ALIMENTARY AND DIETARY IMPORTANCE OF THE VEGETAL OILS

Paula DOROBANȚU[1], D. BECEANU[1]

University of Agronomy Sciences and Veterinary Medicine of Iasi, Faculty of Horticulture
e-mail: dorobantu.paula@yahoo.com, dumitru.beceanu@gmail.com

The alimentary, dietary and therapeutical value of the vegetal oils is explained by their complex composition that combines a very large palette of active components and special features to stimulate body immunity, eliminate toxins and re-establish the energetic balance. By their practical use and their balanced chemical composition, the oleaginous plants are largely spread being cultivated in a higher or smaller proportion all over the world. In the current diet, the most used vegetal oils are the ones coming from the sun flower seeds, soy, rape, olive tree and palm tree. There is also the perspective and production of bio-diesel. Edible oils contain a significant quantity of vitamins F also called anti-dermic vitamins. They are represented by the essential fat acids: linoleic, linolenic, arahidonic. The first two are found in the food oils of vegetal origin. Vegetal oils especially the crude ones contain carotenes, the richest being the palm tree oil with values of 50 mg α and β carotenes/ 100g. The white box thorn oil is also an important source of carotenes. These contribute to the anti-oxidant system for the defense of the body against the free radicals. Poorer in carotenes are the nut oil, pea nut oil, sun flower oil and the grape oil. Certain essential acids (arahidonic acid) may be converted in the body, in prostaglandins, substances with a strong physiological and pharmaco-dynamic activity. Vegetal oils contain in different ratios saturated, mono and polyunsaturated fat acids. An ideal vegetal grease must contain equal quantities of the three acid categories. The palm oil, the soy oil and the rape oil are close to this ideal ratio.

Keywords*: vegetal oils, essential fat acids, dietary value.*

Thousands of years ago, people managed to extract from plants yellowish and viscous liquids they called greases (for example cruet, walnut oil) or oils. Consumed as foods, they were extremely consistent and energizing and applied on the skin they had a nourishing and protecting effect. The most famous was the olive oil.

MATERIAL AND METHODS

We used a vast bibliographic material so as to evaluate the alimentary and dietary importance of oils.

We insisted on some characteristic aspects related to type and value of some assortments sometimes less known and highlighted.

RESULTS AND DISCUSSION

Vegetal oils are natural complex mixtures of lipids simple-glycerides (triacil glycerols), that also contain 1-4% very diverse accompanying substances; they are liquids at the environment temperature (18-22º C).

The usual oleaginous **raw materials** come from: oleaginous food plants, oleaginous textile plants and diverse oleaginous residue. The vegetal oils are found in the nature in the plant tissue being concentrated in seeds, in the pulp, and the fruit stone, in tubercles or germs as reserve substances.

The most spread oleaginous plants are: soy (China, U.S.A.), pea nuts (India, China, and Nigeria), palm tree (Africa, Malaysia), sun flower (Argentina, Canada, USA, and Romania), olive tree, rape, castor-oil plant, and cotton (USA, India).

Soy *(Glycine hispida)* possesses exceptional qualities as a source of superior quality protein and as a supplier of significant quantities of oil – it does not contain cholesterol, this oil used regularly helps to prevent blood clots. The soy seed oil contains vit. E, riboflavin, vit. B1, vit. B2, and minerals Fe, Ca, Mg. Seeds contain 20% oil.

Palm tree (African palm tree oil, *Elaeis guineensis*). The palm tree oil occupies one of the first places in the world in terms of consumption. It is rich in β-carotene and it is also a rich source of vitamin E. Due to its contents of linoleic acid it is an appreciated dietary oil. The palm tree fruits contain 46% oil.

Rape (*Brassica napus)* is cultivated in Romania in Dobrogea and Banat. In other countries there are also cultures of black mustard (wild mustard) or wild rape in the wheat fields. The contents of oil vary between 36-42% and 23-28% for the wild rape.

Sun flower *(Helianthus anuus)*. The sun flower oil, obtained by cold pressing has a dark color and a characteristic flavor. It is very rich in vitamins A and E, in non-saturated fat acids as well as substances with anti-infectious, stimulating for the hormonal activity and regenerative effects. The seeds contain 30-50% oil.

Olive tree *(Olea europaea)*. Having a greenish color (due to the contents of chlorophyll) and an easily flavored taste the olive oil is an excellent regenerator, a protector of the blood vessels and the cardiac system and an effective anti-infectious. The effectiveness of the olive oil in the treatment of some cancer forms was investigated successfully by a team of American researchers. The olive oil is rich in poly-phenols (antioxidants preventing the appearance of cardiac and oncologic disorders). The fruits contain 40% oil.

Table 1

Chemical composition of some vegetal oils

Name of product, 100g	Calories	Total fats%	Saturated fat acids
Soy oil	104	20	2
Canola oil	124	40	1

Sun flower oil	120	30-50	1,4
Safflower oil	120	47	0,8
Corn oil	120	20-57	1,7
Pea nut oil	120	37-50	2,3
Sesame oil	120	15,9	1,9
Palm tree oil	120	46	6,7
Olive oil	119	40	1,8
Coconut oil	413	48,1	41,7

The chemical composition of the vegetal oils is given by the different contents in saturated fat acids, mono and polyunsaturated acids, vitamins F and other vitamins (D, E, K) or carotenes (table 1).

Table 2

Proportion of unsaturated fat acids (mono / poly)

Oil	Acid				Vitamin	
	Linoleic, %	Linolenic, %	Arahidonic, %	Monounsaturated, %	β-carotene, mg	E, mg
Nut	48-72	3-10	1-2,5	22,8	0,1-0,5	10,8
Soy	52-60	7-10	3-6	20,5	0,17	15
Sunflower	51-58	0,4	0,6-0,8	22,5	0,04	56
Hemp	53-69	16-24	1,1	-	NC	57
Cotton	42-54	11	0,2-0,4	17,8	0,16	99
Pea nuts	13-27	-	2-4	45,2	0,1-0,5	34
Rape	15-29	1-7	0,4-16	64,3	NC	50
Olives	4-12	-	-	71	NC	12
Sesame	42	0,5	-	45,4	NC	92
Corn	34-35	1,5	-	24,2	NC	93
Grapes	67	0,7	-	18,3-29,7	0,1-0,5	32
Tomatoes	37,6-42,8	-	-	38,7-44,3	NC	NC
Palm tree	10,5	35-65	-	12-34	50	10-130
Linseed	7-27	3-6	-	20,2	NC	NC

To improve the oil stability especially to insure their clear commercial aspect required by consumers, the crude oils are refined.

By refining they ameliorate a series of properties such as: free acidity, color, taste and smell, transparency and preservability. For this purpose they eliminate the unwanted substances such as: phosphatides, mucilage-gums, free fat acids, coloring pigments (chlorophylls, carotenoids), odorizing substances (aldehydes, cetones), waxes and pesticides.

Table 3

Characteristics of some edible refined vegetal oils

Physical-chemical characteristics	Sun flower	Soy	Corn germs
Free acidity (oleic acid), %max	0,35	0,40	0,30
Water and volatile substances, %max	0,13	0,15	0,15
Impurities insoluble in ethylic ether, %max	0,05	0,05	
Soap %max	0,06	0,07	0,07
Non-saponifying organic substances, %max	1,0	1,2	2,0
Iodine color mg I/100cm³, max	9	18	10

These give oils their color, modify their taste and smell, determine the unwanted processes during oil processing and affect unfavorably the oil stability during storage.

By refining, once with the impurities mentioned above, they also eliminate some accompanying valuable substances: sterols, lipo-soluble vitamins: A, D, E, K. They also register an important oil loss. By refining oils may be hardly told ones from the others in terms of origin.

Tocopherols should be kept as much as possible in oil due to their anti-oxidative action. Sterols and Tocopherols, very important substances, are inert from the viewpoint of taste and smell but they behave as biologically active substances with vitamins and an anti-cholesterol role (vitamin E - tocopherols, phyto-sterols – pro-vitamins D). The elimination of these substances from oil during refining is partial.

Table 4

Variation of contents in tocopherols and sterols in the crude and refined oils

Type of oil		Tocopherols mg/100g	Sterols in non-saponifying subst.,%
Sun flower	Crude Refined	68,8 62,0	1,31 1,04
Soy	Crude Refined	152-212 110-175	1,77 1,39
Rape	Crude Refined	41-50 25-42	1,11
Corn germs	Crude Refined	0	1,93 1,43

Palm tree oil: 44% oleic acid, 10% linoleic acid, 40% palmitic acid, 5% stearic acid. Obtained by pressing and refining, the palm tree oil is rich in vitamin E (30 mg/100g); it has no smell and does not influence the taste of prepared foods. When frying, the oil does not produce smoke, make foam or splash. It has the melting point at 24ºC and the smoking point at 230ºC and the high contents of vitamin E increases its resistance to oxidization (rancidity). It has the tendency to solidify at temperatures under 18º C, the oil becoming white opaque. This modification does not influence its qualities it may be brought back to liquid state and gold-yellow color by an easy heating.

The olive oil is characterized firstly by acidity varying between 0,6-0,8% - for very fine oils up to 6,6% - for the inferior oils according to International Olive Oil Council. It may be of three types:

- extra virgin – it is the purest oil, it has the lowest acidity level; it is obtained by mechanic pressing of high quality olives, a procedure that does not need the use of other chemical substances or an increased temperature, it contains natural anti-oxidants that help it not to become rancid,
- virgin – it is a more acid oil and is obtained by pressing common olives even for 2-3 times,
- extraction oil (*di sansa*) – an oil extracted from pulp and stones remained after a second pressing of inferior quality olives; in this process they use different solvents and a high temperature.

The sun flower oil occupies the fourth place after soy, palm tree and rape.

The refine sun flower oil stands out by the following organoleptic properties: clear aspect, without suspensions or sediments, insoluble by heating at 60ºC, pleasant taste and smell, without the specific taste or smell of seeds, without a bitter or rancid taste.

The type obtained by the method of extraction through cold pressing insures the preservation of color, smell and natural taste. This obtaining method insures the preservation in oil of vitamins and microelements in natural state and in quantities very close to the quantities contained in the sun flower seeds. The consumption advantages of the cold pressing oil as compared to the refined one are: the reduced level of the acidity index (1,5), the reduced level of the cholesterin contents (traces), of the composition of aliphatic acids, the contents of linolenic acid of 66,3%, as well as the preservation of smell, taste and natural color of oil.

Table 5

More important physical-chemical properties for the main vegetal oils

Constant	Raw material from which oil is obtained							
	sun flower	soy	corn germs	nut	peanuts	rape	linseed	castor oil
Density kg/m³	920-925, 15ºC	922-934, 15ºC	921-926, 15ºC	923-927, 15ºC	911-925, 15ºC	910-924, 20ºC	920-936, 20ºC	NC
Refraction index at tºC	1,4736 1,4748 25ºC	1,4742. 1,4748, 25ºC	1,4689. 1,4736, 15ºC	1,4698 1,4710 40ºC	1,468. 1,472, 20ºC	1,4710 1,4729 25ºC	1,4789 1,4851 25ºC	1,4789 1,4851 25ºC
Viscosity at 20ºC	12-13	8-9	9-11	NC	NC	17-18	7-8	16-17, 50º C
Melting point, ºC	-16..18	-20..23	-11	NC	NC	-9	-20	-10...-12
Iodine index	119-135	114-140	111-130	132-162	82,7-105,1	94-122	168-205	80-90
Saponification index	184-198	186-196	188-198	188-197	185-206	167-189	188-196	176-187

Peanut oil (*Arachis hypogea)* is obtained by two or three cold pressings, the third being made to a high temperature of about 70ºC. The oil obtained falls into two qualities: 1st quality with an acidity index of maximum 1 and the 2nd quality with an acidity index of maximum 1,5. It is colorless or very weakly colored in yellow, with a smell and taste resembling the olive oil and is used for cooking.

The soy beans, the corn germs, the grapes seeds that are raw materials poorer in oil are not submitted to pressing but they are only crushed and flattened for extraction with solvents.

CONCLUSIONS

A diet rich in oils containing polyunsaturated fat acids means hypo-cholesterol determining a reduction of the contents in serous cholesterol, diminishing the manifestations of atheromatosis and through this the risk of cardiac infarction.

The refines oil is the most used one. It is obtained by pressing and is processed at high temperatures. It is an impurity-free oil but it has reduced nutritive properties.

The cold pressing oil is the healthiest one. It is extracted by cold processing thus preserving its nutritive features and it should be used much more in the human diet.

BIBLIOGRAPHICAL REFERENCES

1. Banu, C., - *Procesarea materiilor prime alimentare şi pierderile de substanţe biologic active,* Ed. „Tehnică" UTM, Chişinău, 2003.
2. Banu, C., Preda N., - *Produsele alimentare şi inocuitatea lor,* Ed. Tehnică, Buc., 1982.
3. Boeru, Ghe., Puzdrea, D., - *Tehnologia uleiurilor vegetale,* Ed. Tehnică, Buc., 1980.
4. Gunstone , Frank, D.,- *Vegetable Oils in Food Technology,* Blackwell Publishing, 2002.
5. Neamţu , Gavril, - *Biochimie alimentară*, Ed. Ceres, Buc., 1997.
6. Schueneman Martha, - *Ghidul caloriilor, carbohidraţilor şi colesterolului,* Chartwell Books, Inc., 2004.
7. Stoll, Andrew L., - *Factorul omega 3,* Elena Francisc Publishing, 2005.
8. XXX- Iorga, E., Popel, S., Parşacova, L., *Perspectivele producerii uleiului de rapiţă în Republica Moldova*, Institutul de Cercetări Ştiinţifice şi Proiectări Tehnologice în Industria Alimentară, Chişinău.
9. www.evenimentul.ro
10. www.sanatate.jurnalul.ro
11. www.en.wikipedia.org
12. www.scielo.br/scielo.
13. www.cyberlipid.org/extract.
14. www.bioproduct.ro
15. www.leshop.ro
16. www.gate.md/mbinet/industries/oils