effects of RF in humans and exposed field levels are still emerging area of investigation. In this measurement study it has been observed that measured average levels of RF electric fields for the center are under the order of occupational and general

public exposure limits. Results showed that ELF magnetic field measurement values also could be announced as safe. However when compared with the IARC's threshold levels based on childhood leukemia epidemiologic studies (22), it can be seen that people are exposed to ELF magnetic fields higher than the limit. Studies on women in workplaces suggest breast cancer for long term exposures to 10 mG and higher. Magnetic field levels measured in this study are also in the order of breast cancer thresholds.

The US Public Health Service states that UV radiation, including the use of sun lamps and sun beds are "known to be a human carcinogen" (24). An IARC Working Group has classified UV-emitting tanning devices as "carcinogenic to humans" (Group 1). Combined analysis of over 20 epidemiological studies shows that the risk of cutaneous melanoma is increased by 75% when the use of tanning devices starts before age 30. There is also sufficient evidence of an increased risk of ocular melanoma associated with the use of tanning devices. Studies in experimental animals support these conclusions and demonstrate that ultraviolet radiation (UVA, UVB, and UVC) is carcinogenic to humans. These findings reinforce current recommendations by the World Health Organization to avoid sunlamps and tanning parlours and to protect people from overexposure to the sun.

A comprehensive meta-analysis concluded that the risk of cutaneous melanoma is increased by 75% when use of tanning devices starts before 30 years of age (). Additionally, several case–control studies provide consistent evidence of a positive association between the use of UV-emitting tanning devices and ocular melanoma (25).Therefore, the Working Group raised the classifi cation of the use of UVemitting tanning devices to Group 1, "carcinogenic to humans'' (26).

There is scientific evidence that each of the three main types of skin cancer, basal cell carcinoma (BCC), squamous cell carcinoma (SCC) and melanoma, is caused by UV exposure (27). Women who visited a tanning parlor at least once a month were 55% more likely to later develop melanoma than women who didn't artificially suntan. Young women who used sun lamps for tanning while in their 20s had the largest increase in subsequent cancer risk – about 150% higher than similar women who did not use tanning beds. Overexposure to ultraviolet radiation induces at least two common genetic mutations. Those include cyclobutane–pyrimidine dimers (CPDs) and 6–4 photoproducts (6–4PPs) and their Dewar valence isomers (28). The mutation types generally differ between UVA and UVB light (29). The basal layer in human squamous tumors harbors more UVA than UVB fingerprint mutations: A role for UVA in human skin carcinogenesis. Mutant cells may die, or become cancerous, depending on which genes were mutated. While DNA repair enzymes can fix some mutations, they are not sufficiently effective, as demonstrated by the relation to cancer, aging and other types of persistent mutation and cell death. For example, squamous cell carcinoma is caused by a UVB induced mutation in the p53 gene (28).

UVA light is clearly associated with increased skin aging and wrinkle production. This is because UVA penetrates the skin more deeply than UVB, and therefore causes damage on a deeper level. Most aging of skin is due to UVA rays destroying collagen and connective tissue beneath the superficial layer of the skin. UVB rays do not reach as far below the skin. Excessive exposure to UVA radiation has its risks, which may cause premature aging, including wrinkles, sunspots, and loss of skin elasticity (30).

The European Union is discussing new regulations that would limit the amount of UVB allowed in tanning lamps and devices. The Province of Ontario, Canada, is also considering introducing regulations obliging tanning salons to post warning labels on the beds informing consumers of the risks of skin cancer due to indoor tanning. They are also considering imposing an age limit to indoor tanning, similar to present controls on alcohol and tobacco.

In the United States, the maximum exposure time in most tanning beds is 20 minutes but varies from bed to bed. This is calculated by the manufacturer according to the amount of time needed to produce 4 MEDs (minimal erythemal doses). This is essentially 4 times the amount of UV that is required to produce a reddening on unexposed skin. A person would start with a much shorter session time and work their way to the maximum exposure time in about 4 weeks. Every tanning bed is required to have a "Recommended Exposure Schedule" on both the front of the tanning bed and in the owner's manual. It must also list the original lamp that was certified for that particular tanning bed, and salon owners must replace the lamps with either the exact same lamp, or a lamp that is certified by the lamp manufacturer to be legally equivalent. Lamp replacement and salon compliance is regulated by the individual state in the USA, whereas the manufacturing and sale of new equipment is regulated by the federal government.

Since many factors can change the performance of any given individual lamp, the United States Food and Drug Administration requires that every tanning bed model is certified separately, and lamps themselves do not have MED ratings. Lamps do have typical TE (or Time Exposure) ratings, but these are not used for certifying beds. Session times on beds can range from 5 minutes to 20 minutes, depending on many factors. In 2010, an FDA panel recommended banning the use of tanning beds for people under 18 years old.

In the United Kingdom anyone under 18 years of age will be banned from using sunbeds, as this legislation was passed by Parliament.

Teaching reasonable behaviour is the supreme issue. Recommended protective measures in the order of their effectiveness are protection by adaptation of

behaviour, by clothes, sun hats and sunglasses as well as by sun creams. Children are the most important target group. With regard to UV tanning appliances it is recommended not to use artificial UV radiation for cosmetic purposes because of the related health risks.

Conclusion

There were many measurements; consultancy and education programmes have been carried out by Gazi Non-Ionizing Radiation Protection Center - GNRP since its foundation. A key element in linking the complexity of the radio frequency radiation exposure sources and patterns with the needs of epidemiology is a measure that is capable of monitoring individual exposure. GNRP prepares training programmes for workers and its work on the determination of occupational exposure levels is still on the way. To minimize the risk of adverse health effects, RF fields must be in compliance with the applicable guidelines. These are under the responsibility of governmental authorities, manufacturers and employers. Further studies using different configurations and methods will be very interesting. Many countries have now established occupational RF health protection standards or guidelines. Turkey has no occupational exposure limits yet. GNRP's studies on establishing Turkey's missing regulations are also on going.

Acknowledgements: Electromagnetic Field measurement devices used in this study were supplied by the grant from Gazi University Research Foundation, No: 31 / 2002-07. We would also like to thank Semih OZDEN for his helps in the measurement.

Declaration of Interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

1. Geller AC, Colditz G, Oliveria S, Emmons K, Jorgensen C, Aweh GN, et al. Use of sunscreen, sunburning rates, and tanning bed use among more than 10 000 US children and adolescents. Pediatrics. 2002;109(6):1009-14.

2. Coskun S, Balabanli B, Canseven A, Seyhan N. Effects of Continuous and Intermittent Magnetic Fields on Oxidative Parameters In vivo. Neurochemical Research. 2009;34(2):238-43.

3. Canseven AG, Coskun S, Seyhan N. Effects of various extremely low frequency magnetic fields on the free radical processes, natural antioxidant system and respiratory burst system activities in the heart and liver tissues. Indian Journal of Biochemistry & Biophysics. 2008;45(5):326-31.

4. Akay C, Canseven AG, Erdem O, Seyhan N. Effect of intermittent and continuous exposure to electromagnetic field on calcium and magnesium levels in serum, brain, liver and kidney tissues. Toxicology Letters. 2007;172:S112-S.

5. Tohumoglu G, Canseven AG, Cevik A, Seyhan N. Formulation of ELF magnetic fields' effects on malondialdehyde level and myeloperoxidase activity in kidney using genetic programming. Computer Methods and Programs in Biomedicine. 2007;86(1):1-9.

6. Canseven AG, Seyhan N, Mirshahidi S, Imir T. Suppression of natural killer cell activity on Candida stellatoidea by a 50 Hz magnetic field. Electromagnetic Biology and Medicine. 2006;25(2):79-85.

7. Guler G, Seyhan N, Aricioglu A. Effects of static and 50 Hz alternating electric fields on superoxide dismutase activity and TBARS levels in guinea pigs. General Physiology and Biophysics. 2006;25(2):177-93.

8. Gueler G, Tuerkoezer Z, Seyhan N. Electric field effects on guinea pig serum: The role of free radicals. Electromagnetic Biology and Medicine. 2007;26(3):207-23.

9. Gueler G, Turkozer Z, Tomruk A, Seyhan N. The protective effects of N-acetyl-L-cysteine and epigallocatechin-3-gallate on electric field-induced hepatic oxidative stress. International Journal of Radiation Biology. 2008;84(8):669-80.

10. Gueler G, Tuerkoezer Z, Ozgur E, Seyhan N. Antioxidants alleviate electric field-induced effects on lung tissue based on assays of heme oxygenase-1, protein carbonyl content, malondialdehyde, nitric oxide, and hydroxyproline. Science of the Total Environment. 2009;407(4):1326-32.

11. Sirav B. Radio Frequency Radiation Sources, Standards / Guidelines of Countries and International Organizations, Turkey's Situation and Radiation Calculation of a Pilot Region, MSc thesis, Gazi University, Institute of Health Sciences, Department of Biophysics, (MSc thesis with the supervision of Prof. Dr. Nesrin Seyhan and co-supervisor Asst. Prof. Dr. Ayse G. Canseven), 2001, Ankara TURKEY.

12. Sirav B, Seyhan N. Radio frequency radiation (RFR) from TV and radio transmitters at a pilot region in Turkey. Radiation Protection Dosimetry. 2009;136(2):114-7.

13. Sirav Aral B. Effects of 900 MHz and 1800 MHz Rad(1)io frequency radiation on blood-brain barrier, PhD thesis, Gazi University, Institute of Health Sciences, Department of Biophysics, (PhD thesis with the supervision of Prof. Dr. Nesrin Seyhan), 2008, Ankara TURKEY.

14. Ozgur E. Variation in Mobile Phone Radiation with Voices of Different Frequencies and Strengths, Effects on Tissue Hydroxyproline Level. Gazi University Health Sciences Institute Biophysics Department, (MSc thesis with the supervision of Dr. Göknur Güler), 2006, Ankara Turkey.

15. Tuysuz MZ. Determination of Mobile Phone Exposure Based RF Dosimetry by using FDTD Methods, MSc thesis, Gazi University Health Sciences Institute Biophysics Department, (MSc thesis with the supervision of Dr. Canseven A.G.), 2007, Ankara Turkey

16. Budak GG, Budak B, Oetuerk GG, Muluk NB, Apan A, Seyhan N. Effects of extremely low frequency electromagnetic fields on transient evoked otoacoustic emissions in rabbits. International Journal of Pediatric Otorhinolaryngology. 2009;73(3):429-36.

17. SCENIHR Report. European Commission – Health & Consumer Protection Directorate – General, SCENIHR – Possible effects of electromagnetic fields (EMF) on Human Health, 2007. http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_007.pdf Last accessed on 10 August 2009.

18. Bernhardt JH. Electrosmog, cellular phones, sunbeds etc. -- adverse health effects from radiation? Health aspects of non-ionizing radiation, Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2005 Jan;48(1):63-75.

19. ICNIRP. Guidelines for Limiting exposure to time varying electric, magnetic and electromagnetic fields (Up to 300 GHz), International Commission on Non-Ionizing Radiation Protection, Health Physics. 1998, 74(4): 494-522.

20. ICTA. Information and Communication Technologies Authority, 2001, Turkey, www.tk.gov.tr Last accessed on 10 August 2009.

21. IARC. Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 80, Non-Ionizing Radiation, Part 1: Static and Extremely Low-Frequency (ELF) Electric and Magnetic Fields, 2002, IARC Press, Lyon, France.

22. Kheifets L, Shimkhada R. Childhood Leukemia and EMF: Review of the Epidemiologic Evidence. Bioelectromagnetics Supplement, 2005, 7:S51-S59.

23. Health Physics Society Report, Ultraviolet radiation and public health, Feb 2007; http://www.hps.org/documents/ultraviolet_ps011-1.pdf.

24. IARC Working Group. The association of use of sunbeds with cutaneous malignant melanoma and other skin cancers: a systematic review. Int J Cancer 2006; 120: 1116–22

25. Seddon JM, Gragoudas ES, Glynn RJ, Egan KM, Albert DM, Blitzer PH. HOST FACTORS, UV-RADIATION, AND RISK OF UVEAL MELANOMA - A CASE-CONTROL STUDY. Archives of Ophthalmology. 1990;108(9):1274-80.

26. El Ghissassi F, Baan R, Straif K, Grosse Y, Secretan B, Bouvard V, et al. A review of human carcinogens - Part D: radiation. Lancet Oncology. 2009;10(8):751-2.

27. Armstrong BK, Kricker A. The epidemiology of UV induced skin cancer. Journal of Photochemistry and Photobiology B-Biology. 2001;63(1-3):8-18.

28. Sinha RP, Hader DP. UV-induced DNA damage and repair: a review. Photochemical & Photobiological Sciences. 2002;1(4):225-36.

29. Nita S. Agar, Gary M. Halliday , Ross StC. Barnetson,Honnavara N. Ananthaswamy, Mark Wheeler, and Alexandra M. Jones. PNAS April 6, 2004;101(14):4954-59.

30. Fisher GJ, Wang ZQ, Datta SC, Varani J, Kang S, Voorhees JJ. Pathophysiology of premature skin aging induced by ultraviolet light. New England Journal of Medicine. 1997;337(20):1419-28.

http://www.natscidiscovery.com
OPEN ACCESS JOURNAL
ISSN: 2149-6307

NSD Natural Science and Discovery
2015; 1(3): 74-9

Original Article

Identification of essential oil composition of four umbelliferae from Turkey

Sukru Hayta[1]*, Gulden Dogan[2], Azize Demirpolat[2], Eyup Bagci[2]

Abstract

Objective: Due to importance of essential oil composition of herbals the identification of essential oil composition of four *umbelliferae* were studied.

Material and Methods: The chemical composition of the essential oils of dried aerial parts of Ferulago angulata, Anthriscus nemorasa, Astrodaucus orientalis, Pimpinella peregrina were analysed by GC and GC-MS.

Results: Forty eight, eighteen, fifty one and twenty components were identified representing 96.5%, 85.9%, 91.4% and 90.1% of the oils, respectively. The main compounds of *Ferulago angulata* were α-pinene (24.1%), β-pinene (22.7%), β-phellandrene (20.5%), α- phellandrene (12.1%); the main compounds of *Anthriscus nemorasa* were β-caryophyllene (23.6%), caryophyllene oxide (12.3%), δ-cadinene (12.1%), and trans pinocarveol (9.8%); the main compounds of *Astrodaucus orientalis* were α-pinene (29.6%), β-pinene (21.5%) and bicyclo(3.1.0)hex-2-ene (7.6%)

Conclusion: The main constituents of Pimpinella peregrina trans-pinocarveol (35.1%), peregijerene (15.1%), α-cubebene (12.4%), (+) Epibicyclosesquiphellandrene (7.5%), and α-terpineol (6.7%) were determined.

Keywords: Essential Oil, Chemotaxonomy, GC-MS, *Ferulago angulata, Anthriscus nemorasa, Astrodaucus orientalis, Pimpinella peregrina*

Introduction

The Apiaceae (formerly umbelliferae) is a large family of flowering and usually aromatic plants mostly growing in temperate areas. There are about 300 genera and 3000 species of this family worldwide (1). This family includes some of the commonly used vegetables and medicinal herbs such as carrot, celery, fennel, dill, anise, parsley, Angelica, caraway, coriander etc. Members of Apiaceae usually possess a characteristic pungent or aromatic smell which is due to the occurrence of essential oil or oleoresin in their different organs (2). Therefore, volatile oils of Apiaceae plants have a wide application in aromatherapy (3).

In the Flora of Turkey, the genus Ferulago is represented by 17 species (1). Ferulago angulata was divided into 2 subspecies by Chamberlain in 1987. The known subspecies distributed in Turkey is F. angulata subsp. angulata; subsp. carduchorum differs from subsp. angulata by having scabrid inflorescence, ovarium, and leaves (not glabrous or subglabrous) (4). The genus Ferulago W.D.J.Koch is represented by 50 species worldwide, 32 of which are found in Turkey (17 species are endemic to Turkey).

Since Ferulago was revised for the Flora of Turkey (5), 3 new species and 1 new record have been added to the Flora of Turkey (6-8).

Ferulago angulata (Schlecht) Boiss is the common species of the genus distributed in the west and central parts of Iran. This plant grows in different areas of the word including Turkey, Greece, republic of Yugoslavia, Macedonia, Australia and Islamic republic of Iran. In Iran you can find it in the mountain in the west like Ariz in Sanandaj, Kooh Safid heights, Gere mountain in Chahar Mahale Bakhtiari and the most important source in the heights 2800–3200 m from the sea surface in Dena, parts of south Zagros mountains (9). The species was reported from north Iraq and southeast of Turkey, as well. Chevil is the common name and “oluklu caksır” – Turkish name of this glabrous herb that reaches up to 150 cm in height. The herbs and spices of Ferulago angulata are used as flavors and antioxidants in food industry for century (10-11). The essential oil composition of Ferulago angulata (Schlecht) Boiss. (Apiaceae) aerial parts was determined.

In folk medicine, different species of Ferulago has been used in Turkey and Iran as sedative, tonic, remedy of digestive panics, aphoristic properties and

Received: 07-12-2015, **Accepted** 14-12-2015, **Available Online**: 15-12-2015
1 Bitlis Eren University, Faculty of Engineering & Architecture, Department of Environmental Engineering, Bitlis, Turkey
2 Firat University, Faculty of Science, Department of Biology, Elazig, Turkey
*Corresponding Author: Sukru Hayta E-mail: sukruhayta@hotmail.com

haemorrhoids. Moreover, different parts of Ferulago species have been traditionally used against ulcers, snake bite and for treatment of headache and disease of the spleen (9, 12-13). Literature is available on the bioactivities of F. angulata. These reports indicated the cytotoxic, antioxidant and antimicrobial potentials of the plant extracts and essential oil and It is also used in perfume and cosmetic industries (14-16).

The genus Anthriscus, commonly known as beaked chervil, beaked parsley, rough chervil, is one of the aromatic members of the Apiaceae family (17). The family of the Apiaceae is well known as a source of essential oils and a number of species are especially cultivated for it, like Pimpinella anisum L. and Anthriscus cerefolium L. Hofmm. (18).

The genus Anthriscus (Apiaceae) is represented with 8 species in Turkey flora. Anthriscus nemorosa (Bieb.) Sprengel is a perennial herb that grows in Europe and in parts of America, Africa, Asia and New Zealand (19-20). Anthriscus nemorosa is named local name “gımıgımı” (21). It is reported that the plant parts are used in the preparation of the “otlu peynir” famous cheese around the Van province in Eastern Anatolian region (22). Some of Antriscus plants have been traditionally used by local people as herbal drugs. The dried root of A. sylvestris is used in Korean and Chinese traditional medicine for the treatment of various diseases (1). It is known as chervil. Chervil is used for culinary purposes, and in folk medicine, for inflammations, as depurative, diuretic and hypotensive. Extracts of chervil has possess antiinflammatory, antifungal, spasmogenic, spasmolytic activities, and negative inotropic effect (23). There is no more study on the essential oils of A. nemorosa in Turkey and there are two study from Serbia and Iran in the world.

The genus Astrodaucus Drude is belonging to Apiaceae family that is represented with one species in Turkey flora (1). This study is the only species in the country of the genus Astrodaucus in Astrodaucus orientalis (L.) qualitative and quantitative composition of the essential oil of its kind in the drum, oil yield has demonstrated and economical aims to provide basic data on availability issues.

Astrodaucus orientalis is named local name "Havyıldız" and it is an aromatic herb (10) It has potential of anticancer activity of A. orientalis extracts and one of its possible mechanisms of action on cancer cell antiproliferation (24). This aromatic plant is traditionally used as a salad, vegetable and a food additive in some parts of Iran and Turkey (25).

Pimpinella is a member of the Apiaceae and comprises approximately 150 species distributed in the northern hemisphere (26). Pimpinella is represented in Turkey by 23 species (5 endemic), 2 subspecies and 2 varieties, representing a total of 27 (1). This genus is well known for a number of medicinally and pharmaceutically important species, P. anisum being the most notable one (27).

One important criterium for studying the oils of this genus is the fact that they contain C12 sesquiterpenoids and phenylpropanoids with a unique structure and their biological activities may have potential for developing newagents for use in agriculture and medicine (27-28).

The most widely known and cultivated Pimpinella species is like that Pimpinella anisum (Anis) fruits (Aniseed) have been used in Turkish folk medicine as carminative, appetizers, sedative, and agents to increase milk secretion (29).

It is aimed that to determine the essential oils of the four species and compared with the genus patterns. The results also will be give some clues on the usability of the plant and essential oils for different purposes.

Materials and Methods

Plant Source

Ferulago angulata, specimens were collected from natural habitats in Bitlis-Hizan; in 2014; *Anthriscus nemorasa,* specimens were collected in Bitlis-Hizan, in 2014; *Astrodau*cus *orientalis* specimens were collected in Elazıg-Harput, in 2014 and *Pimpinella peregrina* specimens were collected from Bitlis-Hizan, 2014. Four voucher specimens were deposited in the Fırat University Herbarium (FUH) under registration numbers Hayta 4818, Hayta 4829, Hayta 4835 and Hayta 4826 respectively.

Extraction of the essential oil

The essential oil was extracted by hydrodistillation using a modified Clevenger apparatus coupled to a 2 L round-bottom flask. A total of 100 g of fresh plant material (aerial parts) and 1 L of water were used for the extraction. The chemical analysis were performed in Firat University, Sci. Fac., Biology Deprt., Plant Products and Biotechnology Res. Lab. The extraction was performed over 3 hour period. Subsequently, the hydrolate was collected and centrifuged at 10,000 rpm for 10 minutes. The organic phase was removed with the aid of a Pasteur pipette, and subsequently transferred to an black coloured vials, wrapped in parafilm and aluminum foil and 4^{o}C under refrigeration until analysis. The yields of oils were calculated on the basis of the dry mass.

Gas Chromatographic (GC) Analysis

The essential oil was analysed using HP 6890 GC equipped with FID detector and HP- 5 MS (30 m x 0.25 mm *i.d.,* film tickness 0.25 µm) capillary column was used. The column and analysis conditions were the same as in GC-MS expressed as below. The percentage composition of the essential oils was computed from GC-FID peak areas without correction factors.

Gas chromatography / Mass spectrometry (GC-MS) analysis

GC-MS analyses of the oils were performed on a Hewlett Packard Gas Chromatography HP 6890 interfaced with Hewlett Packard 5973 mass spectrometer system equipped with a HP 5-MS capillary column (30 m x 0.25 mm id, film thickness 0.25 µm). The oven temperature was programmed from 70-240°C at the rate of 5°C/ min. The ion source was set at 240°C and electron ionization at 70 eV. Helium was used as the carrier gas at a flow rate of 1 mL/min. Scanning range was 35 to 425 amu. Diluted oil in *n*-hexane (1.0 µL) was injected into the GC-MS. The identification of constituents was performed on the basis of Retention Indices (RI) determined by co-injection with reference to a homologous series of *n*-alkanes, under identical experimental conditions. Further identification was performed by comparison of their mass spectra with those from NIST 98 Libraries (on ChemStation HP) and Wiley 7th Version. The relative amounts of individual components were calculated based on the GC (HP-5MS column) peak area (FID response) without using correction factors. The identified constituents of the essential oils are listed in Table 1.

Results and Discussion

The water distilled essential oil of the plant was analysed by GC, GC-MS system. In the result of analysis, forty eight compounds were identified representing 96.5% of the oils. The main compounds of *Ferulago angulata* were α-pinene (24.1%), β-pinene (22.7%), β-phellandrene (20.5%), α-phellandrene (12.1%). Monoterpenes were the main class of essential oil of *Ferulago angulata* (ca. 80-85%). The results has shown that the parts of the plant and essential oil may be used as natural product and food additive. α-phellandrene (24.2 %), β-phellandrene (14.9 %), α-pinene (14.7 %) and pcymene (10.3 %) were the main components of the oils obtained from the *Ferulago angulata* in Iran (30). Similarly, in present analyses results showed that α-phellandrene, β-phellandrene and α-pinene were the major component of the essential oils from Turkey samples.

In this study, hydro-distilled essential oils derived from the aerial parts of *Anthriscus nemorosa* (Bieb.) Sprengel grown in Turkey naturally were analysed by GC and GC-MS. The essential oil yield was determined as 0.2 (v/w). Among eighteen compounds identified (representing 85.9% of the total oil), the main components were: β-caryophyllene (23.6%), caryophyllene oxide (12.3%), δ-cadinene (12.1%), and trans pinocarveol (9.8%). Essential oil analysis of the *Anthriscus nemorosa* has shown that it has β-caryophyllene chemotype from the Eastern Anatolian Region. Pavlovic et al. (2011) (31), found 62 compounds in the roots of *Anthriscus nemorosa* identified (representing 89.0% of the total oil), the main components were: n-nonane (12.1%), n-hexadecanol (6.9%), delta-cadinene (6.4%), beta pinene (6.0%) and germacrene D (5.4%). Our analysis results were not similar with this study findings, because of the absent of the major components (except delta-cadinene) in present samples.

The volatile oil composition of *Pimpinella peregrine L.* (APIACEAE) were collected from the Bitlis. It is named as "El Anasonu" in Turkish. The essential oil were obtained by hydrodistillation in Clevenger-type apparatus, and chemical analyses were performed by GC and GC–MS. The essential oil yield was 0.3 (v/w), from the aerial parts of the *Pimpinella peregrina*. A total of 20 different compounds were identified representing 90.1% of the oils. The main constituents of *Pimpinella peregrina* trans-pinocarveol (35.1%), peregijerene (15.1%), α-cubebene (12.4%), (+) epibicyclosesquiphellandrene (7.5%), and α-terpineol (6.7%) were determined. The characteristic phenylpropanoids in **Pimpinella** oils, a number of other C_{12} sesquiterpenes such as geijerene and azulene were also present in considerable amounts (32-33). From a chemotaxonomic stand point, C_{12} sesquiterpenes and phenylpropanoids are characteristic to the genus **Pimpinella** and are phytochemical markers for this genus that separates them from all the other Apiaceae investigated thus far. These components were detected in our samples.

The composition, percentage and retention indices of components of the oil were listed in Table 1. The essential oil yield is 0.2 (v/w), from the aerial parts of the *Astrodau*cus *orientalis*. Fourty nine constituents were comprised the 91.4% of the total oil. The predominant compounds of *Astrodaucus orientalis* were determined as α-pinene (29.6%), β–pinene (21.5%) and bicyclo(3.1.0)hex-2-ene (7.6%). Mirza et al. (2003) (34) reported that major components of the leaf oil were fenchyl acetate (44.5%) and **α**-pinene (21.6%) but the major constituents of the seed oil were myrcene (47.7%) and **β**-pinene (21.8%) from Iran. Present analysis results were similar with this study findings but the major constituents (myrcene and fenchyl acetate) were not detected in our samples. Overall, the essential oil composition was found to be similar for the different parts of the plant studied regarding the major monoterpenes (α-pinene and β-pinene) and also minor monoterpenes between *Astrodaucus orientalis* and *Ferulago angulata*. However, many differences were determined among the other terpenic compounds. For the different parts analysed, α-pinene and β-pinene were found as major compounds in essential oils of *Astrodaucus orientalis* and *Ferulago angulata* but not in *Anthriscus nemorosa* and *Pimpinella peregrina* oils. Qualitative and quantitative differences were reported in these species essential oils reported and these may be due to the genetic, differing chemotypes, drying conditions, mode of distillation and/or extraction and geographic or climatic factors.

Table 1. Constituents of the essential oil from of four *Apiaceae*

No	Compounds	RI	*F.angulato*	*A.nemorosa*	*A.orientalis*	*P.peregrina*
1	Heptenal	850	0.1	-	0.1	-
2	Hexenal	935	-	-	0.1	-
3	Bicyclo(3.1.0)hex-2-ene	1016	0.2	-	**7.6**	-
4	α-Pinene	1021	**24.1**	0.5	**29.6**	-
5	Camphene	1034	0.3	-	3.3	-
6	Verbenene	1038	-	-	0.1	-
7	Sabinene	1052	1.5	1.7	2.5	0.3
8	β-Pinene	1056	**22.7**	0.5	**21.5**	-
9	β-Myrcene	1065	2.4	-	3.5	-
10	α-Phellandrene	1077	**12.1**	0.4	-	-
11	α-Terpinene	1085	0.1	-	0.1	-
12	p-Cymene	1090	3.2	-	0.5	-
13	dl-Limonene	1096	-	-	2.7	0.1
14	Cis-Ocimene	1097	-	-	0.4	-
15	β-Phellandrene	1098	**20.5**	-	-	-
16	β-Ocimene	1107	0.5	1.0	0.1	0.2
17	γ-Terpinene	1116	0.3	-	0.4	0.1
18	p-Cresol	1128	0.1	-	-	0.1
19	α-Terpinolene	1136	0.7	-	0.2	-
20	Benzene-1-methy-4	1139	0.1	-	-	-
21	Linalool	1146	-	-	-	0.1
22	Bicylo[3.1.0] hex-2-one	1166	0.1	-	-	-
23	Allo-Cymene	1170	-	-	-	4.0
24	Trans-Pinocarveol	1177	0.2	**9.8**	-	**35.1**
25	Trans-Verbenol	1180	-	-	0.6	-
26	2,5-Diethythiophene	1194	1.7	-	-	-
27	Borneol	1199	-	-	-	-
28	3-Cyclohexen-1-ol	1203	0.3	0.8	0.7	0.6
29	Ethanone	1207	-	-	-	
30	α-Terpineol	1214	0.6	2.7	-	6.7
31	Fenchyl acetate	1215	-	-	**5.3**	-
32	1,3-Cylohexadiene	1245	0.1	-	-	-
33	Chrysanthenyl acetate	1251	-	-	0.2	-
34	Bornyl acetate	1280	-	-	2.5	
35	Thymol	1286	0.5	-	-	0.2
36	2H-1-Benzopyran	1288	-	-	0.2	-
37	Peregijerene	1290	-	2.0	-	15.1
38	Carvacrol	1293	0.2	-	-	-
39	2,4-Decadienal	1310	-	-	0.1	-
40	α-Longipinene	1343	-	-	0.1	-
41	α-Cubebene	1358	-	-	0.1	**12.4**
42	α–Copaene	1360	0.1	-	0.6	-
43	β-Bourbonene	1364	-	-	0.4	-
44	[+]-Epibisesquiphellandrene	1367	-	-	0.8	**7.5**
45	β–Elemene	1369	-	4.2	-	-
46	Ethanone	1385	-	-	0.1	-
47	Caryophyllene	1391	0.1	**23.6**	0.3	-
48	β-Caryophyllene	1393	-	-	-	0.9
49	γ -Elemene	1097	0.1	-	-	-
50	α-Farnesene	1399	-	1.0	-	-
51	β-Cubebene	1401	0.1	-	0.1	
52	Trans-β-Farnesene	1416	0.1	-	-	-
53	α-Humulene	1418	0.1	-	0.7	-
54	Aromadendrene	1421	0.4	-	-	-

55	β-Cubebene	1433	0.1	-	-	-
56	Germacren D	1435	0.4	**5.6**	0.8	0.3
57	Valencene	1442	-	0.6	-	0.4
58	Bicylogermacrene	1445	0.1	-	-	-
59	α-Selinene	1446	0.1	-	-	-
60	α-Amorphene	1456	0.1	-	-	-
61	δ-Cadinene	1458	0.1	**12.1**	0.5	-
62	*Cis*-α-Bisabolene	1470	0.1	-	-	-
63	α-Calacorone	1472	-	-	0.1	-
64	Germacren b	1482	0.2	-	0.7	-
65	Cadala-(10)-3,8,triene	1484	-	-	0.1	-
66	Spathulenol	1493	-	-	0.7	1.8
67	Caryophyllene oxide	1496	-	**12.3**	0.6	1.1
68	Salvial-4-(14)-en-one	1502	-	-	0.1	-
69	Carotol	1508	-	**6.2**	**-**	**-**
70	Bergamotone α-Z	1511	-	0.9	-	-
71	Crypton	1512	-	-	0.1	-
72	Humulene epoxide	1515	-	-	0.2	-
73	Trans-β-Caryophyllene	1521	0.1	-	-	-
74	Tau-Muurolol	1532	0.3	-	-	-
75	α-Cadinol	1538	0.1	-	-	-
76	Calarene	1536	-		0.5	-
77	β-Humulene	1547	0.1	-	-	-
78	α-Bisabolol	1554	0.6	-	-	-
79	Dehydroaromadendrene	1558	0.1	-	0.2	-
80	Benzyl benzoate	1596	0.1	-	-	-
81	Benzoic acid	1602	-	-	-	3.1
82	2-Pentadeconene	1629	-	-	0.2	-
83	n-Hexadecanoic acid	1689	-	-	0.1	-
84	Ar-curcumene	1790	-	-	0.1	-
85	α-Toluene	1852	-	-	0.1	-
86	Tricosane	1889	0.1	-	-	-
87	Heptacosane	1899	-	-	0.2	-
Total			**96.5**	**85.9**	**91.4**	**90.1**

Conflict of Interest: The authors declare that, there are no conflicts of interest between the authors. The authors alone are responsible for the content and writing of the paper.

References

1. Davis, P. H. Flora of Turkey and the East Aegean Islands. University Press, Edinburgh. 4 (1972) 323.
2. Singh, V., Jain, D.K. Taxonomy of angiosperms. 6 th ed. India: Rastogi Publications. (2007) 298.
3. Janardhanan, M. Herb and spice essential oils. Discovery publishing house, New-Delhi. (2004) 23.
4. Ozhatay, N., Akalın, E. A new Ferulago (Umbelliferae) from NW Turkey. Botanical Journal of the Linnean Society. 133 (2000) 353-342.
5. Peşmen, H. Potentilla L. In: Davis PH, editor. Flora of Turkey and the East Aegean Islands, Vol. 4. Edinburgh, UK: Edinburgh University Press, (1972) 41–68.
6. Akalın, E., Pimenov, M. Ferulago trojana (Umbelliferae), a new species from western Turkey. Botanical Journal of the Linnean Society. 146 (2004) 499-504.
7. Pimenov, M.G., Leonov, M.V. The Asian Umbelliferae Biodiversity Database (ASIUM) with particular reference to South-West Asian taxa. Turkish Journal of Botany. 28 (2004) 139-145.
8. Kandemir, A., Hedge, I.C. An anomalous new Ferulago (Apiaceae) from eastern Turkey. Willdenowia. 37 (2007) 273-276.
9. Sodefian, G., Ansari, K., Bamoniri, A., Mirjalili, B. Study of chemical composition of Ferulago angulata (Schelchet) Boiss from Iran using supercritical fluid extraction and nano sale injection. Dig J Nonomat Biostruct. 6 (2011) 162–168.

10. Guner, A., Aslan, S., Ekim, T., Vural, M., Babaç, M.T. (edlr.). Türkiye Bitkileri Listesi (Damarlı Bitkiler). Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını. İstanbul (2012).

11. Hedge, I.C. Flora Iranica. Vol. 162. Graz: Akademische Druke Verlgsanstalt (1987).

12. Oztürk, B., Gür, S., Coskun, M., Kosan, M., Erdurak, C., Hafez, C., Ozgunes, G., Cetinkaya, M. Relaxant effect of Ferulago syriaca root extract on human corpus cavernosum. Eur Urol Suppl. 3 (2004) 62.

13. Khalighi-Sigaroodi, F., Hadijiakhoondi, A., Shafiee, A., Mozaffarian, V.A., Shahverdi, A.R., Alavi, S.H.R. Phytochemical analysis of Ferulogo bernardii Tomk & M. Pimen. Daru. 14 (2006) 214–221.

14. Basile, A., Sorbo, S., Spadaro, V., Bruno, M., Maggio, A., Faraone, N., Rosselli, S. Antimicrobial and antioxidant activities of coumarins from the roots of Ferulago campestris (Apiaceae). Molecules. 14 (2009) 939–952.

15. Taran, M., Ghasempour, H.R., Shirinpour, E. Antimicrobial activity of essential oils of Ferulago angulata subsp. carduchorum. Jundishapur Journal of Microbiology. 3 (2010) 10-14.

16. Zare, F., Valiyari, S., Azadmehr, A., Hajiaghaee, R., Bandehagh, A., Baradran, B. Cytotoxic activities of Ferulago angulata on human leukemia and lymphoma cells by induction of apoptosis. J Med Plants Res. 7 (2013) 677–682.

17. Nickavar, B., Mojab, F., Mojahedi, A. Composition of the essential oil from Anthriscus nemorosa. Chemistry of Natural Compounds. 45 (2009) 443-444.

18. Hendrawati, O., Woerdenbag, J., Hille, J. Seasonal variations in the deoxypodophyllotoxin content and yield of Anthriscus sylvestris L. (Hoffm.) grown in the field and under controlled conditions. J.Agri Food Chem. 59 (2011) 8132-8139.

19. Magnússon, S.H. Nobanıs Invasive Alien Species Fact Sheet Anthriscus sylvestris From: Online Database of the North European and Baltic Network on Invasive Alien Species – NOBANIS. Available from: <www.nobanis.org>.(accessed 19.08.2011).

20. Hulten, E., Fries, M. Atlas of North European Vascular Plants North of the Tropic of Cancer. Koeltz Scientific Books, Konigstein (1986).

21. Altundag, E., Ozturk, M. Ethnomedicinal studies on the plant resources of east Anatolia, Turkey. The 2nd International Geography Symposium GEOMED2010. Procedia Social and Behavioral Sciences 19 (2011) 756–777.

22. Tarakci, Z., Coskun, H., Tuncturk, Y. Some Properties of Fresh and Ripened Herby Cheesea Traditional Variety Produced in Turkey. Properties of Herby Cheese, Food Technol. Biotechnol. 42 (2004) 47–50.

23. Fkdmini, G., Bilia, A. R., Breschi, M. C., Martinotti, E., Norelli, I. Anthriscus cerefolium phytochemical and pharmacological study. Pharmacol. Res., Sol. (1993) 33-34.

24. Abdolmohammadi, M. H., Fouladdel, S., Shafiee, A., Amin, G., Ghaffari, S. M., Azizi, E. Antiproliferative and apoptotic effect of Astrodaucus orientalis (L.) drude on T47D human breast cancer cell line: Potential mechanisms of action. African Journal of Biotechnology. 8 (2009) 4265-4276.

25. Nazemiyeh, H., Razavi, S.M., Delazar, A., Asnaashari, S., Khoi, N.S., Daniali, S., Nahar, L., Sarker, S. D. Distribution Profile of Volatile Constituents in Different Parts of Astrodaucus orientalis (L.) Drude Rec. Nat. Prod. 3 (2009) 126-130,

26. Heywood, V.H. The Biology and Chemistry of the Apiaceae, Linnean Society of London, London, p. 232, (1971).

27. Tabanca, N., Bedir, E., Ferreira, D., Slade, D., Wedge, D.E., Jacob, M.R., Khan, S.I., Kirimer, N., Baser, K., Khan, I.A. Bioactive constituents from Turkish Pimpinella species. Chemistry and Biodiversity. 2 (2005a) 221–232.

28. Kubeczka, K.H., Baser, K.H.C., Kirimer, N. (Eds.), Proceedings of the 28th International Symposium on Essential Oils, Eskisehir, Turkey, 1–3 September, (1997) p. 35.

29. Baytop, T. Turkiye'de Bitkilerle Tedavi, Nobel Tip Kitapevi, Istanbul, 1999, p. 149.)

30. Akhlaghi, H. Chemical Composition of the Essential Oil from the Aerial Parts of Ferulago angulata (Schlecht.) Boiss. from Northeast Iran. Jeobp. 11 (2008) 544 – 547.

31. Pavlović, M., Petrović, S., Milenković, M., Couladis, M., Tzakou, O., Niketić, M. Chemical composition and antimicrobial activity of Anthriscus nemorosa root essential oil. Natural product communications. 6 (2011) 271-273.

32. Kubeczka, K.H., Bohn, I., Schultze, W., Naturforsch, Z. 44 (1989) 177.

33. Velasco-Negueruela, A., Perez-Alonso, M.J., Perez de Paz, P.L., Pala-Paul, J., Sanz, J. Chromatogr. A. 1011 (2003) 241.

34. Mirza, M., Baher, Z., Dini, M. Chemical composition of the essential oils of Astrodaucus orientalis (L.) Drude leaves and seeds. Flavour and Fragrance Journal. 18 (2003) 205–206.

http://www.natscidiscovery.com
OPEN ACCESS JOURNAL
ISSN: 2149-6307

NSD Natural Science and Discovery
2015; 1(3): 80-4

Original Article

Comparison of Analysis on Solid Waste and Effluent Water Management between Diyarbakir and Batman Districts

Nilgun Onursal[1*], Ali Riza Kul[2], Deylem Onursal[3]

Abstract

Objective: Diyarbakır and Batman are located in the south eastern region of Turkey. The distance between them is less than 100 km. Diyarbakir with a population of about 1,607,437, is the second largest city in Turkey's south-eastern Anatolia region. Also, Batman became a city in 1957 after the discovery of oil deposits starting in the 1940s which resulted in the Batı Raman Oil field, now the largest oil field in south-eastern Anatolia region & Turkey. The oil field caused a rapid and on-going population growth in Batman after its foundation.

Material and methods: Diyarbakır and Batman cities, District Environment Circumstances Reports.

Results: Regarding recycling, Diyarbakır recycles 13.74 % of the waste that is collected and for Batman the percentage is 19.8. Therefore, despite the fact that Diyarbakir shows more development for the amount of solid waste produced by the public Batman municipality is more effective in the manner of recycling

Conclusion: This paper is focuses to "the Comparison of Analysis on Solid Waste and Effluent Water Management" applies to two of the largest cities in the south-eastern Anatolia region.

Keywords: Batman, Diyarbakır, solid Waste, effluent water, waste management

Introduction

This paper, "Comparison of Analysis on Solid Waste and Effluent Water Management" applies to two of the largest cities in the south-eastern Anatolia region.

According to Rajagopalan, V. (2000), Municipal Solid Waste, as known as Solid Waste, "includes commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes;" [1]

Solid waste in general is a variety of different types of waste which includes household waste, medical waste, hazardous waste, industrial waste and construction waste. In large districts such as Diyarbakır and Batman some sort of the wastes mentioned above are formed in huge quantities. This therefore means that if the wastes are collected from the source, recycling would be possible.

It is quite important to collect, transfer and store the wastes properly because a failure to do so will cause health and environmental problems both in short and long term. In this paper for both of the districts, we have conducted research that analyzes how the wastes are collected from the source, what kind of procedures are used to transfer and the type of storage that is used for the wastes. Also, if any of these steps are not operated according to the international and national standards; what are the reasons and how might they be fixed?

Apart from collection, transfer and storage of the wastes, it is as much as important to raise a public awareness of how to reduce the amount of waste that is produced and make it more efficient for municipality to manage the wastes. Considering that the education level in the south-eastern Anatolia region is not as high as some of the other regions of Turkey, the response of the public regarding the mentioned subjects is quite important to be observed and improved. Otherwise environmental pollution will be inevitable.

Effluent water is result of activities that include water such as washing, bathing, industrial use of water, rainfalls and etc. Considering that water famine is a rising issue currently, it is potentially a lethal issue that needs to be handled very well. Sewage treatment is possible in different ways which are chemical, biological and physical treatment. If contaminants are dismissed on a high aperture, then it is possible to re-use the water. If the level of contaminants is not reduced enough, then only water will be ready for disposal. The result of the bioassay (Biological Assessment) experiment will show if the water is

Received: 07-12-2015, **Accepted** 14-12-2015, **Available Online**: 15-12-2015
1 Siirt University Faculty of Education Elementary Section, Siirt
2 Yüzüncü Yıl University Faculty of Vocational School of Health Services, Van
3 Clark University Undergraduate Student, MA-USA
*Corresponding Author: Nilgun Onursal E-mail: nilgun.onursal@gmail.com

ready to be re-used since the experiments are conducted to measure the effects of a substance on a living organism and are essential in the monitoring environmental pollutants.

Both Batman and Diyarbakir have sewage treatment centers and we will display their efficiency, the producers and systems that are used in them according to our collected data. The centers are in control of the municipalities and we will reveal our analysis on whether or not the centers are operated to clean the water to an acceptable degree. If not, what municipalities can do to clean the water to an acceptable degree? Also, the possibilities of improvement gaps will be mentioned and explained for both of the facilities.

Material and Methods

Solid waste in general is a variety of different types of waste which includes household waste, medical waste, hazardous waste, industrial waste and construction waste.

In this research, district Environment Circumstances Reports of Diyarbakır and Batman cities were used for analysis.

Results and Discussion

In large districts like Diyarbakır some of the wastes that are mentioned above are produced in huge levels. Considering hazardous waste, the area is not a top priority to be examined since the sources of activities that consume hazardous waste in Diyarbakır are nearly zero. However household waste, medical waste, industrial and construction waste are important to be managed efficiently for the sake of environment.

For both Diyarbakır and Batman the percentage of the types of solid wastes are shown in Figure 1 and 2 accordingly.

1. Household waste:

The household waste is consistent of different parts; packages, plastic bags and bottles, paper based products, etc.

Diyarbakır has a population approximately 1,607,437 and this population daily produces about 750-ton solid waste. The %90 percent of this waste comes from household activities.

Batman has a population approximately 348,996 and this population daily produces about 950-ton solid waste. The %90 percent of this waste also comes from household activities. It is also important to mention that the oil company manages its own waste, hence, the difference does not depend on the oil related activities.

The difference in amounts between Diyarbakır and Batman is a result of development difference between the cities. Diyarbakir having more population and producing lower amount of solid waste proves that the public is more aware of environmental problems regarding solid waste.

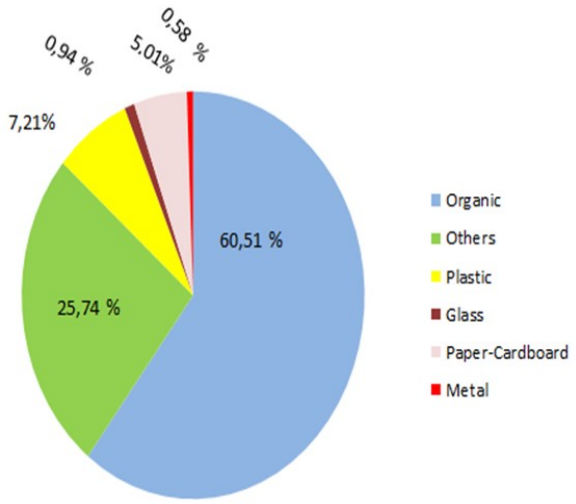

Figure 1: The types of solid wastes in Diyarbakır

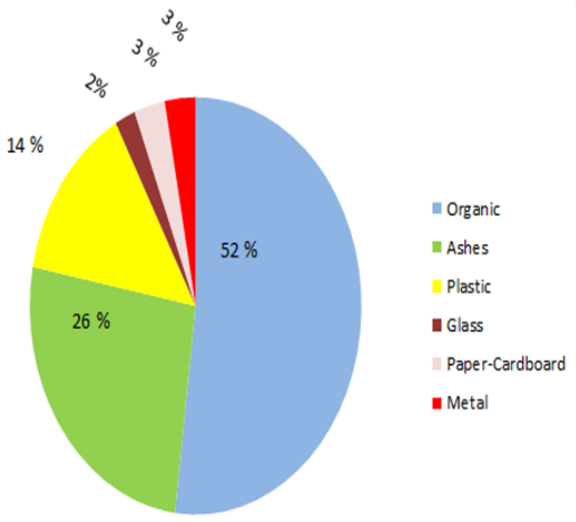

Figure 2: The types of solid wastes in Batman

2. Other types of wastes:

Considering cities like Diyarbakır and Batman medical wastes among other sorts of solid wastes are the most significant because industrial and hazardous wastes are not produced at huge levels, hence, there is not many possible actions or cautions to be taken for reducing or managing those types of wastes. However, Diyarbakır with yearly about 1394.16-ton medical waste production and Batman with yearly about

338.114-ton medical waste production are two of the leading districts in southeastern region of Turkey.

Therefore, the storage of these wastes, collection and transportation of them, also disposal or recycling of the medical wastes are important. Both of the city municipalities work with a private company to collect, transport and sterilize the medical wastes. Also, during our research, we have asked several employees and they confirmed that sometimes some firms are mixing medical waste into the household solid waste for avoiding the extra cost of it. Yet, both of the municipalities do not have any information about the amount of medical wastes mixed with household wastes.

Regarding construction wastes, districts like Diyarbakır and Batman are also leading in the southeastern region of Turkey since they are lead growing cities in the area there is an ongoing construction process in large areas every year. The construction wastes are transported to the chosen areas in both cities. There are not any available data on the amount of these wastes. More importantly, there is not any management plan for recycling or disposing them.

Below, the amounts of collected wastes are shown in charts taken from "Diyarbakır District Environment Circumstances Report" and "Batman District Environment Circumstances Report" for both Diyarbakır and Batman as Table 1.

Table 1: The summary waste production of Diyarbakır and Batman Regions

		Diyarbakır	Batman
Population	Summer	963,457	348,996
	Winter	963,457	348,993
Approximate Amount of the Solid Waste that is collected (ton/day)	Summer	740	441
	Winter	765	470
Solid Waste produced per person	Summer	0.71	0.72
	Winter	0.71	0.8
Waste Composition (Yearly %)	Organic	60.5	50.6
	Paper	5.01	3.3
	Glass	0.94	2.1
	Metal	0.58	2.1
	Plastic	7.21	12.3
	Ash	25.57	29.6

Collection and Transportation of Solid Wastes:

1. Collection:

For both of the cities, the household wastes from the apartments are usually collected by apartment doorkeeper and is transferred to a container. Residents of the apartments which do not have a doorkeeper transfer their waste to a container by themselves.

There are two types of containers available in the districts; underground and on ground metal containers. There could always be trash around the containers whether if the container is full or not. (Figure 3, 4.)

Also, following problems apply to the both cities as well. To start with, both the doorkeepers and residents do not have a manner or transferring their solid waste to the containers on a regular basis. Therefore, randomized transfer act creates a problem for workers that are responsible for collecting the waste from containers and transferring them to the storage area since they cannot constitute an effective working schedule because most of the areas needs to be visited more than once a day. Due to being not able to optimizing work load sometimes containers get full and trash takes place around them and this pollutes the area and if rain falls the water gets polluted as well. Apart from over loading of the containers, sometimes even if the container does not get full, yet the solid waste stored inside the container stays there for a long interval of time then the bacteria production starts and this is also dangerous for the environmental health. Add to this, some street animals also feeds themselves from the trash containers when there is a trash around the containers and considering their interaction with the environment it is another health issue for the public.The difference for the medical waste collection is that since medical waste is produced by organizations and stored in a different container, collection process is more organized since there is a pattern followed by both the institutions and the municipality.

Figure 3: Waste container type 2

2. Transportation:

Both of the municipalities have their own transportation vehicles and these vehicles are being used to collect the wastes and transport them to the storage area. The types of vehicles used for medical waste and household waste transportation are different. Considering construction wastes, companies operating the construction transports the wastes separately with their own vehicles.

Disposal and Recycling of Solid Waste:

1. Disposal:

Both of the cities use hazardous storage areas. Although this method is not quite effective and will eventually result in pollution, it has been an ongoing method for many years for the cities.

The good aspect of this problematic method for the cities is that they have a management plan for the hazardous storage; hence, water contaminated by the waste does not directly go to the underground. Also, the gas levels produced by the waste are under control. Therefore, although the method used is not the most efficient one at least it is being used efficiently.

2. Recycling:

Regarding recycling, Diyarbakır recycles 13.74% of the waste that is collected and for Batman the percentage is 19.8%. Therefore, despite the fact that Diyarbakir shows more development for the amount of solid waste produced by the public Batman municipality is more effective in the manner of recycling.

If both of the cities apply fully applied decomposition of the materials that are collected from solid waste containers, yearly solid waste amount will increase up to 19.78% and for Batman the percentage will be 33.9%. Therefore, reduction in solid waste capacity will result in less environmental pollution and also lower financial costs. However, both of the cities do not apply full capacity decomposition.

Solid Waste vs. Technology:

The connection between solid waste and technology takes an important part in the solid waste management as well. First of all, as technology evolves and improves, hence, standard life quality of humankind enhances accordingly, as well as word globalizes more which makes for people to reach all sorts of products all around the globe easier thus consuming culture takes a wider impact on the human daily life which results as more production of the solid waste and other types of wastes. This results as polluting the environment and natural resources. However, there is a vice-versa effect of technology on the matter of solid wastes since with the evolving technology management, disposal and recycling of solid wastes are far more improved and easier if the technology is used efficiently. Not that it means in every society these variations of technology are used properly, even worse without the proper conscious level usually lacks using technology for the matters mentioned above and therefore technology's impact on solid waste is one way; for environmental pollution.

Effluent Waste comparison of Diyarbakir and Batman:

a. Diyarbakır:

In Diyarbakır there is a physical effluent water treatment center. Yearly capacity of the center is 61.000.000 m3 and last year 31.276.000 m3 is treated.

There is a still continuing construction of a biological effluent water treatment center in Diyarbakır. The approximate cost for the project is 78.800.000 Euro. Since biological centers for treating water is the most effective, after the compilation of the center, bioassay levels for the treated water will be better compared to the physical center's results. Below you can see the photographs of the construction area for the center in Fig. 4 and 5.

Figure 4: Diyarbakır biological water treatment facility

There is also a physical effluent water treatment center in Batman. Yearly capacity of the center is 22.265.000 m3 and last year 14.636.500 m3 is treated.

Figure 5: Diyarbakır biological water treatment open-air facilities

There are not any other ongoing projects in Batman for the effluent water treatment. Also, seeing that physical effluent water treatment already reached 75% of its full capacity and considering the population of the district is increasing day by day and the development of the district is still rapid it is fair to say Batman needs a future plan for water treatment.

Discussion

Both Diyarbakır and Batman stores their solid waste with hazardous storage method. This results negatively for both human health and environmental health. Since Diyarbakır has a wider living area and more concentrated population, the resolution regarding solid waste management and effluent water management should be enhanced prior to Batman for Diyarbakır. Not that Batman should be neglected; rather there is a need for a resolution regarding Batman as well.

The public awareness should be raised in order for people to react against solid waste carefully. This will also help to reduce responsibility and financial liabilities for the governing buddies.

Solid waste collection, transportation and disposal / recycling costs must be reduced by better management and planning with the help of the public. Also by reducing the produced solid waste and effluent water the damage for humanity and environment must be reduced as well. By this we can offer a better future for the youth.

Conclusion

For industrial wastes and hazardous wastes, the governing powers should have a better observation organization. Also the company owner should be informed about how to reduce, store and transfer these sorts of wastes.

Finally, by applying an efficient recycling policy we can re-use the solid waste, hence, our damage against the environment will be lowered.

Conflict of Interest: The authors declare that, there are no conflicts of interest between the authors. The authors alone are responsible for the content and writing of the paper.

References

1. Rajagopalan V. The GAZETTE OF INDIA [Internet]. Envfor.nic.in. 2000 [cited 11 December 2015]. Available from: Http://envfor.nic.in/legis/hsm/mswmhr.html
2. Diyarbakır Governorship. Diyarbakır District Environment Circumstances Report. Diyarbakır: Diyarbakır Province; 2013.
3. Diyarbakır Municipality. Diyarbakır Solid Waste Storage Unit Plan. Diyarbakır: Diyarbakır Municipality; 2014.
4. Batman Governorship. Batman District Environment Circumstances Report. Batman: Batman Province; 2013.
5. Batman Municipality. Batman Solid Waste Storage Unit Plan. Batman: Batman Municipality; 2014.
6. Neyim C. Çevre ve sürdürülebilir kalkinma tematik panel. Presentation presented at; Tübitak, Ankara.
7. Katayanagi K. Solid Waste Management Planning: Master Plan of Appropriate Municipal Solid Waste Treatment Considering Plastic Waste. [Internet]. Environmental Control Center Co., Ltd; 1994. Available from: https://www.jstage.jst.go.jp/article/wmr1990/5/4/5_4_326/_article
8. Kocasoy G, Can O. UKAY 2014.
9. Kavaklı M, Civan Z. Türkiye'de su kullanimi, atiksulari geri kazanma ve yeniden kullanma uygulamalari. [Internet]. [cited 11 December 2015];. Available from: http://www.mmo.org.tr/resimler/dosya_ekler/996535e07258a7b_ek.pdf?dergi=178

NSD

NATURAL SCIENCE & DISCOVERY

ISSN: 2149-6307
Lycia Press LONDON UK

International Journal of
Natural Science and Discovery
Open Access Scientific Journal
2015, Vol.1, No.3

www.natscidiscovery.com