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Analysis of Fatty Acid Composition of Rhizomes with Roots, Leaves and Flovers of *Hosta Plantaginea.*

Moeen F. Dababneh[1]*, Victoria V. Protska[2], and Iryna O. Zhuravel[2].

[1]Department of Pharmacognosy, Faculty of Pharmacy, Aljouf University, Kingdom of Saudi Arabia. .
[2]Department of Chemistry of Natural Compounds, National University of Pharmacy, Kharkov, Ukraine.

ABSTRACT

Hosta plantaginea is used in Eastern folk medicine as an anti-inflammatory, antiviral and antifungal remedy. The fatty acid composition of the rhizomes with roots, leaves and flowers of *Hosta plantaginea* was studied by gas chromatography. As a result 16 fatty acids were cumulatively identified in plant material types of *Hosta plantaginea,* 10 fatty acids were identified in the rhizomes with roots, and 12 – in the leaves and flowers. Unsaturated fatty acids dominated in all the plant material types with quantitative prevalence of linoleic acid. Linolenic acid is predominant in the leaves, where its content was 37,22 %.
Lignoceric and myristoleic acids were present in minor amounts in all the plant material types studied.
Keywords: *Hosta plantaginea*, gas chromatography, fatty acid composition.

Corresponding author

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INTRODUCTION

The genus *Hosta* belongs to the *Hostaceae* family. *Hostas* are the most popular garden plants worldwide due to its resistance and decorative effect [1-3].

Historical homeland of *Hosta plantaginea* is the countries of South-Eastern Asia. *Hosta plantaginea* is used in complementary medicine to treat inflammatory diseases of ENT and pelvic organs, viral and fungal diseases. This plant is also applied for treating stomach, liver and mammary gland tumours [4].

According to literature data *Hosta plantaginea* has a very ample chemical composition. It contains flavonoids, organic acids, saponins and alkaloids [4, 5]. However, valid data as to fatty acid composition are not available in the literature.

From the biological viewpoint, unsaturated fatty acids are of great value for the human body. They are divided into monounsaturated containing one double bond, and polyunsaturated with several double bonds. In particular, monounsaturated fatty acids take part in lipid exchange and restore protective functions of epidermis [6, 7].

Human body is unable to synthesize polyunsaturated fatty acids, thus, they are called essential fatty acids. There are two types of polyunsaturated fatty acids - ω-6 fatty acids and ω-3 fatty acids [7].

Linoleic acid belongs to the ω-6 group of fatty acids. They are a component cellular membrane as well as they take part in prostaglandins synthesis [6, 7].

Linolenic fatty acid belongs to the ω-3 fatty acids which provide the greatest value for the body. It possesses intense hypotensive, immunomodulating, anti-inflammatory effect as well as reduces cholesterol level in the blood. As a result of inactivation of some enzymes, linolenic acid reveals antitumor properties [6, 7].

A study of qualitative composition and quantitative content of fatty acids in the raw material of Hosta plantaginea has become the objective of the research.

EXPERIMENTAL

Rhizomes with roots, leaves and flowers of *Hosta plantaginea* were selected to be the objects of the research. Raw material was collected in 2014 – 2015 within the territory of Kharkiv region, Ukraine.

Lipophilic fractions of rhizomes with roots, leaves and flowers of *Hosta plantaginea* were obtained by hexane extraction and than hydrolyzed. Hydrolyzates were studied by the means of Gas Chromatography which is based on fatty acid methyl esters production with their subsequent determination [8].

Researches of fatty acid methyl esters were performed on the chromatograph "Selmichrom-1» with flame ionization detector. The Gas chromatographic column of stainless steel 2.5 m in length and with inside diameter 4 mm was used, filled with stationary phase – inerton, processed by 10% diethylene glycol succinate (DEGS) [8].

The following operating parameters were set on the chromatograph; temperature of the column heating oven – 180°C, vaporizer's temperature – 230°C, Detector's temperature – 220°C, carrier-gas flow rate (nitrogen) 30 cm^3/min, sample volume - from 2 mm^3 of the solution of acids' methyl ethers in hexane [8].

Identification of methyl esters of fatty acids was carried out by peaks retention time of the peaks in comparison with this index of the standard mixture. Calculation of methyl esters composition was performed by internal normalization method. Standards of saturated and unsaturated fatty acids methyl ethers “Sigma” were used as reference samples. The fatty acids methyl esters, obtained by the modified Peisker’s method allowing the fatty acids methylation, were analyzed. A mixture of chloroform with methanol and sulphuric acid by a ratio of 100:100:1 in the volume 30-50 ml was used for methylation. Lipophilic fraction were dispensed into glass ampoules with addition of 2.5 ml of methylated mixture and the ampoules bulbs were sealed. They

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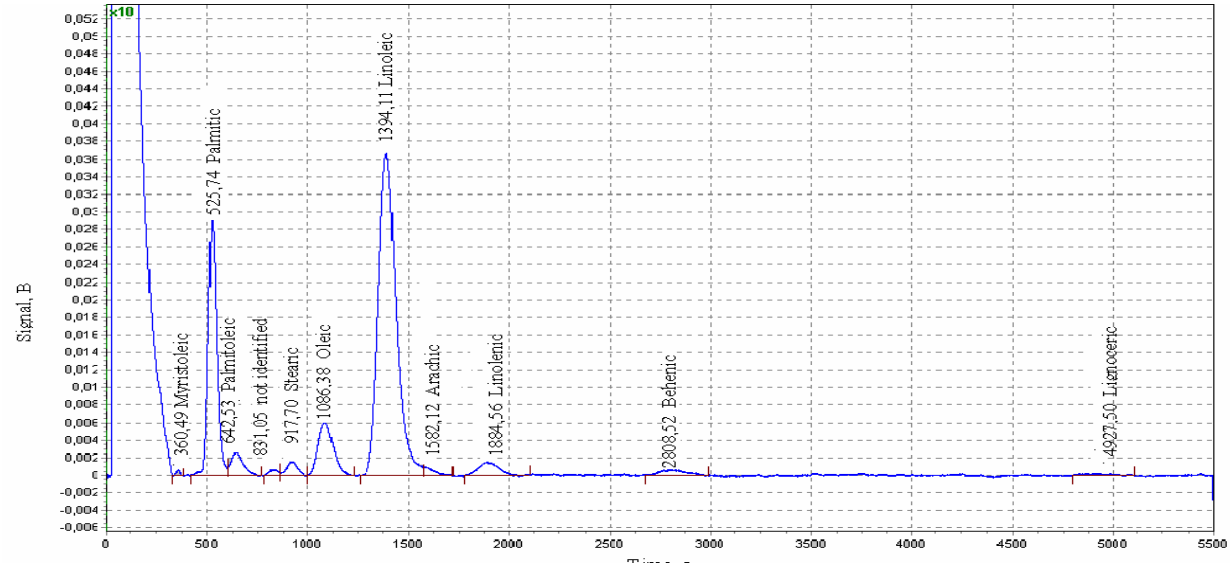
were placed to a thermostat with temperature 105°C for 3 hours. After methylation the ampoules were opened, their content was transferred to a test tube with adding sulfuric acid powder-like zinc on the tip of the scalpel, 2 ml of distilled water and 2 ml of hexane for methyl esters extraction. After thorough stirring and decantation, hexane extract was filtered and used for chromatographic analysis [8].

The fatty acids content was calculated (as % of total amount) in terms of peaks area using the generally accepted procedure [8].

RESULTS AND DISCUSSION

16 fatty acids were in plant material types of *Hosta plantaginea,* 10 fatty acids were identified in the rhizomes with roots, and 12 – in the leaves and flowers.

16 fatty acids were cumulatively revealed, 12 of which were identified, in all types of studied raw materials in the analysis of fatty acids of Hosta plantaginea. Gas chromatograms of fatty acids of *Hosta plantaginea* plant material are represented at the Figure.



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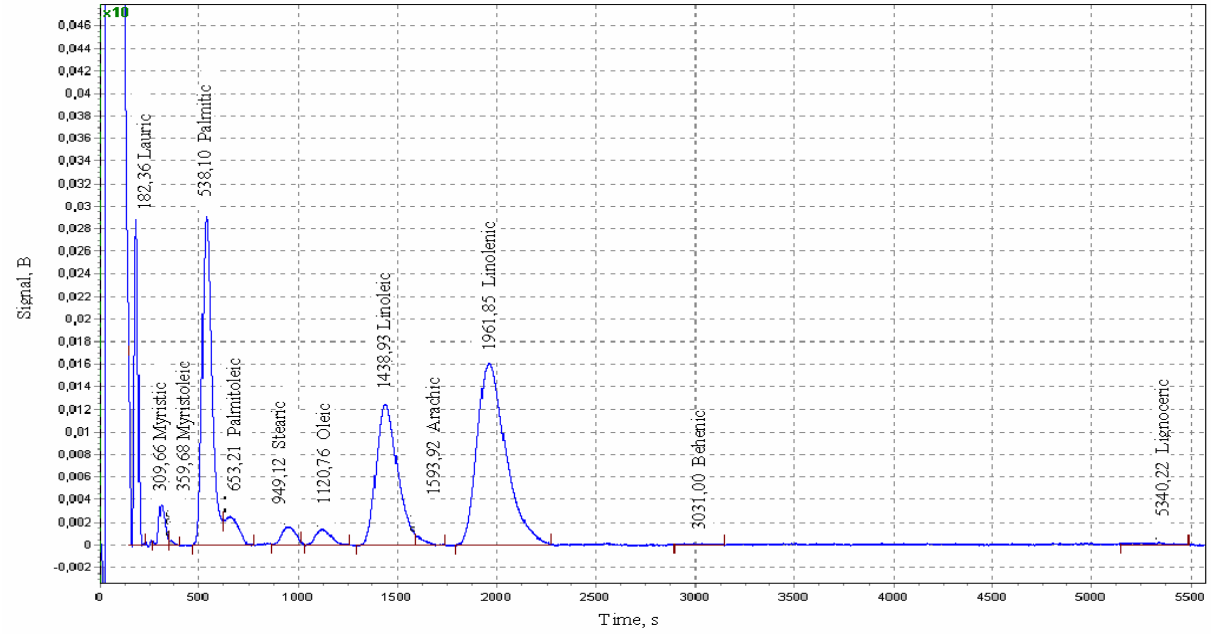

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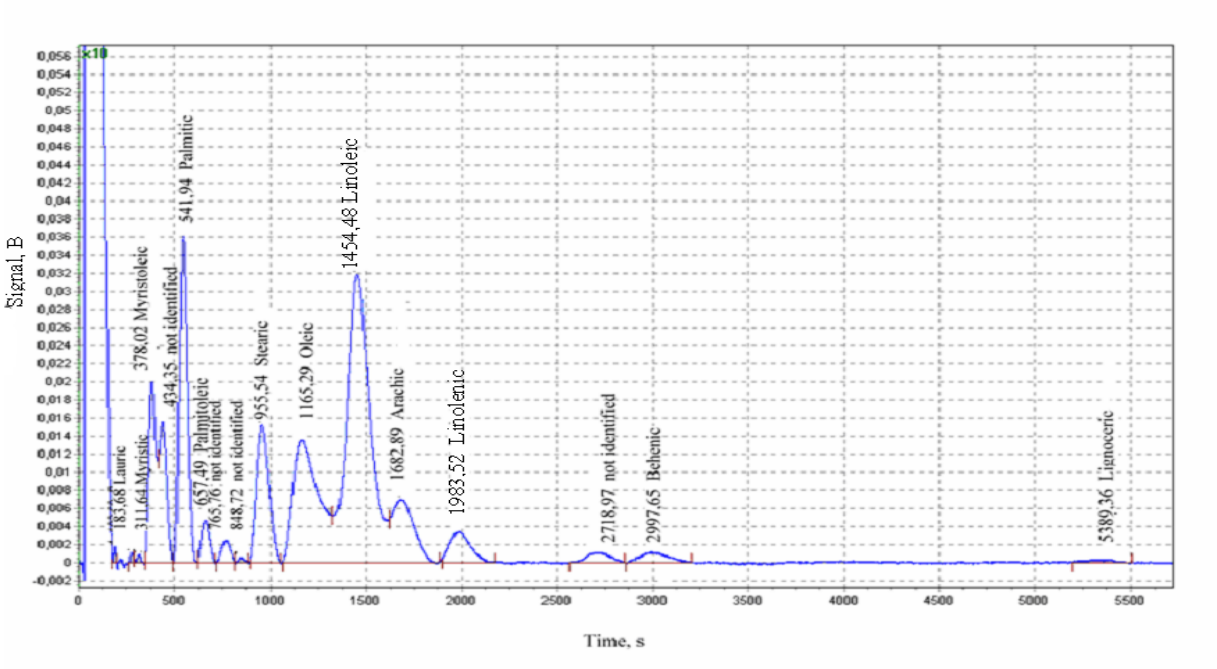

C

Figure: Gas chromatograms of fatty acids in the *Hosta plantaginea* plant material: A – rhizomes with roots; B –leaves; C – flowers.

Results of the qualitative composition and quantitative content of fatty acids in the *Hosta plantaginea* plant material are represented in the Table 1.

Table 1: Qualitative composition and quantitative content of fatty acids in the *Hosta plantaginea* plant material

№	Methyl esters of Fatty acids	Content in %		
		Rhizome with roots	Leaves	Flowers
1	C 12:0 lauric (dodecanoic)	-	9.02	0.19
2	C 14:0 myristic (tetradecanoic)	-	1.77	0.14
3	C 14:1 myristoleic	0.22	0.15	8.52
4	not identified component	-	-	5.70
5	C 16:0 palmitinic (hexadecanoic)	21.87	22.65	13.26
6	C 16:1 palmitoleic (hexadecanoic)	3.02	3.19	1.79
7	not identified component	-	-	1.03
8	not identified component	0.52	-	0.11
9	C 18:0 stearic (octadecanoic)	1.62	1.85	8.88
10	C 18:1 oleic (octadecenic)	8.54	1.68	16.23
11	C 18:2 linoleic (octadecadienoic)	1.77	21.88	30.56
12	C 18:3 linolenic (octadecatrienoic)	2.91	37.22	3.25
13	C 20:0 arachic (eicosanic)	0.89	0.43	7.68
14	not identified component	-	-	1.13
15	C 22:0 behenic (docosanoic)	1.54	0.06	1.39
16	C 24:0 lignoceric (tetracosanic)	0.10	0.10	0.14
Saturated fatty acids content		26.02	35.88	31.68
Unsaturated fatty acids content		73.46	64.12	60.35
Non-identified fatty acids content		0.52	-	7.97

10 fatty acids were identified in the rhizomes with roots of *Hosta plantaginea*. The saturated fatty acids content was 26.02 %, and unsaturated – 73.46 %. Linoleic acid belonging to ω-6 fatty acids, as well as palmitic and oleic acids prevailed in amount in this raw material. The rest of fatty acids were present in the material in the amount not higher than 3 %.

The content of unsaturated fatty acids was somewhat lower in the leaves – 64.12 %. The dominant fatty acids in this plant material were linoleic, linolenic and palmitic acids. Concurrently, the high content of linolenic acid belonging to ω-3 fatty acids, is typical (37.22 %). Behenic acid is detected in a minor amount in the leaves of *Hosta plantaginea* (0.06%).

Unsaturated linoleic, oleic acids as well as a saturated palmitic acid prevailed in the flowers. The total content of unsaturated fatty acids equals to 60.35%. Arachinic acid was present in a very low amount.

The highest content of unsaturated fatty acids is typical for rhizomes with roots. Thus, linoleic acid was present in great amounts in all types of raw material. It's content in the rhizomes with the roots comprised 58.77 %, almost twice less in the leaves, and in the flowers – 2.5 times less. High content of linolenic acid is typical for the leaves of *Hosta plantaginea* – 37.22%, which is almost a half of the total unsaturated acids' content in this plant material.

Lignoceric and myristoleic acids in all types of the raw material studied were present in insignificant amount.

CONCLUSIONS

- As a result 16 fatty acids were cumulatively identified in plant material types of *Hosta plantaginea,* 10 fatty acids were identified in the rhizomes with roots, and 12 – in the leaves and flowers.
- Unsaturated fatty acids quantitatively predominated in all types of raw material with high content of linoleic acid – 58.77% in the rhizomes with the roots, 21.88 % in the leaves and 30.56% in the flowers of Hosta plantaginea.
- Linolenic acid dominated in the leaves, where its content was 37.22%.
- Lignoceric and myristoleic acids in all types of the raw material studied were present in insignificant amount.

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