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VOLATILE OILS FROM PEPPERMINT, BASIL, ROSEMARY AND GINGER – EXTRACTION AND APPLICABILITY IN A NEW DRESSING COMPOSITION

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Abstract: Four varieties of a salad dressing containing lemon and parsley as main ingredients were formulated with the aim of developing functional food products, with good sensorial acceptability, ready for consumers use. The dressing consumption may bring benefits on the overall health of the consumers, due to its antioxidant, anti-inflammatory, digestive and anti-carcinogenic capacity, derived from the product enrichment with one of the essential oils of peppermint, basil, rosemary and ginger. The dressings were analysed in terms of pH, acidity, vitamin C content, mineral composition, antioxidant capacity and total polyphenolic content. The sensorial analysis of the dressing products revealed overall acceptability of the products.
Keywords: salad dressing, volatile oils, essential oils, antioxidant capacity, spices.

Introduction

Dressings are sauces based on water, oil or vinegar, with or without any other additional ingredients. They are of high interest since they can be consumed with a large variety of foods, being usually served with salads, sandwiches, cooked vegetables, fish or meat. Salad dressings are produced in two different finished product forms: emulsified and separated. Emulsified or one phase pourable salad dressings are homogenized or blended to maintain a creamy non-separating consistency and the homogenization process is responsible to reduce the oil droplet size to produce a smooth and creamy dressing. Separating salad dressings have a separate oil layer above an aqueous phase. These products must be shaken before use and show quick phase separation after pouring (Perrechil *et al.*, 2010). The high variety and addressability of dressing made them a perfect matrix which can undergo some tailoring and with the addition of some ingredients, may become a functional aliment. Since dressing may have both, a hydrophilic and a hydrophobic part, interesting substances can perfectly be included in their formulations. Emulsifiers are an indispensable element for the stability of the dressings containing both oil and water, but since consumers are more and more pretentious and prefer food products without any added chemicals or synthetic ingredients, there is a trend in formulating simple and natural food products, ready to use and with long shelf life.

There is a continuing and expanding international demand for herbs and essential oils. Social changes, including food diversification, the desire for new flavours, are driving an increase in this demand (FAO, 2005). Nutritious foods are also of high demand and the curative effects of foods are more and more credible to the consumers, who prefer to prevent rather to cure some health problems.

Parsley leaves, contain a mixture of volatile oil 0.3%, namely apiol, miristicine, tetra-allyl-methoxy-benzene, terpineol, p-cimol and phellandren. They may also contain flavonoids (apigenine, glucozides or cosmozine, apiosil) cumarins and terpens (Chaves *et al.*, 2007). Two other flavonoids have also been identified in parsley leaves: diosmetin apiosyl glucoside and luteolina. Apiole compound seems to act as an antiseptic in the urinary tract and stimulate uterine muscles (Trifunschi and Ardelean, 2012). Vitamin A, a hydro soluble vitamin, folic acid and minerals are also contained by parsley leaves in considerable amounts. They can be considered natural vitamin and mineral supplements; this is why parsley was chosen as ingredient for the functional dressing proposed by this article.

Citrus fruit is very popular due to its unique and specific flavour and test, as well for the multiple health benefits associated with its consumption (Alfadul and Hassan, 2016). The most specific chemical compound in lemon is D-limonene, a terpene which imparts the specific taste and smell of lemon. Citric acid in lemon is responsible for its sour taste and low pH. Vitamin C (ascorbic acid), a hydro soluble vitamin, is present in high contents in lemon and is causing resistance against many diseases. Ascorbic acid content of some lemon juices has been reported to be as high as 680mg/ of juice, depending on the growing conditions, maturity of the fruit and its freshness (Alfadul and Hassan, 2016). It was suggested that the Citrus essential oil may be a new potential source as natural antimicrobial and antioxidant agents applied in food systems and pharmaceutical industry (Hsouna *et al.*, 2017).

Ethno pharmacological analysis of the ingredients is useful for identifying potential therapeutically effects of the medicinal plants, which may contribute due to some several compounds contained, to the prophylaxis and treatment of a wide variety of pathologies. Plants have been used in traditional medicine since ancient times to cure many diseases. Essential oil, as well as any other plant based natural ingredients, has been the beneficiary of legal, regulatory, and consumer preference as the result of a shared opinion on food safety (Burdock and Wang, 2017). Other numerous health improving capacities were also attributed to various types of essential oils. Studies suggest that basil oil might be good innovative therapeutic strategies against cancer (Taie *et al.*, 2010). The essential oil of basil also presented efficient antimicrobial activity against *Staphylococcus aureus*, *Citrobacter freundii* and lactic acid bacteria (Ionica *et al.*, 2016).

The anti-inflammatory properties of ginger have been known and valued for centuries. Ginger oil has been reported to possess antimicrobial effects, and studies by have shown that the essential oil of ginger extracted by hydro distillation possesses high antibacterial effects on food pathogens (*Staphylococcus aureus, Bacillus cereus,* and *Listeria monocytogenes*), with a minimum concentration of 6.25μg/mL to inhibit *B. cereus* and *L. monocytogenes* (Natta *et al.*, 2008). Some volatile compounds having antimicrobial properties are α-pinene, borneol, camphene and linalool. Ginger contains pungent compounds: gingerol and shagaol, while zingiberene is a pre-dominant component of oils. The medicinal properties have been mainly used for treating the symptoms of vomiting, diarrhea, light-headedness, blurred vision, dyspepsia, tremors, decrease in body temperature and high blood pressure. Furthermore, 6-gingerol and 6-shagaol can reduce viability of gastric cancer cells (Sa-Nguanpuag *et al.*, 2011).

Rosemary extracts have been used in the treatment of diseases, due to its hepato-protective potential, therapeutic potential for Alzheimer's disease and its antiangiogenic effect. The biological properties in rosemary are mainly due to phenolic compounds, to the presence of carnosic acid, carnosol, rosmarinic acid and hesperidin, as major components. Of the other identified compounds found in extracts of rosemary, rosmarinic acid and hydroxyhydrocaffeic acid, also exhibit some complementary antioxidant activity. It also demonstrated antimicrobial activity against *E. coli, Bacillus cereus, Staphylococcus aureus, Staphylococcus aureus, Clostridium perfringens, Aeromonas hydrophila, Bacillus cereus* and *Salmonella choleraesuis*, so it was included in a lot of food products with this aim (Nieto *et al.* 2018).

The leaves of peppermint are the most commonly used and they contain an amount of 0.5-3.5% of volatile oils. Usually the main components of peppermint oil include menthol (45-70%), menthone (8-24%) and menth, substances that gives the mint its characteristic aromas and flavours is menthol. The peppermint oil is reported to have antioxidant and antibacterial activities and is one of the most important constituents of some over-the-counter remedies in Europe for irritable bowel syndrome (Gavahian *et al.*, 2015).

The current paper describes and characterize a novel dressing sauce, based on natural ingredients, namely parsley and lemon juice, enriched in essential oils of peppermint, basil, rosemary and ginger, in order to obtain products with antioxidant, anti-inflammatory, digestive and anti-carcinogenic properties.

Materials and methods

Materials

For the dressing preparation, parsley, lemon and sugar were purchased from a local shop, while the medicinal plants: peppermint, basil, rosemary and ginger, were purchased from a specialized shop (Fares).

Volatile oils extraction

Essential oils are usually obtained by the procedure of extraction that allows separation and purification of specific compounds (volatile or essential oils), from a homogeneous or heterogeneous mixture, based on their selective solubilisation in different solutions added to the mixture which contains the oils. The essential oils of peppermint, basil, rosemary and ginger were obtained by hydro distillation and the boiling of the mixtures, for vaporization of the volatile compounds and their collection in a recipient connected to the hydro distillation installation. The lab scale installation is made up by a glass balloon representing the extraction platform, a heating source (gas bulb), a refrigerant and a recipient for collecting the volatile essential oils.

From each type of the plants: peppermint, basil, rosemary and ginger, finely chopped beforehand, 50 g was introduced in the extraction platform with 750 ml water, and the hydro distillation was finished in approximatively 3 hours. The resulting oils had different colour, depending on the provenience plant: yellow-green for the peppermint and basil, pale yellow for the rosemary and yellow-white for ginger. The yield of the hydro distillation process was differentiated according to the characteristics of each prevenient plant.

Preparation of the dressing

The basic ingredient of the dressing is represented by the parsley leaves, which were visually analysed and manually sorted of any impurities, then boiled in a sufficient amount of water. When the water begun to boil, sugar was added, lemon juice being also introduced to the composition. The resulting viscous green sauce was heated to room temperature. Prior to the addition of 10µl of each type of essential oils to 50 ml of sample, the sauce was filtered. The resulting dressing varieties were dosed in glass recipients and then pasteurized, to prolong their shelf life and availability.

Table 1

Extraction yield of the hydro distillation process

Samples	Yield [cm^3] / 50g plant material
Basil	0.3
Peppermint	0.28
Rosemary	0.65
Ginger	0.2

pH Analysis

pH determination is based on the property of indicators contained by the pH paper to change their colour in the presence of hydrogen ions.

Titrable acidity

The total acidity was performed by neutralization with sodium hydroxide solution (0.1 N) in the presence of fenolftaleine as indicator.

$$\text{Total acidity} = m \times 0.0067 \times 2 \times V \text{ g \% acid malic},$$

where: m - the weight of the sample, V– volume of NaOH 0.1N used for titration; 0.0067 conversion factor – 1 ml 0.1 N sodium hydroxide corresponds to 0.0067 g malic acid.

Determination of vitamin C

The chemical methods used for vitamin C analysis are based on its reducing properties. Ascorbic acid is converted by oxidation into dehydroascorbic acid. The iodometric method based on the oxidation of ascorbic acid with excess iodine in the presence of starch was used to enhance the presence of vitamin C in the dressing formulation (water, parsley, lemon, sugar) with no added essential oils. When the vitamin C is completely oxidized the iodine is released and in reaction with starch, a blue colour appears.

$$\text{Vit. C mg/100g sample} = \frac{V*0{,}0008*5*176}{G*100},$$

where: V – volume in ml of KIO_3 - 0.0008M used in titration; G – mass of the analysed material.

Determination of ash

Ash was determined by calcination at 550-600 °C of 3 g of probe until a grey ash was obtained, with the removal of the carbon black spots by splashing with water, then the process is continued until a grey or white ash results (after 6 hours).

Antioxidant capacity assessment

Antioxidant activity was determined using the 2.2- diphenyl-1-picrylhydrazyl (DPPH) method according to Muresan *et al.* (2014). An amount of 10µl of the methanol extract was transferred into a glass test tube with a screw cap, then 90 µL of distilled water and 3.9 mL of DPPH solution in methanol (0.025 g/l) were added. The incubation of the test sample was carried out in dark, at room temperature for 30 min. The absorbance value was read at 515 nm against methanol with UV-VIS spectrophotometer (Shimadzu 1700 UV-VIS) as percentage of the DPPH solution absorbance.

$$\text{RSA [\%]} = \frac{ADPPH - \text{AP}}{ADPPH} 100 \,,$$

where: RSA is the radical scavenging activity; A_{DPPH} is the absorbance of DPPH and A_P is the absorbance of the probe.

Assessment of total polyphenols content

Polyphenols are aromatic compounds with one or more hydroxyl groups substituted at the aromatic core, with redox properties. The method is based on the oxidation of the hydroxyl groups by the Folin Ciocaltau reactive and the resulting of a blue coloration of the probe. Total polyphenol content of the dressing was determined according to the method described by Semeniuc *et al.* (2016). The total polyphenols of the volatile oils of peppermint, basil, rosemary and ginger were assessed. 1 ml of probe was homogenized with methanol, and then centrifuged 5 minutes at 6000 rpm and then successive extractions were realized at 35˚C under pressure using a Heidolph Rotavapor. The resulting concentrate was collected with 9 ml methanol and deposited at -20˚C until the analysis was performed. 25µL sample was transferred into a glass test tube. Then, 1.8 mL of distilled water and 120 µL of Folin–Ciocalteu phenol reagent were added. After 5 min, 340 µL of sodium carbonate aqueous solution (7.5%, w/v) was added to the mixture. After incubation for 90 min at room temperature, in dark, the absorbance was read at 750 nm, using a Shimadzu UV-1700 spectrophotometer, against the blank, in which the sample was replaced with methanol. Standard curve was performed using different concentration solution of Gallic acid and the results were expressed as mg of GAE/100 g sample.

Results and discussions

The pH of the dressing without any essential oils was 3, depicting an acid medium. The acidity of the medium was 0.6231% and this is due to the lemon juice from the dressing composition. The vitamin C in the dressing composition was of 1.64 mg/100 g sample, therefore the thermal processing affects the vitamin content in the final product. The ash varied between 0.34% (for the dressing without any essential oils) and the maximum of 0.47% (specific for the dressing enriched in ginger oil), little differences between samples being registered.

Basil volatile oil demonstrated the highest antioxidant capacity, (92.67%), followed by ginger and rosemary oils (38%) and mint oil (16.67%). Even that the antioxidant capacity of the essential oils differed, the four types of dressings containing essential oils in the composition, demonstrates similar antioxidant capacities, the highest value resulting for the rosemary containing dressing, followed by the dressing with no essential oils and the rest of the samples that displayed similar values for the antioxidant capacity (17,07 – 19,76). Because parsley contains apigenin flavone in an amount of 510–630 mg of the /100 g it has also a high antioxidant capacity (Justesen and Knuthsen 2001).

The basil volatile oil demonstrated high total polyphenolic content (111.95 mg GAE/100g), followed by ginger essential oil 56.37 mg GAE/100g, mint oil 29.88 mg GAE/100g and rosemary oil 20.38 mg GAE/100g. The results increased significantly for the basic dressing and the volatile oils containing dressings, 152.3 mg for the rosemary dressing, 118.75 mg for the mint dressing, 118.33 mg for the ginger dressing, 93.21 mg for the basil dressing and 73.69 mg for the basic dressing with no essential oils added. The total content of the polyphenolic compounds may vary in the essential oils due to their origin, or due to the state of the aromatic plant prior to the oil extraction. The polyphenolic compounds are responsible for the antioxidant activity of the products, this is why the highest antioxidant activity was registered for the rosemary containing dressing. The rosemary dressing exhibited the highest antioxidant capacity, and it was already reported that rosemary extracts are capable of retarding the oxidation more successfully than other natural and synthetic antioxidants such as butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) (Frutos and Hernandez-Herrero, 2005).

There was no direct correlation between the results in the antioxidant capacity and total polyphenolic compounds of the essential oils of the dressing containing the same type of oils.

Conclusions

The results of physicochemical analyses of the ingredients and the four varieties of the proposed functional dressings fall in the legal limits allowed, demonstrating that the novel dressings can be used as food or as an additive in different types of food: salads, steaks, desserts, as an adjuvant in the treatment and control of certain health conditions. It is recommended to accompany any kind of cuisine, chosen according to taste, aroma, spice, garnish tendency or other wishes.

The samples remained homogeneous and visually stable for a long time, but further studies on the stored samples must be conducted in order to find out whether the product maintains its biological activity during storage.

The novel dressing formulations are natural products, which don´t contain dyes, preservatives, or chemical substances. As a future perspective, it would be also interesting to develop dressings based on the addition of two or more essential oils in the formulation and to conduct clinical studies designed to evaluate the nutritional effects of their consumption.

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