



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(3): 572-576
© 2018 TPI
www.thepharmajournal.com
Received: 24-01-2018
Accepted: 25-02-2018

MA Obodianskyi
Ivano-Frankivsk National
Medical University, Ukraine

MV Melnyk
Ivano-Frankivsk National
Medical University, Ukraine

VM Vodoslavskyi
Ivano-Frankivsk National
Medical University, Ukraine

OV Zarichanska
Ivano-Frankivsk National
Medical University, Ukraine

AR Grytsyk
Ivano-Frankivsk National
Medical University, Ukraine

Research of physico-chemical properties of plant oils

MA Obodianskyi, MV Melnyk, VM Vodoslavskyi, OV Zarichanska and AR Grytsyk

Abstract

A comparative analysis of the chemical parameters and fatty acid composition of vegetable oils (mustard oil, olive oil, sunflower oil) of foreign and domestic production was carried out. It was established that the studied samples of vegetable oils consistent with the standards. The fat-acid compositions of mustard oil, olive oil, sunflower oil of the brand «Korolivskyi Smak» unrefined, «Oleina» refined were identified. The content of erucic acid in mustard oil is negligible and is 7.58%. The main fatty acid in the studied samples is oleic acid, its content is in the range of 27.10 - 72.80% of the total content of fatty acids.

Keywords: Mustard oil, olive oil, sunflower oil, fatty acid composition, polyunsaturated fatty acids

1. Introduction

Compared to other foods, fats have the highest caloric content and are the main source of energy. Fats provide energy use of man by about 33%. However, fats perform other functions - they participate in the plastic processes of the human body, protect it from the influence of external factors, are biologically valuable food products.

Insufficient fat intake in the human body leads to central nervous system disorders, decreased of the immunological mechanisms, changes in the skin, kidneys, vision, and shortened life expectancy. At the same time, excessive amount of fats in the diet leads to obesity, atherosclerosis, gallstone and other diseases.

Some types of fats need to be consumed in accordance with the theory of balanced rational nutrition in a certain ratio. In the process of biological transformations in the body, lipids exhibit a mutual influence on the optimality of action and assimilation. The average need for an adult in fats is 90 g per day, including:

- Vegetable oil 25 - 30 g;
- Butter 20 - 25 g;
- Margarine, culinary fats 40 - 50 g.

Vegetable oils contain more vitamin A and carotene than animal melted fats, as well as phospholipids, which are completely absent in animal fats. Animal melted fats are digested worse (73 - 95%) than vegetable oils (95 - 98%). Vegetable oils are important sources of polyunsaturated fatty acids (linoleic and linolenic), which are necessary for our body to build cells, synthesize hormones, and support immunity. Polyunsaturated fatty acids are not synthesized in the body, but come only from food, regulate important vital processes of the body, and they are the best allies in the fight against atherosclerosis, add stability and elasticity to the blood vessels, reduce the sensitivity of the organism to the action of ultraviolet rays and radioactive radiation, regulate reduction of smooth muscle, etc.

Ukraine has long remained a country where the population prefers unrefined oils, primarily because of the prevailing consumption culture. In recent years, there has been a tendency to increase the proportion of refined and packaged oil in consumption.

Since the beginning of the 19th century, sunflower oil had become a national Ukrainian product. It is extremely rich in polyunsaturated fatty acids. It is one of the most important vegetable oils and has received great national economic significance. It is used directly for food, as well as for the production of margarine, culinary fats, soap and varnish industry. Sunflower oil is a part of various medical preparations (for example, sea buckthorn oil is prepared based on sunflower).

The second most popular in Ukraine is olive oil. The olive trees are not grow in Ukraine, all olive oil presented in this segment is imported. Olive oil is imported from Turkey and Greece, which are the largest suppliers of this oil in the world, and not Spain and Italy, as our society

Correspondence
MV Melnyk
Ivano-Frankivsk National
Medical University, Ukraine

used to think. As long as the number of olive trees growing in Spain and Italy is sufficient for olive oil production only for these two countries, because there is very high consumption of olive oil fats there. Therefore, almost all of the olive oil produced in Italy and Spain is sold on the domestic market and its small amount are supplied to the nearest European countries.

However, quite often the olive oil imported in Ukraine, which we consider Italian or Spanish, is in fact Turkish or Greek: it was brought to Spain or Italy in tanks and bottled under their trademarks. Unrefined olive oil is labelled "Extra Virgin", but such oil is rapidly oxidized. While the olive oil was travelled to Italy or Spain, where it was bottled, and then arrived in Ukraine - as a result, its oxide number is very high and the quality is lower.

Ukrainian consumers had created the myth about Turkish and Greek olive oil - it is considered as a less quality product. In fact, the quality of such oils is much higher than that of Spanish and Italian, which is presented on the market because it got practically from the olive garden on the shelf of the Ukrainian stores.

Olive oil is obtained by pressing the pulp of olives. The colour of olive oil - light yellow with a greenish tinge, taste and smell - nice, but specific. At a temperature of about 0°C, the oil is freezing, when heated it melts and becomes transparent. Olive oil contains less essential fatty acids and vitamin E than some other vegetable oils, but it has a good effect on the digestive system of the organism. Olive oil has become widespread in Europe thanks to the so-called "Mediterranean diet", the essence of which is to reduce the consumption of the animal fats and their replacement with the vegetable oils. The best varieties of olive oil are obtained by the method of the cold pressing (these oils are called "extra virgin"). In cooking, such an oil is used for salads and for cooking different dishes at temperatures not higher than 180°C, because at higher temperatures it decomposes.

Mustard oil is extracted by pressing the seeds of oilseed varieties of mustard - plants of the family of Cabbage. The colour of the oil is yellow, sometimes with a greenish tinge. It contains relatively little linoleic acid. The specific taste and intense coloration of mustard oil limit the possibility of its application.

Despite numerous facts of falsification of food products in Ukraine, studies on the quality and authenticity of products by domestic researchers are few [2 - 6]. That is, an appropriate review of the modern physic-chemical methods used for examination of vegetable oils.

The purpose of this work is to highlight the modern physic-chemical methods of establishing quality control of vegetable oils.

To classical methods of studying fats can be attributed: titrimetric, refract metric and aerometric. The basis of identification is the determination of the values of the iodine number, the number of saponification, the refractive index and the relative density of the vegetable oil under study and the comparison of the data with known values of these parameters. The most accurate way to establish the type of the oil is to determine their chemical composition. The components by which natural oils can be identified accurately are fatty acids (FAs) - bound to glycerides or free. The composition of natural fats includes more than 200 different

fatty acids. The predominant fatty acids are FAs with a paired number of carbon atoms from 8 to 24. The relative content of fatty acids in natural oils, their fatty acid composition, is a rather stable indicator not only for their identification, but also for quality assessment.

In Ukraine, standards are existed to regulate methods for establishing fatty acid composition of fats and oils:

- DSTU ISO 5508-2001 «Zhyry ta olii tvarynni i roslynni. Analizuvannya metodom hazovoi khromatohrafiu metylovykh efiriv zhyrnykh kyslot»;
- GOST 30418-96 «Masla rastitelnye. Metod opredeleniya zhirnokislotochnogo sostava»;
- GOST 30623-98 «Masla rastitel'nye i margarinovaya produkciya. Metod obnaruzheniya fal'sifikacii»;
- GOST 25219-87 «Kisloty zhirnye sinteticheskie. Metody opredeleniya frakcionnogo sostava gazovoj hromatografiej».

2. Materials and Methods: The object of the study had been selected 4 samples of the vegetable oils (mustard, olive, sunflower unrefined and refined). The research on the vegetable oil of the Sarept mustard seeds was carried out on the industrial sample of "Agroselprom" LLC of the «Golden Kings of Ukraine» brand. Olive oil was used by the brands «Delizia Carapelli (Firenze)». Sunflower oil «Oleina Tradytiina» refined is produced from high quality seeds, using modern technology of cleaner production, which allows preserving the benefit of the seeds in the sunflower oil. Unrefined sunflower oil of the first pressing of the highest grade «Zhyvylna kraplyna» of the brand «Korolivskyi smak» is produced by the press method at low temperatures (below 60°C) from the selective seed of Ukrainian sunflower [1].

The standard methods were used to determine the quality of the vegetable oils studied. The peroxide number was determined according to DSTU ISO 3060: 2001 [2], iodine value – according to DSTU ISO 3961: 2004 [3], acid number - DSTU 4350: 2004 [4]. The organoleptic properties of the vegetable oils were evaluated in appearance, colour, smell and taste according to DSTU 4536: 2006 [5]. The determination of the fatty acid composition was carried out in accordance with DSTU ISO 5509: 2002 [6].

3. Results and Discussion: In the basis of the identification by the analytical method is the determination of the iodine value, the number of saponification, the refractive index and the relative density of the vegetable oils under study and the comparison of the obtained data with known values of these parameters for a particular type of the vegetable oil. The most accurate way to determine the type of the vegetable oil is to determine its chemical composition. The ingredients, by which you can most reliably determine the naturalness of the vegetable oils, are fatty acids. The relative content of fatty acids in the studied vegetable oils is a rather stable indicator. Table 1 shows the physic-chemical parameters of the studied samples of the vegetable oils of domestic and foreign production. The data provides the information that among the vegetable oils, the lowest acidity is sunflower oil of the brand "Oleina" refined. The values of the iodine numbers of the studied samples of the vegetable oils fluctuated within 89-145 g I₂ / 100 g and are determined by their fatty acid compositions.

Table 1: Characteristics of chemical parameters of the studied samples of the vegetable oils

Indicators	Mustard oil	Olive oil	Sunflower oil unrefined	Sunflower oil refined
Colour number, mg iodine	7,5	30	10	9
Acid number, mg KOH / g	1,50	0,85	1,50	0,22
Peroxide number, ½ O mmol / kg	0,55	1,2 - 4,9	10,3	9,98
Iodine number, g I ₂ / 100 g	106	89	145	125

According to the current standards, the fatty acids composition of the vegetable oil is determined by gas chromatography. This method investigates a variety of fatty acids - with the content of carbon atoms from 1 to 30 and higher, saturated, branched, unsaturated, cis- and transomers, hydroxy acids. Fatty acids, especially higher, do not have sufficient volatility to carry out a gas chromatographic analysis, so they were pre-translated into volatilisation form. Sampling is based on alkaline hydrolysis

of triglycerides to free fatty acids, and then with formation of the methyl ethers of fatty acids. The resulting methyl ethers were chromatographed and determined their compositions by the period of holding peaks on chromatograms.

The results of the research, the chromatograms of methyl ethers of essential fatty acids of mustard, olive and sunflower oils are unrefined and refined are shown on Figure 1, 2, 3, 4 and Table 2.

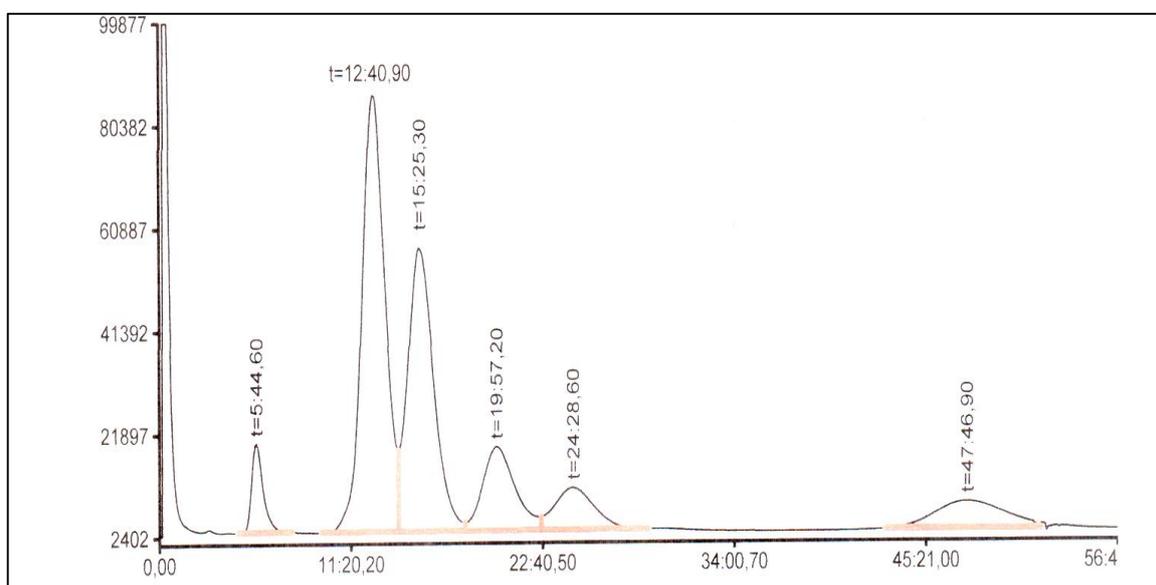


Fig 1: The chromatogram of the fatty acids of mustard oil

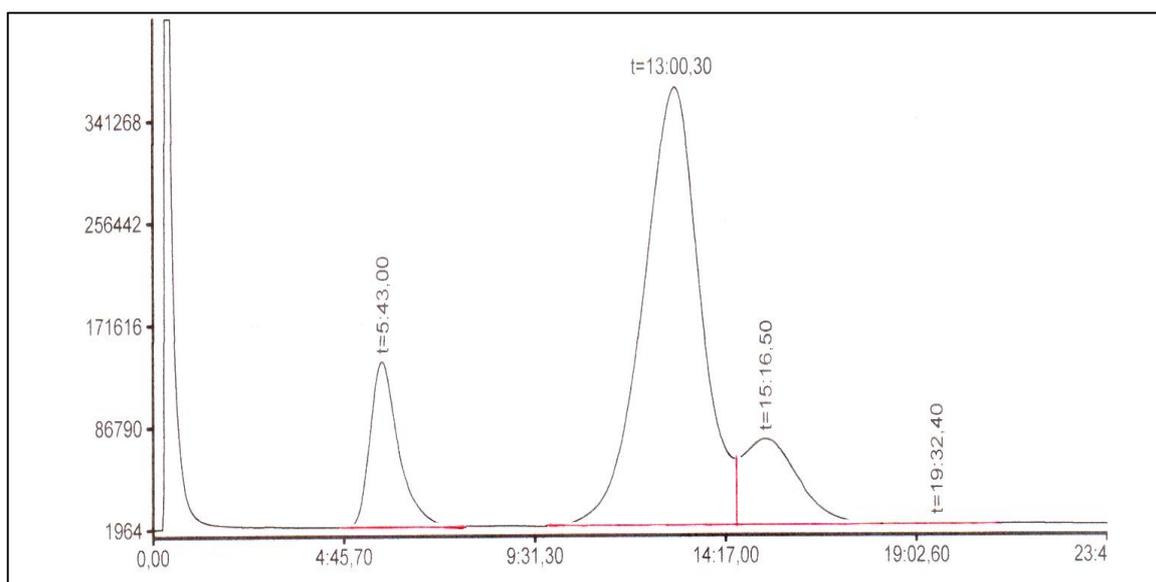


Fig 2: The chromatogram of the fatty acids of olive oil

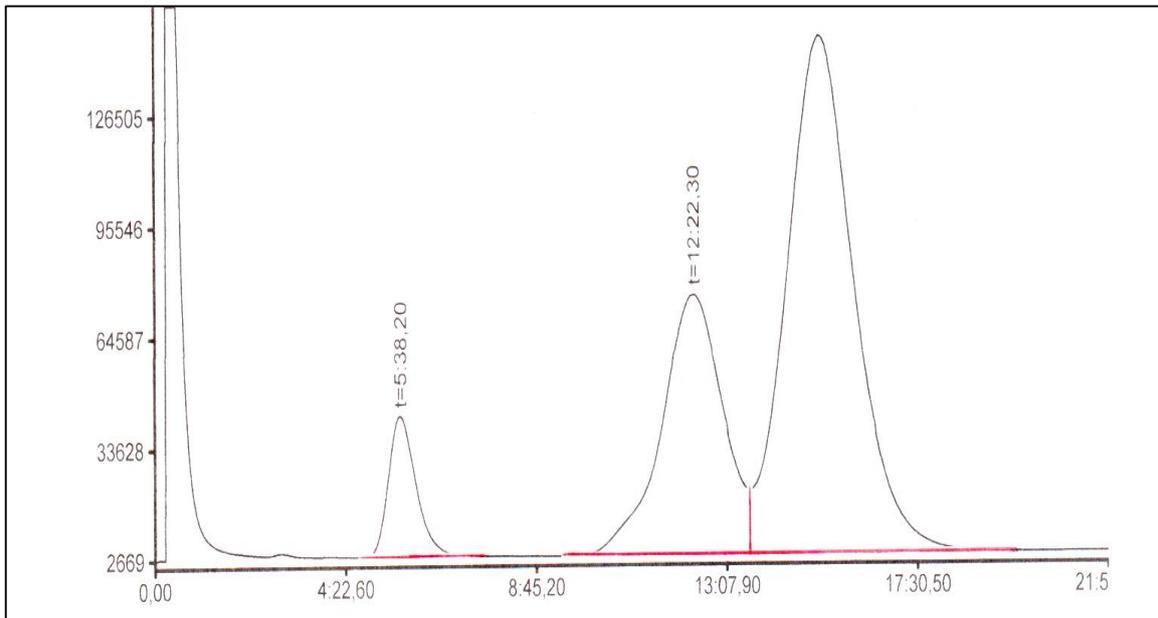


Fig 3: The chromatogram of the fatty acids of sunflower oil unrefined

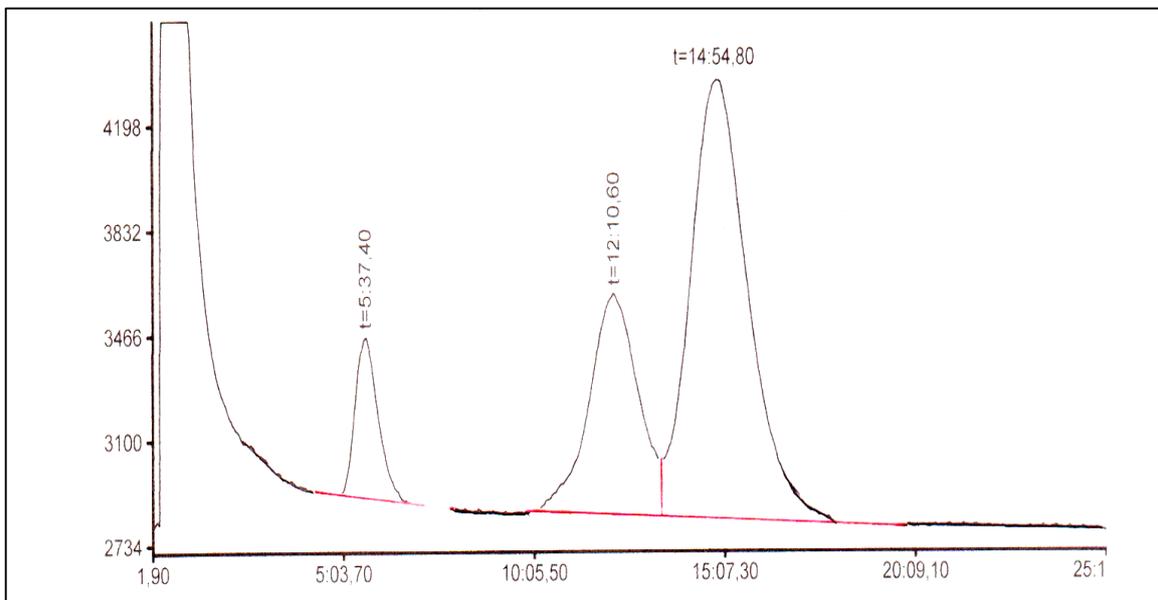


Fig 4: The chromatogram of the fatty acids of sunflower oil refined

Table 2: The content of the fatty acids in the studied vegetable oils

Vegetable oils	The content of the fatty acids, % of total weight					
	Palmitic	Oleic	Linoleic	Linolenic	Eikosanin	Erucic
Mustard oil	4,11	40,65	29,87	11,04	6,72	7,58
Olive oil	13,53	72,80	13,48	0,18	-	-
Sunflower oil unrefined	7,16	29,20	63,63	-	-	-
Sunflower oil refined	9,60	27,10	63,28	-	-	-

The data shows that erucic acid has been found in mustard oil. The main fatty acids contained in all samples were olein and linoleic acids. The content of the essential fatty acids in mustard oil and olive oil – linoleic (ω -6) and linolenic (ω -3), is 29.87% - 11.04% and 13.48% - 0.18%, respectively.

4. Conclusions

1. A comparative analysis of chemical indicators of quality and composition of mustard, olive and sunflower oils of unrefined and refined domestic and foreign production has been carried out.
2. During the experiment, it has been found that samples of sunflower-seed oils of unrefined and refined peroxide and iodine numbers comply with the norms of DSTU 4492: 2005.

5. References

1. ДСТУ 4492:2005. Олія соняшникова. Технічні умови.
2. ДСТУ ISO 3960:2001 «Жири та олії тваринні і рослинні. Визначення пероксидного числа».
3. ДСТУ ISO 3961:2004 «Жири тваринні і рослинні та олії. Визначення йодного числа».
4. ДСТУ 4350:2004 «Олії. Методи визначення кислотного числа».
5. ДСТУ 4536:2006 «Олії купажовані. Технічні умови».

6. ДСТУ ISO 5509:2002 «Жири та олії тваринні і рослинні. Приготування метилових ефірів жирних кислот».

The authors:

1. M.A. Obodianskyi, M.V. Melnyk, V.M. Vodoslavskyi, O.V. Zarichanska, A.R. Grytsyk
2. Obodianskyi Mykhailo Anatoliiovych – Doctor of Philosophy, Senior Research Officer at the Sciences Department Ivano-Frankivsk National Medical University.
3. Melnyk Maria Volodymyrivna – Doctor of Philosophy, Associate Professor at the Department of Pharmacy Ivano-Frankivsk National Medical University.
4. Vodoslavskyi Vasyl Myroslavovych – Doctor of Philosophy, Associate Professor at the Department of Pharmacy Ivano-Frankivsk National Medical University.
5. Zarichanska Olena Vasylivna – Doctor of Philosophy, Associate Professor at the Department of Pharmaceutical Chemistry Vinnytsya National Pirogov Memorial Medical University
6. Grytsyk Andriy Romanovych - Doctor of Pharmaceutical Sciences, Head of the Department of Pharmacy Ivano-Frankivsk National Medical University.