RESEARCH ON THE QUALITY OF COLD PRESSED SUNFLOWER FLAVOURED OIL

CERCETĂRI PRIVIND CALITATEA ULEIULUI AROMATIZAT DE FLOAREA-SOARELUI OBȚINUT PRIN PRESAREA LA RECE

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Abstract. *Cold-pressed flavoured sunflower oil is a virgin oil that has undergone maceration by adding herbs, spices vegetable, or fruit seeds in order to extend the product's shelf life, being considered a superior quality product. The aim of the present research was to determine, by means of sensory and physicochemical analyses, the quality of sunflower aromatized oils obtained by cold pressing. The physicochemical properties of the analysed oil assortments were represented by the following determinations: impurity content, moisture, relative density, acidity, iodine, saponification and peroxide indexes.*
Key words: cold press, flavoured oil, assortments, quality features

Rezumat. *Uleiul aromatizat de floarea-soarelui presat la rece este un ulei virgin care a fost supus macerării prin adaos de legume, ierburi, condimente sau seminţe din fructe cu scopul de a prelungi perioada de valabilitate a produsului, fiind considerat un produs de calitate superioară. Scopul prezentei cercetări a fost de a determina, prin intermediul analizelor senzoriale și fizico-chimice, calitatea uleiurilor aromatizate de floarea soarelui obținute prin presare la rece. Proprietățile fizico-chimice ale sortimentelor analizate au fost reprezentate de următoarele determinări: conţinutul de impurităţi, umiditate, densitatea relativă, indicii de aciditate, iod, saponificare și de peroxid.*
Cuvinte cheie: presare la rece, ulei aromatizat, caracteristici de calitate

INTRODUCTION

Cold-pressed flavoured sunflower oil is a virgin oil that has undergone maceration by adding herbs, spices, vegetables or fruit seeds in order to extend the product's shelf life, being considered a superior quality product.

In last decades, cold-pressed oils received an increased attention due to their health-promoting compounds, such as polyunsaturated fatty acid (PUFA), tocopherols, sterols and polyphenols and their health-beneficial impact. Unlike refined oils, virgin oil has the ability to maintain the most important characteristics of the raw material, also contributing to the formation of the specific flavour of food through its use, but the quality of cold-pressed oil can be negatively influenced by the presence of impurities and husks in the pressed material.

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The benefits of these oils compared to refined ones are related to higher amounts of bioactive compounds, which are not eliminated during refining operations. The increasing preference for cold-pressed oils versus refined oils is attributed to consumers opting for less processed products. These oils are also distinguished by their high amounts of vitamins and minerals and other ingredients extremely useful for human health (Dimic, 2005; Bendini *et al*., 2011; Dimic *et al*., 2015; Nistor and Hoha, 2017; Nistor *et al*., 2018; Konuskan *et al*., 2019). Also, cold-pressed sunflower oil shows cardiovascular benefits associated with reduced total plasma cholesterol and low-density lipoprotein (LDL) cholesterol levels. In addition, this oil is helpful in lowering atherosclerosis, artery disease and stroke, due to the presence of vitamin E at high levels (Adeleke *et al*., 2020).

Moreover, regarding numerous food commodities, customers are seeking less processed alternatives, with cold-pressed oils frequently regarded as healthier than refined vegetable oils (Tauferova *et al*., 2021). Cold-pressed oils must be generated exclusively by mechanical processes, without the use of heat treatment. These oils can be refined using aqueous washing, followed by sedimentation, filtration and centrifugation. The use of chemical and physical refining processes, such as degumming, neutralization, bleaching and deodorization, and the supplementation of cold-pressed oils with synthetic additives, is banned (Bendini *et al*., 2011; Redondo-Cuevas *et al*., 2018). The technological procedure utilized in the manufacturing of cold-pressed oil enhances its nutritional value and sensory appeal for certain consumers (Febrianto and Yang, 2011; Parker *et al*., 2023).

Regarding the fact that cold press oils easily oxidize, it is important to prevent oxidation and decrease of their stability and sensory quality during storage and thermal treatment (Rusinek *et al*., 2020). Oil stability is an important factor that affects the cold pressed oil quality, due to the fact that instable oils have an undesirable flavour (Romero *et al*., 1999; McDowell *et al*., 2017). Functional compounds present in cold-pressed sunflower oil, such as phenolics, are often associated with diminished acceptability to consumers, due to their bitter or pungent flavour (Mohammed *et al*., 2018) as well as some minor antioxidant components and numerous external factors (Tauferova *et al*., 2021).

Spices or herbs have been used since ancient times, the main purpose being to flavour or enhance flavours in food, to extend the shelf life through the action of the antiseptic substances in the composition of aromatic plants, having at the same time a therapeutic purpose in improving some medical manifestations.

On the Romanian market, vegetable oils flavoured with various spices are sold in the form of: extra virgin olive oil, refined or cold-pressed sunflower oil, as well as rapeseed oil, to which various aromatic plants are added: thyme, basil, garlic, sage, bay flowers, oregano, mint, peppercorns, hot peppers, rosemary, anise, sea buckthorn, calendula, dried tomatoes, turmeric or ginger.

Spices and herbs such as anise, chilli, basil, sage, garlic, sage, parsley, thyme etc. contain antioxidants which stabilize lipids and lipid-containing foods (Peter, 2006; Yanishlieva *et al*., 2006; Nybe *et al*., 2007; Mousavi *et al*., 2012; Bravi *et al*.,

2016; Niamat *et al.*, 2016; Eftinzjijoska and Pavlovska, 2019; Temelkovska and Pavlovska, 2021, Temelkovska *et al*., 2023) and are widely used as food additives, increasing oxidative and microbiological stability (Rababah *et al*., 2012; Przygodzka *et al*., 2016; El-Sayed and Youssef, 2019; Al Soudy *et al*., 2020). Addition of spices and herbs influence the sensory features of the products, improving the taste and smell (Issaoui *et al*., 2016; Habib *et al*., 2017; Hamad *et al*., 2017; Amer and Rizk, 2022; Tawfek and Ali, 2022; Temelkovska *et al*., 2023).

Anise (*Pimpinella anisum* L., family *Apiaceae*) is an aromatic plant used since Antiquity, cultivated in the temperate climate region. The phytonutrient anethole is found in anise and fennel seeds, having a role in relief of menstrual cramps or colic in babies (Rocha and Fernandes, 2016; Akbar, 2020; Singletary, 2022).

Chilli pepper is part of the *Capsicum genus*, from the *Solanaceae* family and contains the alkaloid capsaicin, spread in the membrane and inside the pepper seeds, which produces beneficial effects on the muscular and cardiovascular system, but at the same time is responsible for the hot or intense taste of the culinary preparations (Peter, 2006; Nybe *et al*., 2007).

Basil (*Ocimum basilicum*) belongs to the *Ocimum genus*, *Lamiaceae family* and is a versatile aromatic plant, originating from North Africa, India and Southeast Asia. Basil contains small quantities of vitamins A and K, calcium, and iron, and it has a pleasing pungent aroma. Basil also contains methyl chavicol (estragole) and linalool, which help retard the growth of bacteria (Veronezi *et al.*, 2014; Fernandes *et al*., 2019; Beldean *et al*., 2020).

Sage (*Salvia officinalis*) is native to the Mediterranean Basin and the plant name means "rescue" in Latin. Sage contains small amount of magnesium, zinc, copper and vitamins A, C E and K. Also sage contains caffeic acid, chlorogenic acid, rosmarinic acid, ellagic acid and rutin - all of which play a role in its beneficial health effects. Sage contains over 160 distinct polyphenols, which are plant-based chemical compounds that act as antioxidants may and have anti-inflammatory, anticancer and neuroprotective effects (Hamidpour *et al*., 2014).

Garlic contains two types of antioxidant compounds, flavonoids and sulphur - containing compounds: allyl-cysteine, diallyl sulphide and allyl trisulphide. Derivatives of amino acids that contain sulphur allin (S-allyl-L-cysteine sulfoxide) can be converted into allicin (diallyl disulfide-S-oxide), a compound responsible for the smell of garlic, under the action of the enzyme allinase (Pardo *et al*., 2007). Allicin is a reactive molecule, which can undergo various transformations, depending on pH and temperature and organosulfates give specific aroma and anticancer, antimicrobial, anti-inflammatory, antioxidant and antithrombotic effects (Gonzalez *et al*., 2017; Ansary *et al*., 2020).

Introduction of new varieties of flavoured sunflower oils on the national and international market have brought certain benefits to consumers, both in food preparation and in aromatherapy. The quality of cold-pressed sunflower flavouring oils is largely influenced by the properties of the aromatic plants. The main benefits produced by certain plants, with a role in aromatization, are

characterized by effects on the human and nervous system. Food that is enriched with spices and herbs has functional, nutritional and health benefits (Peter, 2006; Nybe *et al*., 2007; Labban *et al*., 2014; Agyare *et al*., 2017; Ansary *et al*., 2020; Nayak *et al*., 2020; Rahbardar and Hosseinzadeh, 2020; Lesnik *et al*., 2021; Temelkovska *et al*., 2023).

MATERIAL AND METHOD

The aim of the present research was to determine, by means of sensory and physicochemical analyses, the quality of sunflower aromatized oils obtained by cold pressing. In order to achieve the objectives, the main sensory attributes were evaluated and water content, insoluble impurities (%), relative density, free acidity (mg/g), saponification index (ml/g), iodine index (g I_2/g) and the peroxide index (meq/kg) were determined.

Sensory evaluation of flavoured sunflower oil samples was performed by a team of twenty untrained panellists using a 5-point system scale as described by (Banu *et al*., 2007) each of the board members received three coded samples, corresponding for each type of flavoured sunflower oil. Sensory attributes were overall appearance, colour, taste, and smell (Carabante and Prinyawawatkul, 2018). The obtained results are interpreted based on a 20 points scale for quality evaluation (Banu *et al*., 2007).

The insoluble impurities of cold-pressed sunflower flavoured oils were determined according to SR EN ISO 663:2017. Determination of humidity was carried out in according with SR EN ISO 662:2016 standard, which establishes the determination methods for humidity. Oil's density was determined according to SR EN ISO 18301:2014. Iodine value was established in accordance with SR EN ISO 3961:2018. Acidity value is the amount of potassium hydroxide in milligrams needed to neutralize free fatty acids in one gram of fat. The technique involves neutralizing the free acidity of a specific amount of fat using an alcoholic solution of potassium hydroxide with a known titre and factor, in the presence of phenolphthalein in accordance with SR EN ISO 660:2020 standard. To calculate the saponification value, a measured amount of fat (oil) is mixed with an excess of 0.5n potassium hydroxide (in alcohol) and then boiled. At the completion of saponification, the remaining amount of potassium hydroxide is determined via acid titration to identify the excess amount. The amount of potassium hydroxide used in fat neutralization and saponification can then be calculated by subtracting the excess amount (Hamm and Hamilton, 2000; Gunstone, 2004). Peroxide value was determined in accordance with SR EN ISO 3960:2017 standard. The product is titrated in a mixture of acetic acid and chloroform, using a solution of potassium iodide.

RESULTS AND DISCUSSIONS

At the end of sensorial analysis of the investigated flavoured oils assortments (fig. 1) and after data processing were calculated the weighed mean score for all the evaluated sensorial features and the total mean score (fig. 2).

Following the sensory analysis, all the samples of oils flavoured with anise, hot pepper, basil, sage and garlic have the qualification "very good" and are considered high quality oils by the panellists.

The oil flavoured with anise obtained a total score of 18.30 points. The most valued sensory feature of this type of oil was the appearance with an average of 4.5 points, compared to 4.4 points for the colour.

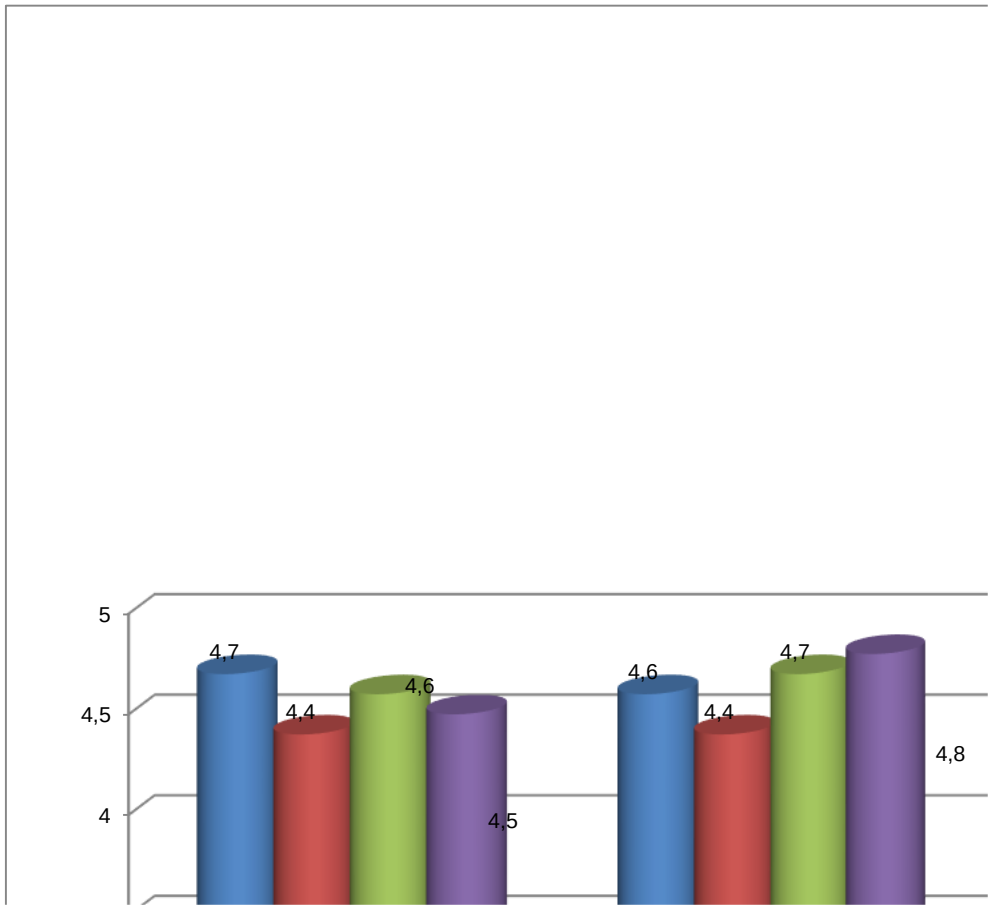

Fig. 1 Graphical representation of the average scores obtained by the analysed oils

The hot pepper flavoured oil obtained a total score of 18.60 points. The most valued sensory property of this type of oil was the taste with an average of 4.8 points, compared to 4.4 points for the colour. The oil flavoured with basil obtained a total score of 18.25 points. The most valued sensory feature of this type of oil was taste with an average of 4.6 points, compared to 4.5 points awarded for the appearance, colour and smell. Sage flavoured oil obtained a total score of 18.75 points. The most valued sensory property of this type of oil was appearance with an average of 4.8 points, compared to 4.5 points awarded to both colour and smell. The oil flavoured with garlic was the most appreciated type of oil, the total score of 19.25 points being the highest among all 5 varieties. The most valued sensory property of this type of oil was the smell with an average of 5 points, compared to the score of 4.6 for the appearance.

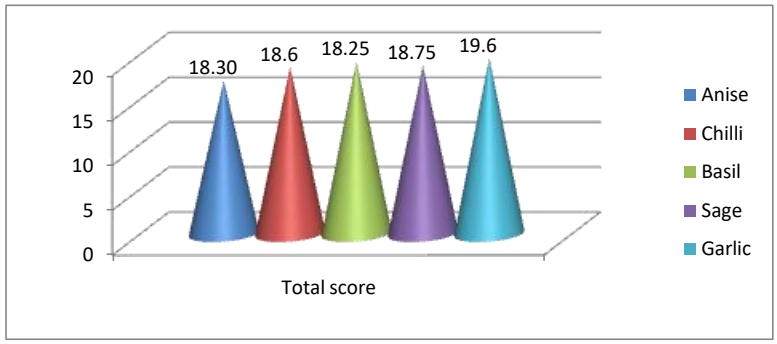

Fig. 2 Graphical representation of the total average scores obtained by the analysed oils

Through this graphic representation, it can be seen that the oil flavoured with sunflower garlic obtained by cold pressing obtained the highest total value of 19.25 points, followed by the oil flavoured with sage, hot peppers and anise, and the oil flavoured with basil obtained the lowest total value of 18.25 points.

After determining the content of impurities for the 5 varieties of flavoured oil, small differences were obtained between the samples, the values being presented in table 1.

Insoluble impurities in sunflower flavoured oils can contribute to the depreciation of the product if their values exceed the admissible limits.

Table 1

The results for oils' impurity content

No.	Assortment	Impurity content (%)	Standard value
1	Anise	0.04±0.05	< 0.25 %
2	Chilli	0.09±0.05	
3	Basil	0.06±0.06	
4	Sage	0.05±0.02	
5	Garlic	0.02±0.04	

Moisture is a parameter which shows the water content in oil. After determining the moisture content of five extra virgin sunflower oil samples, it was found that the average value is carried out with the standards in force. In table 2, a maximum difference between the obtained values of 0.03% was highlighted.

Table 2

The results for oils' moisture content

No.	Assortment	Moisture content (%)	Standard value
1	Anise	0.42±0.01	< 0.50 %
2	Chilli	0.43±0.04	
3	Basil	0.41±0.03	
4	Sage	0.43±0.06	
5	Garlic	0.44±0.04	

Density represents the rate between the mass of a volume of analysed substance and the mass of the same volume of water, at the same temperature. Data obtained are presented in table 3.

Table 3

The results of relative density

No.	Assortment	Density (g/cm^3)	Standard value
1	Anise	0.921±0.03	< 0.25 %
2	Chilli	0.920±0.01	
3	Basil	0.920±0.02	
4	Sage	0.921±0.03	
5	Garlic	0.919±0.04	

After carrying out this determination, the oil flavoured with sage, respectively the one with anise obtained the relative density of 0.921 g/cm^3, and 0.919 g/cm^3 is the lowest density of the oil flavoured with garlic.

Acidity value is a physical-chemical parameter which allows us to appreciate the preservation degree of the oils (tab. 4).

Table 4

Acidity value of flavoured oils

No.	Assortment	Acidity (%)	Standard value
1	Anise	0.46±0.04	< 7 % oleic acid
2	Chilli	0.81±0.07	
3	Basil	0.52±0.04	
4	Sage	0.51±0.07	
5	Garlic	0.90±0.08	

Following this determination, the oil flavoured with garlic obtained the highest amount of free acidity expressed in 0.90% oleic acid, and the lowest value of 0.46% oleic acid was obtained for the oil flavoured with anise.

The difference between the five flavoured oil samples is a maximum of 6 mg KOH/g. The highest value of the saponification index was obtained for the sample of oil with basil in the amount of 188 mg KOH, and for the oil flavoured with garlic the lowest value of 183 mg KOH. Also, both the oil flavoured with anise and the oil with sage obtained the same value of the saponification index (tab. 5).

Table 5

Saponification value of flavoured oils

No.	Assortment	Saponification mg KOH/g	Standard value
1	Anise	186±0.54	182-195 mg KOH/g
2	Chilli	185±0.21	
3	Basil	188±0.45	
4	Sage	186±0.34	
5	Garlic	183±0.64	

The iodine index is a very important analytical constant, being used for the characterization of natural lipids (tab. 6).

Table 6

Iodine values of flavoured oils

No.	Assortment	Iodine values (g I_2/100g)	Standard value
1	Anise	86.2±0.45	79-120 (g I_2/100g)
2	Chilli	86.6±0.64	
3	Basil	85.9±0.96	
4	Sage	86.1±0.49	
5	Garlic	86.1±0.45	

The analysed flavoured oil samples fall within the limits of the standards and are admissible. The lowest value of the iodine index is 85.9 g I_2/100g for the oil flavoured with basil, and the highest for the oil with hot peppers 86.6 g h/100g. The difference in the iodine index compared to the 5 types of oil is relatively small, this value being less than 0.7 g I_2/100g.

Along with the acidity index, the peroxide index provides very important information on the age and stability of cold press sunflower oil (tab. 7).

Table 7

Peroxide value of the analysed flavoured oils

No.	Assortment	Peroxide value (meq/100g)	Standard value
1	Anise	2.73±0.47	< 12
2	Chilli	2.76±0.64	
3	Basil	2.74±0.60	
4	Sage	2.74±0.54	
5	Garlic	2.81±0.41	

The lowest value of the index is 2.73 meq/100g of peroxide at the oil flavoured with anise seeds. The highest value of the peroxide index is 2.81 meq/100g for the oil flavoured with garlic.

CONCLUSIONS

The flavoured oils were subjected to sensory analysis, in which the appearance, colour, taste and smell of each type of oil flavoured with anise, chilli, basil, sage and garlic were followed.

The most appreciated oil was the oil flavoured with garlic, the average total score obtained was 19.25 being included in the high quality class, together with the oil flavoured with basil which obtained the lowest total value of 18.25 points. Sage-flavoured oil received an average score of 4.8 due to the aspect that best fit the allowable conditions. The oil the most intense smell that received the maximum score of 5 points was the one flavoured with garlic.

By performing the physicochemical analyses of the 5 flavoured oils, values were obtained that fall within the limits of the standards

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