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The Study of *Daucus Carota subsp. Sativus* Fruits Fatty Acid Composition of 'Olenka', 'Kharkivska Nantska' and 'Yaskrava' Varieties.

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ABSTRACT

The study of fatty acids composition in *Daucus carota subsp. sativus* fruits of "Yaskrava", "Nantska Kharkivska" and "Olenka" varieties was conducted by gas chromatography technique. According to the analysis results, 13 fatty acids were identified in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties. Only 10 fatty acids were identified in *Daucus carota subsp. sativus* fruits of "Olenka" variety. Unsaturated fatty acids quantitatively dominated in all types of *Daucus carota subsp. sativus* plant raw material. Their content in *Daucus carota subsp. sativus* fruits of "Yaskrava" (86.02±2.15%) and "Nantska Kharkivska" (87.63±2.19%) varieties was almost the same. Their content in *Daucus carota subsp. sativus* fruits of "Olenka" variety (70.63±1.77%) was 1.2 times lower. Oleic acid dominated among unsaturated fatty acids in all the types of studied plant raw material. Its content was 70.40±1.76% and 72.67±1.82% in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" types respectively. It was 49.03±1.23% in *Daucus carota subsp. sativus* fruits of "Olenka" variety. Moreover, linoleic acid was accumulated at a high amount in all the analyzed samples.

Keywords: Daucus carota, fruits, "Yaskrava" variety, "Nantska Kharkivska" variety, "Olenka" variety, fatty acid composition, gas chromatography.

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INTRODUCTION

18 million of people die from cardio-vascular diseases every year. Insults and heart attacks cause 80% of all the deaths [1].

Due to the results of the studies conducted by Japanese and Indian scientists, omega-3 unsaturated fatty acids contribute to cholesterol and lipoproteins of high density level lowering. Cholesterol and lipoproteins of high density are the factors that influence the development of cardio-vascular diseases. Omega-3 unsaturated fatty acids show angioprotective and anti-inflammatory action. Their ability to regulate sodium and calcium balance in blood influences the arrhythmia development [2, 3]. Moreover, scientists from the USA presented the data according to which ω-3 unsaturated fatty acids therapy has a positive influence on the patients' recovery dynamics after the acute myocardial infarction and acute heart failure [64

The carrot *(Daucus carota subsp. sativus (Hoffm.) Arcang.)* is a subtype, a domesticated form of a wild carrot (*Daucus carota L.*). It is a well-known agricultural root culture. According to the literature data, this plant contains phenolic compounds, including flavonoids and coumarins, carotenoids, polyacetiylene and terpene compounds, polysaccharides [5-9]. This complex of biologically active compounds, due to numerous studies, shows antioxidant, antidiabetic, antimicrobial, antidepressant, anti-inflammatory, reparative, antitumor, gastroprotective, hepatoprotective and nephroprotective action. Moreover, extracts obtained from different organs of *Daucus carota subsp. sativus* have hypotensive, ionotropic and hypocholesterolemic effects. They act as miorelaxants on smooth muscles, lower intraocular pressure and have a cardioprotective effect [5-9].

Earlier, Iraqi, Turkish and Swiss scientists studied fatty acids content in *Daucus carota subsp. sativus* fruits. The obtained data showed that this plant raw material contains a high amount of unsaturated fatty acids with the dominant content of oleic (about 8%), linoleic (more than 43%), linolenic (from 10% to 12%) and petroselinic (up to 11%) acids [5, 6, 9]. As the plant chemical content can differ significantly depending on the variety, place and growing conditions, the study of fatty acid content of *Daucus carota subsp. sativus* fruits of "Yaskrava", "Nantska Kharkivska" and "Olenka" varieties popular in Ukraine was of a great interest for their further standardization.

The aim of the work was the study of a qualitative composition and quantitative content of fatty acids in *Daucus carota subsp. sativus* fruits of "Yaskrava", "Nantska Kharkivska" and "Olenka" varieties by gas chromatography technique.

EXPERIMENTAL

Daucus carota subsp. sativus fruits of "Yaskrava", "Nantska Kharkivska" and "Olenka" varieties harvested at the territory of Research Farm "Research Institute of Vegetable and Melon Studies of the National Academy of Science of Ukraine" in Merefa, Kharkiv region (Ukraine) in 2016-2017 years were chosen as the research objects.

The lipophylic fractions of wild carrot fruits (*Daucus carota)* were obtained by hexane with following hydrolysation. The obtained hydrolyzed compounds were studied by gas chromatography technique based on the fatty acids methyl esters with their further determination [10].

Fatty acids methyl esters were analyzed by "Selmichrom-1" chromatograph with flame ionization detector. A stainless steel column of 2.5 m length and 4 mm diameter was used. Inertone processed with 10% diethyleneglycolsuccinate (DEGS) was used as an immobile phase [10].

The following chromatographing setting were chosen: column thermostat temperature – 180°C, evaporator temperature – 230°C, detector temperature – 220°C, the flow velocity of carrier gas(nitrogen) – 30 cm^3/min, a sample volume – from 2 mm^3 of methyl esters solution in hexane [10].

Fatty acids were identified by the retention time of the peaks compared to the same meaning of the standard mixture. Calculation of the composition of methyl esters was carried out by inner normalization method. The standards of saturated and unsaturated fatty acids methyl esters produced by "Sigma" were taken as control samples. Fatty acids methyl esters modified by Peysker method were analyzed which provided

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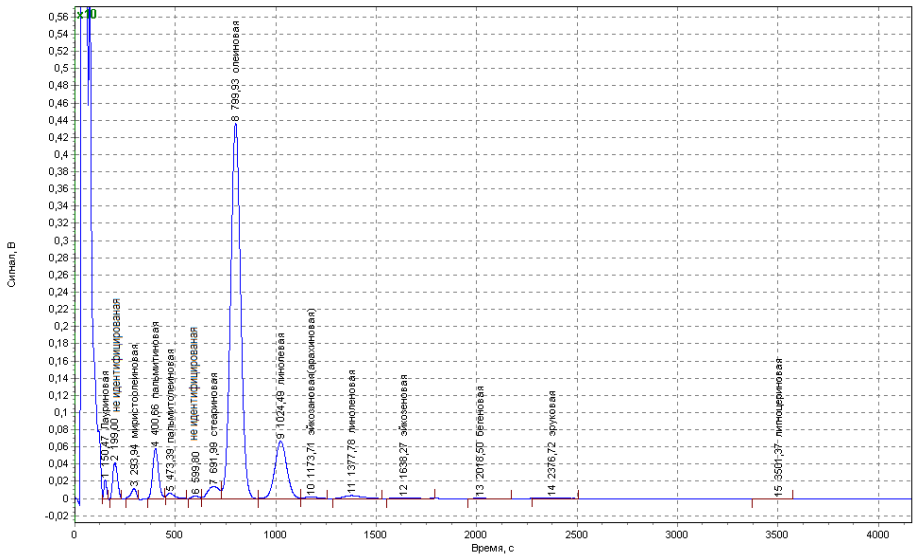
full fatty acids methylation. The methylating mixture contained chloroform, methanol and sulfur acid at a ratio of 100:100:1.

30-50 µl of lipophylic fraction was put into glass ampules with addition of 2.5 ml of methylating mixture and following sealing of ampules. Afterwards, those ampules were put into a thermostat at 105°C. At the end of methylation ampules content was put into a tube with addition of sulfuric acid powdered zinc at the tip of a scalpel, 2 ml of distilled water and 2 ml of hexane for methyl esters extraction. The obtained mixture was thoroughly stirred and allowed to stand. The hexane extract was filtered and used for a chromatography analysis [10].

Fatty acids content was calculated in % from the total amount according to the peaks area using conventional method [10].

RESULTS AND DISCUSSIONS

Due to the results of fatty acids analysis in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties 13 fatty acids were identified. Only 10 fatty acids were identified in *Daucus carota subsp. sativus* fruits of "Olenka" variety. Chromatograms of *Daucus carota subsp. sativus* fruits fatty acids of the studied varieties obtained by gas chromatography technique are presented in the figure 1.



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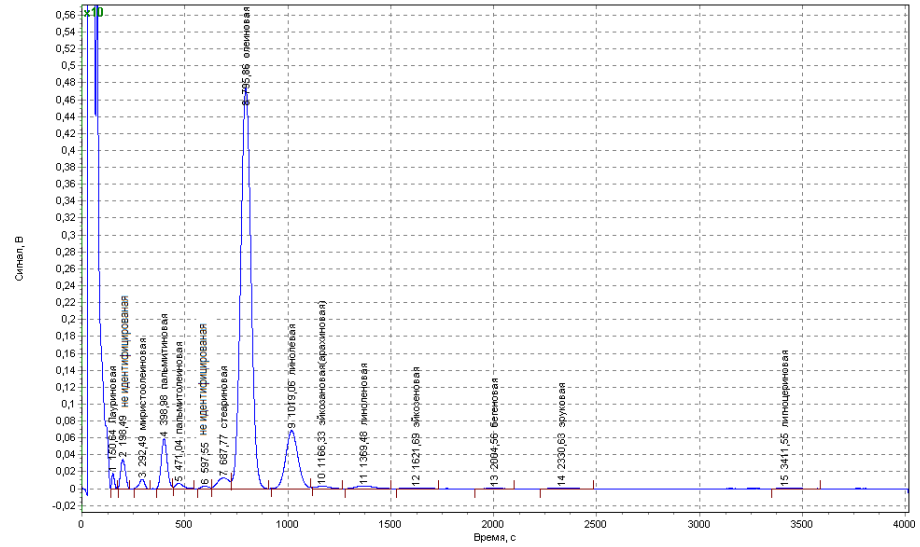

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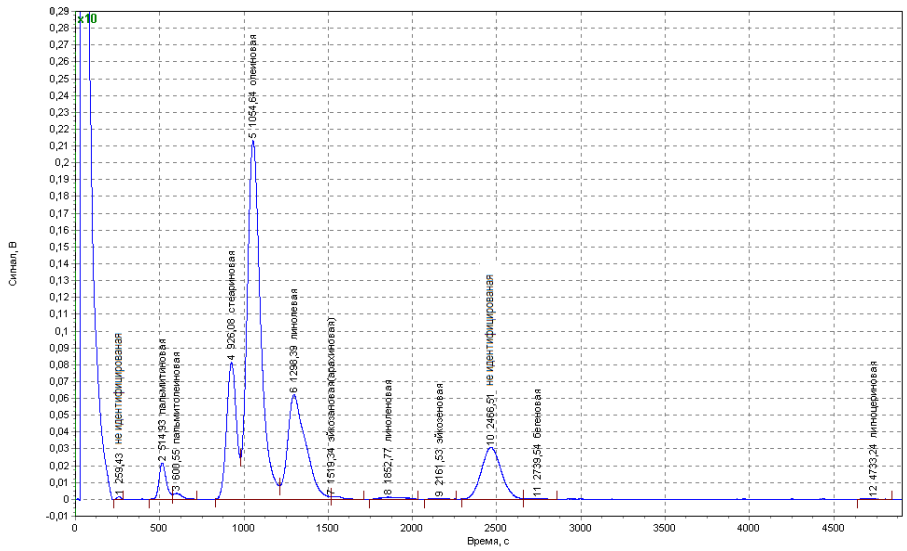

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Fig 1: Chromatograms of *Daucus carota subsp. sativus* fruits fatty acids obtained by gas chromatography technique: A – "Yaskrava" variety, B – "Nantska Kharkivska" variety, C – "Olenka" variety

Table: **Fatty acids qualitative composition and quantitative content in *Daucus carota subsp. sativus* fruits of "Yaskrava", "Nantska Kharkivska" and "Olenka" varieties**

№	Fatty acids	Content, %		
		Variety "Yaskrava"	Variety "Nantska Kharkivska"	Variety "Olenka"
Saturated fatty acids				
1	Lauric (dodecanoic)	0.95±0.02	0.69±0.02	-
2	Palmitic (hexadecanoic)	5.44±0.14	5.17±0.13	2.74±0.07
3	Stearic (octadecanoic)	2.95±0.07	2.45±0.06	14.81±0.37
4	Arachidic (eicosanoic)	0.43±0.01	0.65±0.02	0.33±0.01
5	Behenic (docosanoic)	0.08±0.01	0.05±0.01	0.11±0.01
6	Lignoceric (teracosanoic)	0.06±0.01	0.07±0.01	0.09±0.01
7	Gondoinic (eicosenic)	0.30±0.01	0.30±0.01	0.12±0.01
Total amount of saturated fatty acids		9.91±0.25	9.08±0.23	18.08±0.45
Unsaturated fatty acids				
8	Myristoleic (tetradecenoic)	0.95±0.02	0.85±0.02	-
9	Palmitoleic (hexadecenoic)	0.74±0.02	0.70±0.02	0.60±0.02
10	Oleic (octadecenic)	70.40±1.76	72.67±1.82	49.03±1.23
11	Linolic (octadecadienoic)	12.70±0.32	12.37±0.31	20.32±0.51
12	Linolenic (octadecatrienoic)	1.03±0.02	0.85±0.02	0.68±0.02
13	Erucic (docosenoic)	0.20±0.01	0.19±0.01	-

Total amount of unsaturated fatty acids	86.02±2.15	87.63±2.19	70.63±1.77
Total amount of non-identified fatty acids	3.77±0.10	2.99±0.08	11.17±0.28

According to the obtained research results, unsaturated fatty acids dominated in all analyzed types of *Daucus carota subsp. sativus* fruits. Their total content in *Daucus carota subsp. sativus* fruits of "Yaskrava" variety and "Nantska Kharkivska" variety was almost at the same level and equaled 86.02±2.15% and 87.63±2.19% respectively. Unsaturated fatty acids content in *Daucus carota subsp. sativus* fruits of "Olenka" variety was 1.2 times less than in other varieties and it equaled 70.63±1.77%.

Saturated fatty acids content in *Daucus carota subsp. sativus* fruits of "Yaskrava" (9.91±0.25%) and "Nantska Kharkivska" (9.08±0.23%) varieties differed slightly. Saturated fatty acids content in *Daucus carota subsp. sativus* fruits of "Olenka" variety was almost 2 time higher than in "Yaskrava" and "Nantska Kharkivska" varieties and equaled 18.08±0.45%.

Oleic and linolic acids dominated among unsaturated fatty acids in all the analyzed samples. Oleic acid content in *Daucus carota subsp. sativus* fruits of "Yaskrava" (70.40±1.76%) and "Nantska Kharkivska" (72.67±1.82%) varieties was 1.5 times higher than in *Daucus carota subsp. sativus* fruits of "Olenka" variety (49.03±1.23%). Linolenic acid content in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties was 12.70±0.32% and 12.37±0.31% respectively that was 1.6 times less than in *Daucus carota subsp. sativus* fruits of "Olenka" variety (20.32±0.51%).

Palmitic acid dominated among saturated fatty acids in the analyzed samples of the plant raw material of *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties. Its content equaled 5.44±0.14% and 5.17±0.13% respectively. Stearic acid was a dominant saturated fatty acid in *Daucus carota subsp. sativus* fruits of "Olenka" variety (14.81±0.37%). At the same time, stearic acid content in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties and palmitic acid content in *Daucus carota subsp. sativus* fruits of "Olenka" variety was less than 3%.

The maximum content of palmitoleic (0.74±0.02%) and linolenic (1.03±0.02%) acids was detected in *Daucus carota subsp. sativus* fruits of "Yaskrava" variety. Arachidic (0.65±0.02%) acid highest content was determined in *Daucus carota subsp. sativus* fruits of "Nantska Kharkivska" variety. Behenic (0.11±0.01%) and lignoceric (0.09±0.01%) highest content was determined in *Daucus carota subsp. sativus* fruits of "Olenka" variety. The equal high content of gondoinic acid (0.30±0.01%) was found in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties.

Due to the analysis data, lauric, myristoleic and erucic acids were identified only in *Daucus carota subsp. sativus* fruits of "Yaskrava" (0.95±0.02%, 0.95±0.02% and 0.20±0.01% respectively) and "Nantska Kharkivska" varieties (0.69±0.02%, 0.85±0.02% and 0.19±0.01% respectively).

The obtained results did not contradict with the literature data describing qualitative composition of *Daucus carota subsp. sativus* fatty acids. Nevertheless, data showing their quantitative content slightly differ.

CONCLUSIONS

1. 10 fatty acids were detected in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties and 13 fatty acids – in *Daucus carota subsp. sativus* fruits of "Olenka" variety by gas chromatography technique.
2. Unsaturated fatty acids dominated in all analyzed types of plant raw material.
3. Palmitic acid was a dominant one among saturated fatty acids in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties (5.44±0.14% and 5.17±0.13% respectively). Steric acid was a dominant one in *Daucus carota subsp. sativus* fruits of "Olenka" variety and its content equaled 14.81±0.37%.
4. Oleic acid was a dominant one among unsaturated fatty acids in all studied samples. Its content in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties equaled

70.40±1.76% and 72.67±1.82% respectively. It was 49.03±1.23% in in *Daucus carota subsp. sativus* fruits of "Olenka" variety.

5. Lauric, myristoleic and erucic acids were identified only in *Daucus carota subsp. sativus* fruits of "Yaskrava" and "Nantska Kharkivska" varieties.
6. The obtained results did not contradict with the literature data describing qualitative composition of *Daucus carota subsp. sativus* fatty acids. Nevertheless, data showing their quantitative content slightly differ.
7. The results of this research can be used for the further quality control methods development for *Daucus carota subsp. sativus* fruits and new plant remedies on their basis.

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