Fatty Acids Composition of Plant Oils

Tamara Tultabayeva, Urishbay Chomanov, Bakhtiyar Tultabayev,
Alibek Tursunov, Aruzhan Shoman, and Rabiga Kassymbek

***Abstract*---** Wheat germ oil differs from many vegetable oils very high (over 70%) and most balanced content of polyunsaturated fatty acids, linoleic acid (ω 6) and linolenic (ω 3), oleic (ω 9). Also in the wheat germ oil in much smaller quantity contain saturated fatty acid (palmitic, stearic and others.). We have investigated the fatty acid composition of wheat germ oil, which was obtained by the new technology developed by us cold pressing.

Keywords **---** Wheat germ oil, sunflower oil.

I. INTRODUCTION

CURRENTLY, there is a need to develop new and improve existing technologies for complex and deep processing of secondary raw materials, as every year in Kazakhstan in the development of 5 million. Tons of flour produced more than 100 thousand tons of wheat germ.

At the largest mill combine Kazakhstan installed equipment company "Buhler" in the technological scheme which provided for the allocation of the embryo as one of the by-products of grain processing. On the other enterprises embryo almost completely depersonalized in the bran, which go mostly to feed farm animals.

Thus, in the Republic of wheat embryos not treated, while the oil contained in them (7-8%) differs from many vegetable oils high in polyunsaturated fatty acids, vitamin E and group B /1/.

In this regard, we have developed a technology for processing of wheat germ oil in order to obtain enhanced bioavailability. The developed technique involves obtaining wheat germ oil by cold pressing, which allows to preserve the biochemical properties of the oil.

Tamara Tultabayeva[1] is professor, doctor with «The Kazakh scientific research institute overworking and the food-processing industry» Ltd Almaty, Kazakhstan, (corresponding author's phone: +7(727) 3960419; fax: +7(727) 3960419;e-mail :tamara_tch@list.ru).

Urishbay Chomanov[2], is member of the NAS Academy, professor, doctor with «The Kazakh scientific research institute overworking and the food-processing industry» Ltd Almaty, Kazakhstan, (e-mail: chomanov_u@mail,ru).

Bakhtiyar Tultabayev[3] is PhD student with «The Kazakh scientific research institute overworking and the food-processing industry» Ltd Almaty, Kazakhstan, (corresponding author's phone: +7(727) 3960419; fax: +7(727) 3960419; e-mail: baha-baha63@mail.ru).

Alibek Tursunov[4] is M.Sc.Eng. with «The Kazakh scientific research institute overworking and the food-processing industry» Ltd Almaty, Kazakhstan,. (e-mail: alibektursunov@mail.ru).

Aruzhan Shoman[5] is M.Sc.Eng. with «The Kazakh scientific research institute overworking and the food-processing industry» Ltd Almaty, Kazakhstan,. (e-mail: shoman_aruzhan@mail.ru).

Rabiga Kassymbek[6] is student in South Kazakhstan State University named after M. Auezov. Shymkent, Kazakhstan. (e-mail: firabiga@mail.ru).

This valuable product is used not only in the food industry as all kinds of food additives, but also in various fields of medicine for the treatment of many diseases /2/.

Sunflower oil is a traditional product of daily consumption, therefore we obtained by the new technology, wheat germ oil, sunflower oil introduced into the oil in an amount of 1% of the (enriched) to improve its quality and high resistance to oxidation.

II. MATERIALS AND METHODS

GLC we defined the following fatty acid composition of vegetable oils: sunflower, wheat germ oil and sunflower oil-rich, containing a large number of essential (essential) fatty acids ω 3, ω ω 6 and 9.

Gas chromatographic analysis of fatty acid composition of milk fat is one of the principal methods of determining the lipids therein.

Gas chromatographic analysis was performed on a gas chromatograph "Shimadzu GC 2010" with a flame ionization detector, after translation into the methyl esters by the method interstate standard (GOST 30418-96) transesterification of fat using sodium methoxide in methanol. Separation of the methyl esters were carried out on a capillary column 30 m in length and an internal diameter of 0.25 mm, carrier gas of hydrogen was passed at 40 ml / m. Separation was performed on a polar stationary phase SUPELCOWAX 10 with increasing temperature from 60C to 180C to 200C at a rate per minute, maximum temperature in the column 2300S /3/.

Polar stationary phase enables the separation of the methyl esters of fatty acids of carbon number and unsaturation degree. Calculation of the components of milk fat of all samples was performed by the internal normalization. As the standard was specified mixture of methyl esters of individual fatty acids - saturated from $C_{4:0}$ (oleic) and $C_{22:0}$ (behenic), branched (iso - and ante-iso) of $C_{13:0}$ (iso- tridecyl) to $C_{18:0}$ (iso-stearic) from the monounsaturated $C_{10:1}$ (caproleic) to $C_{20:1}$ ω9 (gondoinic) and polyunsaturated $C_{18:2}$ ω6 (linoleic), $C_{18:3}$ ω6 (γ- linolenic), $C_{18:3}$ ω3 (α - linolenic) and $C_{20:4}$ ω6 (arachidonic).

III. RESULTS AND DISCUSSION

Nutritional value of wheat germ oil is due to a high content of unsaturated fatty acids. On the main physiological effect is linoleic acid, arachidonic turning into, helped present in wheat germ oil vitamins B and E /4/.

Chromatograms of methyl esters of fatty acids of plant oils is given in Fig. 1, 2 and 3. The fatty acid composition of these oils is given in Tabl. 1.

As can be seen from Tabl. 1, the quantitative content of saturated fatty acids of $C_{14:0}$ and $C_{20:0}$ in the oil of wheat germ (WGO) compared with sunflower oil above except stearic acid

3.15 and 3.60%, respectively. It is also possible to note the high content of linoleic acid $C_{18:2}$ ω 6 Sunflower oil 64.03%.

As a result of making a sunflower oil, 1% of wheat germ oil is observed increase in the quantitative content of fatty acids, in particular ω 3 essential acid (α-linolenic) with 0.14 to 0.68% (5 times).

Also, the analysis showed that the minimum wage has an inhibitory effect and its introduction in the amount of 1% increases the oxidative stability of sunflower oil in 1.1-1.2 times. Use of the additive more than 1% is impractical because it leads to higher sunflower oil. Longer storage of enriched sunflower oil can be explained by the high content of oxidants, such as tocopherols contained in WGO.

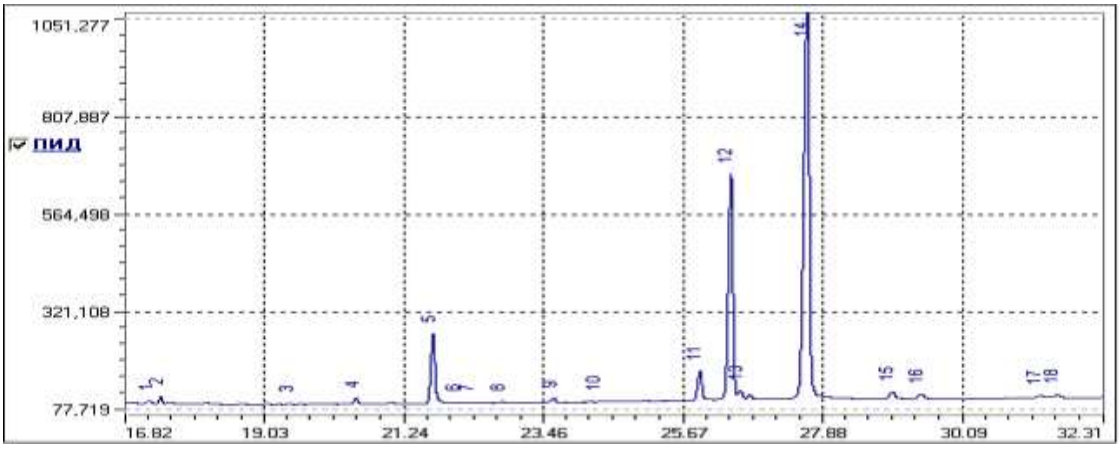

Fig. 1 wheat germ oil chromatogram

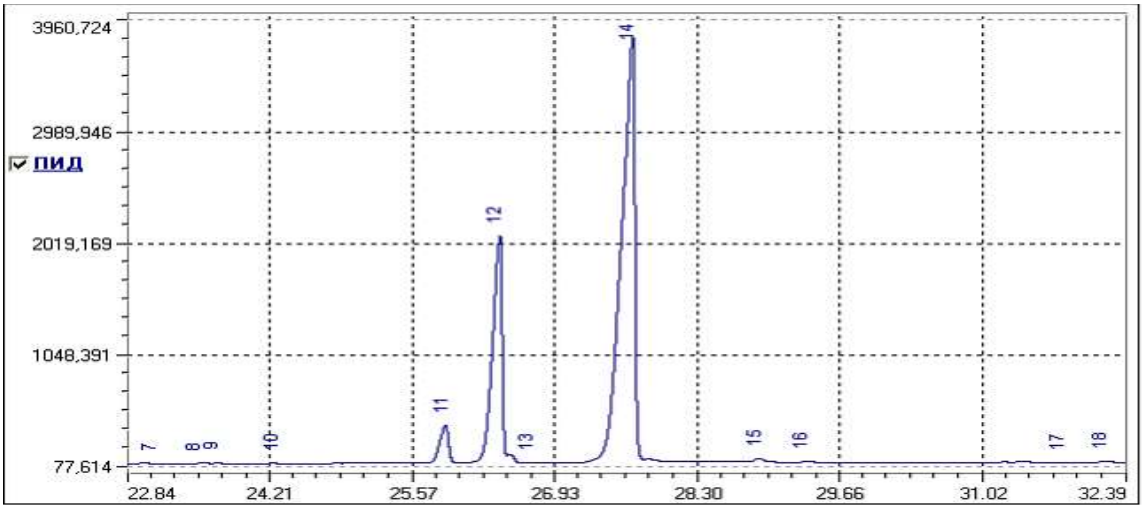

Fig. 2 sunflower oil chromatogram

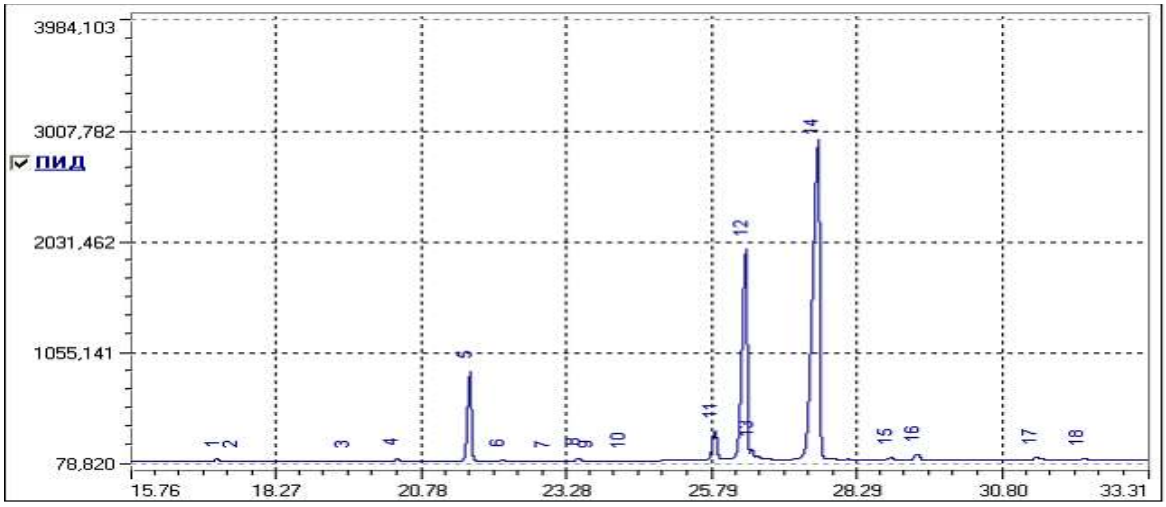

Fig. 3 enriched sunflower oil chromatogram

TABLE I
THE FATTY ACID COMPOSITION OF PLANT OILS

Acids code	classification	Fatty acid content,%		
		Wheat germ oil	sunflower oil	Enriched sunflower oil
Saturated fatty acids (EFAs)				
Myristic acid $C_{14:0}$		0,42±0,01	0,08±0,01	0,15±0,01
pentadecanoic acid $C_{15:0}$		0,06±0,01	0,02±0,01	0,02±0,01
palmic acid $C_{16:0}$		7,39±0,01	6,60±0,01	8,01±0,01
margaric acid $C_{17:0}$		0,43±0,01	0,07±0,01	0,02±0,01
stearic acid $C_{18:0}$		3,15±0,01	3,60±0,01	3,17±0,01
arachidonic acid $C_{20:0}$	H-	0,42±0,01	0,02±0,01	0,39±0,01
Branched (iso- anteiso-) saturated fatty acid				
Iso - myristic $C_{14:0}$	Изо-	0,23±0,01	0,13±0,01	0,20±0,01
Iso-margaric acid $C_{17:0}$	изо-	0,17±0,01	0,10±0,01	0,03±0,01
Monounsaturated fatty acids (MUFA)				
pentadecenic $C_{15:1}$	ω5	0,42±0,01	0,08±0,01	0,23±0,01
7-hexadecenoic acid $C_{16:1}$	ω9	0,13±0,01	0,06±0,01	0,10±0,01
palmitoleic acid $C_{16:1}$	ω7	0,17±0,01	-	-
heptadecenoic acid $C_{17:1}$	ω7	0,03±0,01	0,03±0,01	0,04±0,01
oleic $C_{18:1}$	ω9	25,70±0,01	23,64±0,01	26,85±0,01
vaccenic acid $C_{18:1}$	ω7	1,55±0,01	0,83±0,01	1,39±0,01
gondoinic acid $C_{20:1}$	ω9	0,59±0,01	0,11±0,01	0,14±0,01
Polyunsaturated fatty acids (PUFAs)				
linoleic acid $C_{18:2}$	ω6	57,31±0,01	64,03±0,01	58,06±0,01
linolenic $C_{18:3}$ -γ	ω6	1,13±0,01	0,36±0,01	0,24±0,01
linolenic $C_{18:3}$ -α	ω3	0,70±0,01	0,14±0,01	0,68±0,01

IV. Conclusion

Thus vegetable oils (wheat germ oil, sunflower oil and sunflower enriched) are a rich source of essential (indispensable) polyunsaturated ω6 ($C_{18:2}$ linolenic) acids. These oils have not only the nutritional value and physiological activity. There is a definite relationship between the content of cholesterol and dietary intake of polyunsaturated fatty acids, the more highly unsaturated fatty acids in the diet, the lower the cholesterol content in the blood. When consumed in large amounts of food of animal fats containing a large quantity of high saturated fatty acids leads to the formation of cholesterol esters and the subsequent development of atherosclerosis and thrombus formation.

It is therefore necessary to use fats useful balanced fatty acid composition of the unsaturated, monounsaturated (ω9) and ω3 and ω6 polyunsaturated fatty acids.

References

[1] Nechaev A.P., Kochetkova A.A. Functional vegetable oils // Fat industry. 2005. No3. P. 20-21.
[2] Kulakov S.N. Bajkov V.G., Bessonov V.V., Nechaev A.P., Tarasov V.V Features of vegetable oils and their role in nutrition // Fats industry. 2009. No3. P. 16-20.
[3] GOST 30418-96 Interstate standard. Vegetable oil. Method for determination of fatty acid composition.
[4] Prokopenko L.G., Boynyazheva L.I., Pavlov E.V. Polyunsaturated fatty acids in vegetable oils // Fats industry. 2009. No2. P. 11-12

Tamara Tultabayeva is Head of the Laboratory, "The technology of processing and storage of animals' products" Was born in 19th of March 1966 in the Uzbek SSR, Tashkent region.

In 1988 graduated from the Technology Faculty of Semipalatinsk institute of technology of the meat and dairy industry as an engineer-technologist of milk and dairy products. Since 1988 to 1996 she worked at the Almaty regional dairy industrial complex.

In 2000 she pass Ph.D. defense on the theme "Development of technology for dairy products on the basis of camel's milk with bioadditive."

Since 2008 he has been working in the «The Kazakh scientific research institute overworking and the food-processing industry» in the position of head of the laboratory.

In 2010 she passed doctoral dissertation on theme "Scientific and practical bases of technology improvement of combined soft cheese with the fermented vegetative additives»

She has more than 110 scientific publications in national and international publications, the author of two analytical reports on national and combined dairy products. Total work experience is 27 years, researcher experience – about 18 years. In leading position is about 10 years.