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4. Cold-pressed oils as functional food

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Abstract. In the present work the characteristics of functional food, cold-pressed oils and the method of its extraction were described. The factors influencing the quality attributes of the obtained oils were discussed. The nutritionally valuable bioactive components of cold-pressed oils were presented such as: tocopherols, sterols, carotenoids and phospholipids with oxidizing properties partly removed from refined oils or destroyed during the industrial refining. Their health beneficial properties and trends in fat processing technology were depicted.

Introduction

The quality requirements imposed both by the oil industry and more health-conscious consumers continue to increase and this trend forces the oil producers to improve their technology. It is achieved through the application of the most advanced technological solutions in different fields in order to obtain fats with the best health, nutritional and utilitarian attributes. Moreover, the ecological and economic aspect of fat production should be emphasized [1].

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In the recent years the consumers are paying more and more attention to those aspects of their life which improves its quality. Therefore, the diet, in addition to the way and conditions of life, is one of the key factors influencing human health and well-being. The consumers for fear of chemical remnants in the food and those environmentally-conscious choose the oils unaffected by drastic thermal treatment. Recently, an increase in the consumption of cold-pressed edible oils has been observed. These oils are much more beneficial than the refined ones in terms of nutritional values. [2, 3, 4, 5]. Such oils contain natural, nutritionally valuable food components like: tocopherols, sterols, carotenoids, phospholipids with oxidative properties partly stripped from refined oils or destroyed during the refining process [6].

More and more often the consumers turn to natural food with health promoting qualities, termed functional food. Food may me be defined as functional if beyond its nutritional values, it has proven to have therapeutic potentials on one or more of the body functions leading to health promotion and disease prevention. Functional food must have attributes of conventional food and exhibit beneficial effects with values expected to be consumed with everyday's diet being neither pills nor capsules, but integral part of an appropriate diet. The health contributing effect of functional food should be well documented with scientific research [7].

The division of functional food was made taking into consideration its impact on physiological functions of the human body: food reducing the risk of circulatory diseases, cancer and osteoporosis developments; food regulating appropriate functions of GI tract; and food aimed at combating stress-related symptoms. Another division was defined considering its end-users: for sportspeople, pregnant women, infants, adolescents and the elderly. Besides, food was divided into the natural food rich in particular nutrient, food enriched with health promoting components and food deprived of anti-nutritional values. More and more often the term of functional food has been applied to the products containing n-3 polyunsaturated fatty acids (PUFA), phytosterols, fiber, selected strains of lactic acid bacteria (LAB) and others [8, 9, 10].

Functional food may incorporate cold-pressed oils. Cold-pressed oils provide a wide range of bioactive substances, such as tocopherols and tocotrienols, free and estrified sterols, hydrocarbons (squalene), triterpene alcohols, carotenoids and chlorophylls along with colorants being valuable nutrients. They also contain n-3 and n-6 PUFA or sterols having biologically active effects [11, 12, 13, 14]. The concentration of these ingredients in oils is dependent on the quality, grain type and its varieties which may serve as a functional food. The chemical composition of oils determines their health beneficial capacities and their practical application. The intake of cold-pressed edible oils can result in inhibition or retardation of diet-dependent lifestyle diseases, such as obesity, ischemic heart disease (IHD), hypertension thanks to the presence of antioxidants like tocopherols and polyphenol compounds (demonstrating increased antioxidative properties) [15, 16, 17, 18].

Characteristics of cold-pressed oils

Cold-pressed oils free from chemical activities characteristic of refining processing can be valuable edible oils providing that they do not contain harmful to humans chemical and microbiological contamination including mytotoxins and metals (Fe, Cu) accelerating the oxidation of oils and chlorophylls usually removed during the refining process [6, 19, 20].

Modern technology of obtaining oils through cold-pressing using nitrogen atmosphere or supercritical carbon dioxide extraction allows to retain them almost in an intact state. Their chemical composition is richer in by-products with a higher level of biological and antioxidating activity. The presence of antioxidants inhibiting deleterious changes and an insight into their activity and stability is of paramount importance not only for food technologists but also for nutritionists [21].

Apart from the cold-pressing parameters, the technological attributes of raw material play a crucial role in obtaining the final quality of these oils. The cold-pressed oils can be produced from grains (including seeds), fruit, nuts or germs.

Cold-pressed rapeseed oil should gain special attention. Although cold-pressed oils account for a modest market share of edible oils, they are becoming more and more popular with the consumers preferring natural, traditional and low processed food. Cold-pressed rapeseed oil possessing characteristic taste with a hint of nuts, distinct aroma and intensive color has grown in popularity not only in Poland, but also in Germany, Switzerland, Austria and Great Britain [22]. The cold-pressed rapeseed oil in contrast to the refined one is less resistant to oxidation, unlike olive oil (*extra virgin*). The rape seeds of low quality i.e., too moist, unripe, contaminated, damaged and those already undergoing hydrolytic and oxidative changes result in obtaining low quality oil characterized by a low oxidative stability. The most valuable in terms of sensory attributes are oils from high-quality raw materials subjected to minimum oxidative changes [6, 22].

The physical traits of seeds also play an important role. It was demonstrated that the seed quality exerts a considerable influence on their technological parameters. The seeds measuring from 1.6 and more than 2.0

mm were associated with higher technological values and increased extraction efficiency due to a lower level of contamination while containing more fats. The oil derived from these seeds was of higher quality owing to a lower content of chlorophylls, phospholipids and by-products of lipid hydrolysis and oxidation [23, 24].

Cold-pressed oils have distinct aroma and taste. They are used both as an additive to fresh food and as an ingredient enhancing various products (e.g. bread, mayonnaise) with specific bioactive nutrients. Oxidative stability is a crucial quality marker of cold-pressed oils containing natural antioxidants (carotenoids, tocopherols, sterols, phospholipids, phenol compounds, among others) as well as undesirable substances with oxidative properties (e.g. chlorophylls, metals) being removed in refining process [25].

The appropriate measures taken to protect oils just after their extraction using various procedures such as inhibition or elimination of: oxygen in contact with oils, light, metal ions promoting oxidation (Fe, Cu) as well as inclusion of substances which reduce oxidation processes in oils permit to extend the shelf-life. Consequently, various kinds of antioxidants are utilized. Due to many health reasons associated with synthetic antioxidants a trend towards their limited application has been observed. However, a great importance is attached to the employment of natural antioxidants or their identical alternatives. Their versatile antioxidant activity may result in autooxidation of plant-derived oils rich in omega-3 PUFAs and while being introduced to diets they can render therapeutic effect on human body thanks to their capacity to scavenge free radical [21].

Wroniak and Lukasik [26] in their study demonstrated that cold-pressed sunflower and rapeseed oils and their refined counterparts did not produce statistically significant differences in terms of their stability in Rancimat test. On the contrary, the differences between cold-pressed soybean oil and extra virgin olive oil and refined oils were statistically significant. The extra virgin olive oil was characterized by the longest induction time and the sequence of other oils was as follows: refined rapeseed oil, cold-pressed rapeseed oil, refined soybean oil, cold-pressed soybean, refined olive oil, refined and cold-pressed sunflower oil.

Cold-pressed oil production

Cold-pressed oils are derived from seeds and fruit of oil plants having more than 15% fat content. The exception is the oil extracted from amaranthus seeds whose fat content is 4.9 – 8.1 %. The quality attributes of oils or plant-derived fats are greatly affected by plant taxonomy and classification. Based on type of raw material and botanic classification oils can be obtained from seeds (e.g. canola, flax, poppy, borage, hippophae or sea-buckthorns, pumpkin, blackcurrant, grapes), fruit (e.g. plums, hippophae or sea-buckthorns), nuts or kernels (e.g. hazel, walnuts, argan) or sprouted grains (e.g. wheat germs) [25].

Cold-pressing is one of the most ancient natural ways of oil extraction. This method is generally recognized as safe (GRAS) since no solvents are used. It is performed using hydraulic or expeller (screw-type) press equipped with cooling system. This method is relatively easy and inexpensive.

The primary stages of cold-pressing include:

- Seed defattening – enables to obtain better quality of oils (brighter color, higher oxidative stability) and meal, though it is not used on an industrial scale due to some technological difficulties. This process improves the oil quality by reducing the content of chlorophylls and other substances such as metals, pesticides permeating through the hulls or shells into the oil.

- Seed fragmentation (crushing) – permits to extract the oil by a partial destruction of the seed structure and hull, opening some cells, enlarging the oil spillage area and lowering the cell resistance. Crushed seeds should immediately be subjected to further processing as the quality and stability of cold-pressed oil is time-dependent.

- Seed conditioning – roasting in the ovens by exposing the pulp to the temperature of approx. 100 ^{o}C and if necessary moisturizing it to the optimal humidity. This treatment positively affects the oil extraction; however it negatively influences the oil and meal quality [26].

The high quality of cold-pressed oils is affected by many factors. Of utmost importance is the raw material quality i.e. its purity, uniformity, integrity and ripeness. Harvest time is another key determinant. In addition, the raw material quality is impacted by pre-pressing activities including crop gathering, drying, storage and post-harvest handling [25].

Notably, seed roasting and heat pressing exert influence on the whole extraction yield along with the quality and oxidative stability of the obtained oil and pomace (cake). During the extraction at higher temperatures the level of impurities increases. Some of them such as chlorophylls, sulphur compounds or phospholipids lead to a decrease in the oil quality whereas others like tocopherols, sterols, carotenoids and non-enzymatic browning compounds result in its increase. In the studies conducted by [27] it was postulated that a drop in the extraction temperature below 40°C allows to obtain the oil with good sensory and physicochemical properties being suitable for immediate consumption. The quality of hot pressed oil, especially in industrial settings is lower when compared to that of cold-pressed oil, but it is considerably higher in comparison with the expeller pressed oil. On a whole, in order to obtain high food quality, hot pressed oil should be subjected to refining process. The screw and hydraulic presses are widely used for cold-pressed extrusion with maximum exiting oil temperature of 50°C and 20-25°C (ambient temperature), respectively [24].

The technological quality of seeds i.e., the content of fats, proteins, chlorophylls and the acid and peroxide values of fat extracted from seeds is determined by their moisture, ripeness, spoilage and impurities. The issue of impurities found in rapeseeds is a crucial factor as it negatively influences the process of oil extraction (reduced oil yield, decreased efficiency and lower oil quality) thus globally reducing the technological quality of seeds and incurring higher costs of refining process on an industrial scale [20, 28]. One of the key factors leading to an increase in usable particles (or usable dockage) and damaged grain is the combine harvesting and the post-harvest handling such as drying method (natural or in the grain drier), grain moisture and drying temperature. Adverse weather conditions and inappropriate cultivation techniques also contribute to the level of contamination (of mould grain, weeds and pests) [24, 26, 29].

Górecka and others [27] studying the cold-pressed oils extracted in hydraulic presses indicated that the only advantage of whole seed conditioning (roasting) before extrusion was a reduced level of lipid hydrolysis i.e. no significant changes in acid value in proportion to milled seeds. They suggested seed milling and application of conditioning temperature at 60 - 80 ºC in order to obtain the optimal oil quality and cause desirable changes (an increase in extraction yield and oxidative stability) while reducing the negative trends (taste deterioration, elevated acid and peroxide value and higher amount of pigments). Based on the findings it was discovered that in screw-type press used for cold pressing regardless of a nozzle diameter it was possible to extract oils in mild conditions without any changes in primary and secondary oxidation state (number) in fatty acid content and oxidative stability of the obtained oils. However, the extraction efficiency was low whereas the residual fat content in pomace (cake) high. Exposing seeds to elevated temperatures prior to pressing itself caused a significant increase in extraction yield in conjunction with an increase in lipid hydrolysis, pheophytin content and color darkening [24].

Bioactive compounds present in cold-pressed oils and their health beneficial properties

The cold-pressed oils contain triglycerides (approx. 95%) and a small amount of diglycerides, monoglycerides and free (unestrified) fatty acids (FFA). The rest consists of non-glycerol fraction – unsaponifiable matter demonstrating a wide range of quantitative and qualitative modifications. These are phospholipids, tocopherols and tocotrienols, free and estrified sterols, hydrocarbons (squalene), triterpene alcohols, carotenoids and chlorophylls along with color-forming compounds being valuable nutrients. The presence of these components is dependent on raw material quality, plant genotype along with climatic conditions of growth and cultivation techniques used. The content of fatty acids both in cold-pressed and refined oils does not change drastically whereas the content of non-glycerol fraction is reduced. During the chemical refining process the unsaponifiable matter is partly removed e.g. tocopherols, sterols or polyphenolic compounds. Table 1. presents bioactive compounds present in the selected cold-pressed oils [21, 22, 24, 25, 30. 31].

The evaluation of the anlyzed oils was based on their chemical composition i.e composition and content of fatty acids, tocopherols and sterols.

The value of cold-pressed oils stems from the fact that they are opulent sources of monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs). PUFAs include essential fatty acids (EFAs) that are not synthesized by the human organism and must be provided with food [32]. These are: α-linolenic acid (18:3, n-3; ALA), linoleic acid (LA, 18 : 2, n-6) and gamma-linolenic (GLA) (C(18:3). Cold-pressed oils containing considerable amounts of PUFA LA and ALA are those extracted from flax (15.82 and 56.93 %, respectively), camelina sativa (13.85 and 38.8 %), hippophae or sea-buckthorns (37.33 and 23.13 %) and raspberry (54.5 and 29.1 %).

Cold-pressed oils obtained from hippophae (sea-buckthorns), raspberry, flax or camelina sativa contain considerable amounts of gamma-linolenic acid that can be used for formation of long-chain fatty acids of n-3 family - eicosapentaenoic acid (EPA, 20 : 5) and docosahexaenoic acid (DHA, 22 : 6) – *in vivo* through elongation and desaturation. EPA and DHA act primarily as cancer-preventive, cardio-protective, anti-hypertensive and immuno-poteniating agents [33]. Special attention should be drawn to the acids of n-3 (e.g. linolenic acid) and n-6 (γ-linolenic acid) family with regard to their impact on functions of the human organism. They help to regulate, among others, lipid management by reducing cholesterol and triglyceride level in blood (preventing cardio-vascular diseases), influence the immunology system (possessing anti-inflammatory and anti-allergic properties) and the nervous system (improving the brain functions). In addition, they serve as a precursor of the prostaglandin, tissue hormones, regulate the blood pressure and they facilitate to release the lipids from endosperm [34, 35].

Table 1. List of bioactive compounds present in plant-derived cold-pressed oils.

Oils derived form	**Characteristic bioactive compound**	**Average content or percentage content in oil**
Olive oil	• Oleic acid (n-9) • squalene	55 – 83 % 0.7 %
Rapeseeds	• brassicasterol • plastochromanol - 8	104 mg/100 g 55 – 80 mg/100 g
Flax seeds	• α- linolenic acid • linoleic acid • plastochromanol – 8 • Sterols • Carotenoids	51.8 – 60.4 % 15.2 – 17.4 % 34.8 – 55.3 mg/kg oil 475.4 mg/100 g 147.5 mg/kg
Camelina seeds	• linoleic acid • eicosenic acid • Tocopherols • Sterols • Carotenoids	30 – 40 % 15 % 713.6 mg/kg 510.9 mg/100 g 160.1 mg/kg
Evening primrose seeds	• α- linolenic acid • linoleic acid	8 – 14 % 70 – 75 %
Borage seeds	• α- linolenic acid • Tocopherols • Chlorophylls	16 – 27 % 1410.2 mg/kg 2.8 mg/kg
Raspberry seeds	• α- linolenic acid	29.1 – 32.4 %
Grape seeds	• linolenic acid	50.1 – 77.8 %
Amaranthus seed	• squalene	6 – 8 %
Pumpkin seeds	• squalene	0.9 %
Rice bran	• γ- oryzanol	1.5 – 2. 9 %
Echium seed	• stearidonic acid • Sterols • Chlorophylls	12.4 % 424.9 mg/100 g 6.5 mg/kg
Black caraway seeds	• thymoquinone	3.5 – 8.7 mg/g
Sesame seeds	• sesamin	0.5 – 1.1 %
Blackcurrant seeds	• α- linolenic acid • Tocopherols • Sterols	13 – 17 % 1231.6 mg/kg 562.1 mg/100 g

For PUFAs it is important to maintain the right ratio of n-6 fatty acid content to that of n-3. Though, this proportion should not be higher than 5:1 as it greatly influences the appropriate metabolism in the human body. Based on the recent scientific studies, desirable ratio of n-6 fatty acid content to that of n-3 should be (4 - 5) : 1, or even 3 : 1. Inappropriate dietary ratio of these acids have been implicated in havocking disorders in the body functions, leading to antagonistic reactions and eventually even causing disease [2, 36, 37, 38]. Of great importance is the synthesis of PUFAs from LA and ALA precursors competing for the same enzymes (Δ^5-desaturase and Δ^6-desaturase) in metabolic changes [34]. Cold-pressed oil exhibiting nutritionally desirable omega-6/omega-3 ratio (reaching 2.3) is rapeseed oil [39, 40]. Cold-pressed oils did not show any presence of trans fatty acid isomers, whereas in refined oils subjected to refining and deodorizing processes these isomers occurred at approx. 1% [29]. Table 2. presents average fatty acid composition in selected vegetable oils [6, 20, 21, 22, 24, 25].

Apart from unsaturated fatty acids, sterols play a fundamental role in edible oils. In plants these compounds occur in form of free sterols, estrified sterols or estrified stanols. Phytosterols being natural components of plant-derived oils demonstrate the capacity to lower LDL- cholesterol level in blood through reduction of cholesterol absorption and, as a consequence, they inhibit the development of heart diseases. The scientific research has proven that the intake of 1.5 - 2 g of plant sterols or stanols lowers the concentration of serum LDL cholesterol by 9-14% with no effect on the HDL and triglyceride level [25, 41].

Plant oils are characterized by varied sterol content in terms of quality and quantity, but the dominant phytosterol is β-sitosterol accounting for 55-74% of total sterol content. The characteristic sterol naturally occurring in rice oil is γ-oryzanol accounting for 1.5-2.9% and demonstrating potent anti-oxidant and anti-hypercholesterolaemic properties. The refining process or the application of thermal hydrolysis of estrified sterols result in their drop in edible oils even by 20% [42].

In addition to sterols, the main components of unsaponifiable matter of plant oils are tocopherols. They are natural anti-oxidants with a different level of anti-oxidative activity resulting from their chemical composition. Tocochromanols exhibit the ability to quench reactive oxygen species (ROS) and free radicals. Tocochromanol content is expressed as an equivalent of vitamin E [21, 25].

Of oils most abundant in tocopherols are those obtained from soybeans, raspberry and black currant seeds. The predominant form of tocochromanols occurring in cold-pressed oils is γ-tocopherol. The exception is the oil derived from borage whose main tocopherol form is δ-tocopherol. Bleaching and neutralization processes might contribute to the loss of these bioactive nutrients [43].

Among carotenoids that occur in plant-based oils are the following carotenes: β- carotene, lycopene, γ-carotene, α-carotene and xanthophylls: lutein and zeaxathin [23]. According to [21, 44] flaxseed oil contains 20-115 mg/kg of carotenoids, mainly lutein (69 mg/kg). Flaxseed oil may contain small quantities of chlorophyll pigments (10-60 mg/kg), borage oil contains on average 23 mg/kg of carotenoids and only trace amounts of β-carotene, while black currant seed oil – 114 mg/kg of carotenoids including 27 mg of β-carotene. Their content in edible oils is greatly affected by refining process as it removes 98% of total carotenoids [28].

Table 2. Average fatty acid composition in selected vegetable oils.

	Fatty acids [%]										
Oils	∑SFA	∑MUFA	18:2 n-6	18:3 n-3	18:3 n-6	18:4 n-3	20:2 n-6	∑PUFA	n-6	n-3	n-6/ n-3
Olive oil	13.2	79.1	7.1	0.6	-	-	-	7.7	7.1	0.6	11.8
Rapeseeds	6.3	63.4	21.7	9.6	-	-	-	31.3	21.7	9.6	2.3
Flax seeds	9.6	17.7	15.8	56.9	-	-	0.03	72.8	15.9	56.9	0.3
Camelina seeds	7.9	31.4	13.9	38.8	-	-	-	52.7	13.9	38.8	0.4
Evening primrose seeds	8.3	7.4	73.9	0.3	9.7	0.07	-	84.0	83.6	0.4	239
Borage seeds	14.3	24.2	37.0	0.2	23.5	0.18	0.2	61.2	60.8	0.4	152
Raspberry seeds	3.7	12.0	54.5	29.1	-	-	-	83.6	54.5	29.1	1.9
Grape seeds	10.3	22.2	67.2	0.5	-	-	-	67.7	67.2	0.5	134
Amaranthus seed	26.4	34.7	38.2	0.7	-	-	-	38.9	38.2	0.7	55
Pumpkin seeds	23.5	20.8	55.6	0.2	-	-	-	55.8	55.6	0.2	278
Black caraway seeds	15.9	24.3	59.5	0.2	-	-	-	59.8	59.5	0.2	248
Sesame seeds	15.7	40.1	45	0.4	-	-	0.1	45.7	45.3	0.4	113
Blackcurrant seeds	8.8	12.0	45.2	13.2	16.9	3.3	-	78.6	62.1	16.5	3.8

Trends in fat processing technology

The current studies conducted in the fat processing sector are aimed at obtaining technology that guarantees the production of high quality and health enhancing food and low level wastes harmful to natural environment, improved raw material and by-product utilization and better energy-efficiency.

Research in the field of plant genetics and breeding focuses on engineering cultivars with advanced fatty acid composition. For this purpose genetic variability occurring in one plant species, mutagenic seeds and haploid cell mutagenesis „in vitro”, hybridization and genetic transformation technologies are applied [1]. Since the application of these solutions allows to breed plant varieties resistant to herbicides and pests, very intense genetic engineering research is being attempted.

One of the lines of inquiry is research into non-thermal technologies permitting to preserve nutritional values and maintain intact nutritional components and sensory lipids. Electric field strengths of 10 - 100 kV/cm (seed treatment whose purpose is to inactivate the microbial growth) and hydrostatic pressure of 100 - 800 MPa are employed. It, in turn, allows to conduct experiments at temperatures much lower than those using conventional technologies and to reduce energy consumption. As an example of technology using hydrostatic pressure is an extraction of high quality oil from oil seeds and protein isolates at temperature ranging 30-40°C. The chemical derivatives of methane act as a solvent. The obtained oil is characterized by a high level of anti-oxidants and vitamin E. In the case of rapeseeds, the soluble protein (SP) content in meal is twice higher than that of hexane solvent extraction [1, 45]. The aforementioned method of seed oil extraction serves also as an example of present trends to eliminate petroleum naphtha/hexane from oil production process. The research is being undertaken to improve the extraction process and application of other extraction methods for plant oils [1].

One of the methods used was the employment of membrane filtration in the fat processing such as: reverse osmosis, ultra filtration, microfiltration and electro dialysis. These procedures are very effective in the elimination of particular contaminants in fractional distillation. However, there has been limited application of these solutions in edible oil production due to a restricted output of devices and high investment costs. The processes of ultra filtration and reversed osmosis are applied e.g., while removing phospholipids from raw oils or miscela (petrol and oil mixture) refining [38]. Scientists in the field of oil refining have been conducting research into the deployment of biotechnological methods using biocatalyzers (biorefining,

„green” refining). The utilization of phospholipasis A_2 in the process of oil degumming_is the best ex ample [28, 46]. The attempts are being made to use phospholipasis A_1 for the same purpose [47].

High nutritional values and health contributing properties of edible plant oils rich in omega-3 PUFAs have lent support to the idea that the production of these oils should be increased and their product range be expanded in order to reach intended beneficiaries. At the same time, keeping a particularly low oxidative stability of these oils in mind a range of protective measures should be taken to minimize the oxidative stress beginning from starter material through processing, storage and ending with sales of finished products. Special attention should be paid to the grain quality, application of fractional separation technique for oil extraction like cold-pressing in atmosphere of inert gas or supercritical CO_2 extraction, employment of inert gas at cleaning stage, preliminary oil storage and packaging (bottling into glass containers, encapsuling or microencapsuling).

It should be noted that the application of other more active anti-oxidants (synthetic), metal chelators and methods facilitating the stabilization of omega-3 PUFAs should be taken into consideration [21].

Conclusions

Cold-pressed oils have been accepted as functional food due to the presence of the bioactive substances. The content of EFAs, sterols or tocopherols may prevent or retard the lifestyle diseases such as cardiovascular diseases, cancer, and obesity or have anti-ageing properties. Recently, numerous studies have been undertaken to evaluate the nutritional values of various cold-pressed oils. Cold-pressed oils presented in the current study possess unique fatty acid content (oils obtained from borage, flaxseed or black currant) or are characterized by a large tocopherol content (oil derived from raspberry seeds) or squalene (oil from amaranthus kernel).

Chemical composition of cold-pressed oils determines their health contributing potential and their application.

The ingestion of cold-pressed oils should be appropriate in order to balance the intake of omega-6 and -3 PUFAs.

The extraction efficiency of cold-pressing method is lower than that with the application of thermal treatment or solvents, thus the products are very often tampered with by the producers. In order to provide the consumers with the all necessary information on cold-pressed oils, the manufacturers should be concerned about the product quality advising the consumer, in particular, on origin, composition and compliance with health beneficial claims.

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