ESTIMATION OF LIPID AND FATTY ACIDS COMPOSITION OVER THE GROUND PART OF NEPETA OLGAE REGEL (L.) PLANTS GROWING IN NAMANGAN REGION

Abstract

The article is devoted to the study of lipids and fatty acid composition of the above-ground part of the Nepeta Olgae Regel (L.) plant of the Laminaceae family. It was found that the content of neutral lipids (NL) is 5.54%, PL - 6.12%, and total lipids (NL, PL) - 11.66%. Of the neutral lipids, the unsaponifiable substances (HB) had a bright yellow color, which is explained by a small amount of carotenoids (88.87 mg%). Glycolipids dominate in PL. Among the unsaponifiable substances were found biologically active components such as hydrocarbons, carotenoids, aliphatic alcohols, sterols and triterpenols. Phytosterols were the main component of unsaponifiable NS.

Quantitative and qualitative analysis of fatty acids from the plant Nepeta Olgae Regel (L.) was carried out by gas chromatography (GC). 28 acids were identified, of which 11 compounds are saturated, and 7 compounds are unsaturated fatty acids. Of the fatty acids, the main ones are linolenic 18:3 (35.48), palmitic 16:0 (33.38%), as well as ω-3 polyunsaturated fatty acids, including eicosanoic 20:1, cis-11,14-eicosadienoic 20:2, 8,11,14-eicosatriene 20:3 + arachidonic 20:4.

Extracts of Nepeta Olgae Regel (L.) were distinguished by a high content of polyunsaturated acids, which determines their potential biological activity.

Key words: extracts, lipids, fatty acid composition, Nepeta Olgae Regel (L.), gas chromatography, qualitative and quantitative analysis.

Introduction.

The Lamiaceae family includes a wide range of plants with biological and pharmaceutical potential [1]. Many representatives of this family are medicinal, spicy, essential oil and ornamental plants and are of significant practical importance [2-9].

The healing properties of this type of plant are explained by the fact that its leaves, stems, roots and flowers contain vitamins, flavonoids, fatty acids, lipids and other biologically active substances (BAS) having therapeutic and preventive qualities [1].

One of the criteria of vegetative raw material quality is its fatty acid composition, as it can be used for identification of prospective vegetative raw material for the food, pharmaceutical and cosmetic industries.

There are no reports in the scientific literature about the chemical composition of lipids and fatty acid composition of Nepeta Olgae Regel (L.).

Lipids (from the Greek word "Lipos" - fat) are widespread in nature; a group of biologically active substances that make up the bulk of organic substances of all living organisms. They accumulate in plants in the seeds and in fruits, and perform a number of vital functions (they are the main components of cell membranes and energy reserves for the body, etc.). Being intermediate products of lipid metabolism, unsaturated fatty acids have a relatively high biological value for the organism [10-11].

Considering the role of lipids in the human body, it is impossible not to note that for normal growth and functioning the body needs fat-soluble vitamins and unsaturated acids. This factor alone makes lipids an irreplaceable component of food.

Thus, the study of the structure and properties of lipids is an important step in the study of biochemical processes.

The importance of lipids and fatty acids in the life of living organisms presents the study of fatty acid composition as an urgent task that will identify the chemicals that determine the pharmacological activity of the plant.

The above factors point to the urgency of studying lipid and fatty acid composition of the plants Nepeta Olgae Regel (L.), as a potential source of these compounds.

In this article we present for the first time the results of study of qualitative and quantitative lipid and fatty acid composition of plants Nepeta Olgae Regel (L.) ground part taken from the territory of Namangan area of Chust district (slopes of the Gova mountain) during flowering (May-June, 2021-2022).

While studying the qualitative and quantitative analysis of fatty acid composition of Nepeta Olgae Regel (L.) plants by gas chromatography (GC) method, 18 compounds were identified that belong to this class of compounds. Of these, 11 compounds belonged to the substitutable, 7 compounds belonged to the irreplaceable.

Purpose of work - The purpose of the research - study of lipid and fatty acid composition of plants Nepeta Olgae Regel (L.) growing in Uzbekistan, Namangan region.

Materials and methods.

Extraction of lipids. Seeds of Nepeta Olgae Regel (L.) plants were separated from impurities and crushed. After that, the moisture content of plant seeds was determined [12].

Neutral lipids (NL) of yellowish color were isolated from air-dry crushed raw materials in a Soxhlet apparatus [13] using extraction gasoline (bp 72-800C)

as an oily, mobile, turbid, glycerol-like liquid. From NL by hydrolysis with 10% KOH solution in methanol we extracted unsaponifiable substances of dark yellow color and determined their content [14]. The content of carotenoids in unsaponifiable substances was determined by photoelectrocalorimetric method [15].

The remains after extraction of HL was air-dried and polar lipids (PL) were extracted from it three times with a mixture of chloroform and methanol (2:1) [16]. The combined chloroform-methanol extract was treated with 0.04% aqueous solution of CaCl2 to remove non-lipid components and dried with anhydrous sodium sulfate. After removal of the solvent, an ointment-like residue of brown-green PL was obtained.

Next, PL was fractionated by column chromatography (CC) on silica gel into individual lipid groups, with the residual PL eluted with chloroform and combined with the PL extracted with gasoline. Glycolipids (GLs) were washed with acetone and phospholipids (PLs) were washed with methanol. After evaporation of the solvent, PLs had a smear-like consistency, with GLs having a brownish-green color and FLs having a brownish color. The yield of lipid groups was determined gravimetrically.

Column and thin-layer chromatography of lipids was performed on Chemapol silica gel (Czechoslovakia) with particle sizes of 100/160 and 5/40 mesh, respectively, at a sample/sorbent ratio of 1:60 (by weight). Table 1 shows the results obtained.

The qualitative composition of HL, GL, FL and unsaponifiable components was established by analytical TLC method using silica gel L 5/40 mc "Chemapol" (Czech Republic), adding 5% gypsum. For the separation of HS we used systems: 1) hexane - diethyl ether 4:1; 2) 3:2. Zones of substances were manifested in iodine vapor and by spraying plates with 50% H_2SO_4 solution followed by heating.

The GL composition was established in the solvent system chloroform: acetone: methanol: acetic acid: water 65:20:10:10:3. The transmitting reagent was α-naphthol. The solvent system used for PL analysis was chloroform: methanol: 25% ammonia 65:35:5 . Stains of PL components were manifested using Waskowski and Dragendorf reagents [13]. The solvent system hexane:ether 4:2 was used to separate unsaponifiable substances.

To determine the composition of fatty acids, the lipids were hydrolyzed with an alcohol alkaline solution [17] and the isolated LCs were methylated with freshly prepared diazomethane. The LC methyl esters were analyzed by gas chromatography (GC). The purified LCMs were dissolved in hexane and analyzed on a GC 8860 chromatograph with flame ionization detector, SP-2560 capillary column, 100 m × internal diameter 0.25 mm, film thickness 0.2 mm, carrier gas:

H_2, column programming temperature from 140^0C to 250^0C. The results of the analysis are presented in Table 2.

Discussion of results.

Table 1 shows the obtained characteristics of lipids of Nepeta Olgae Regel (L.). The data in the table show that the content of NL is 5.54%, PL is 6.12%, and total lipids (NL, PL) is 11.66%. Unsaponifiable substances (UL) were extracted from neutral lipids by hydrolysis with 10% KOH solution in methanol. Unsaponifiable substances had bright yellow color, which was explained by insignificant amount of carotenoids (88.87 mg%). The PL was dominated by glycolipids.

Table 1.

Characteristics of lipids over the terrestrial part
Nepeta Olgae Regel (L.)

Indicator	Contents
Moisture and volatile matter, % by weight of raw material	7,8
Neutral lipid yield at actual humidity, % by weight of raw material	5,54
LA yield per absolutely dry matter, % by weight of raw material	6,00
Unsaponifiables content, % by weight of raw material	14,8
Carotenoid content in free-flowing grains, mg%	88,87
Carotenoid content in unsaponifiable substances, mg%	100,16
Polar lipids (PL), % by weight of raw materials, including: **glycolipids, altered chlorophylls** **phospholipids**	6,12 5,27 1,06

According to the results of the analysis, the qualitative composition of neutral lipids, in the solvent system hexane:ether - 8:2, (Rf) is as follows: hydrocarbons + carotenoids (0. 97); triacylglycerides (0.73); free fatty acids (0.37); aliphatic alcohols (0.30); triterpene alcohols (0.27); phytosterols (0.12); (developer: 50% H_2SO_4 solution, J_2 vapor). Biologically active components such as hydrocarbons, carotenoids, aliphatic alcohols, sterols, and triterpenols were found among unsaponifiable substances. Phytosterols were the main component of unsaponifiable HB substances. Standard substances (phytosterols, triterpenols, etc.) were used to identify the components.

Table 2.

Fatty acid composition of neutral lipids of above-ground parts Nepeta Olgae Regel (L.), GC, % by weight of acids

Fatty Acid	Content
Caprylic, 8:0	0,73
Caprylic, 10:0	0,99
Undecyl, 11:0	0,91
Laurinic, 12:0	0,86
Myristinic, 14:0	2,68
Palmitic, 16:0	33,38
Palmitoleic, 16:1	1,84
Margarine, 17:0	1,06
Stearic, 18:0	5,11
Oleic, 18:1	3,27
Linoleic, 18:2	6,34
Linolenic, 18:3	35,48
Arachinic, 20:0	0,84
Eicosene, 20:1	1,38
Cis-11,14-eicosazadienoic, 20:2	1,71
Begene, 22:0	1,32
8,11,14-eicosatrienoic, 20:3 + arachidonic, 20:4*	1,45
Lignocerine, 24:0	0,65
∑saturated GIs	48,53
∑unsaturated GIs	51,47
∑monoenes	6,49
∑polyenes	44,98
∑saturated/ ∑nenas, units	0,94
∑poly./ ∑mono, units.	6,93

* This pair of fatty acids in the GC conditions used is not separated and comes out with one peak

From the data in Table 2 we can see that 18 components of fatty acids are identified with a significant predominance of unsaturated (essential) components (sum 51.47%), predominantly linolenic 18:3 acids. The saturated (substitutable) LC is (sum 48.53%), with a significant predominance of palmitic acid 16:0.

The high content of the sum of unsaturated FAs accounts for the oily, mobile, turbid, glycerol-like liquid lipids of Nepeta Olgae Regel (L.)

Lauric acid is found in small amounts (0.86%), as in some plant lipids is found in the range of 1-4% and is rarely found in large quantities.

There is information in the scientific literature that unsaturated acids with chain lengths of C_{18}, C_{20} and C_{22} are rarely found from plants cultivated in Uzbekistan. For example, 11(Z)-eicosaenoic acid was found in spare lipids of Copiolida species and close to it genus Delphinium [18, 19]. Its diene isologue-11,14(Z,Z)-eicosadienoic acid was identified in black cumin seed oil [20, 21].

Essential fatty acids are part of the structural lipids of the cell, they play an important role in the formation of structural mitochondrial membranes. Performing structural functions, they are part of phospholipids [22,23].

Of scientific interest are linoleic and linolenic acids (6.34% and 35.48%, respectively), which are essential unsaturated fatty acids with antiproliferative and cytostatic activity in nonliving models (in vitro) [24].

Linoleic and linolenic acids belong to the group of omega-3 fatty acids, which are characterized by the following types of action on the living body: immunomodulatory, anti-inflammatory, anti-aggregant, hypocoagulant, hypotensive and antiarrhythmic. Linoleic acid is converted in the body into γ-linolenic acid, which in turn is a precursor of digomo-γ-linolenic acid and further converted to arachidonic acid. Digomo-γ-linolenic acid in the body acts as a biologically active substance that is a precursor of the first series of the body's prostaglandins and leukotrenes [25,26].

The peculiarity of fatty acids of Nepeta Olgae Regel L. seeds growing in Namangan region is high content of linolenic 18:3 (16.67 %) and linoleic 18:2 (6.34 %) acids as well as oleic 18:1, eicosene 20:1, cis-11,14-eicosadiene 20:2 (3.27 %, 1.38 %, 1.71 %) respectively.

Thus, *Nepeta Olgae Regel* (L.) can be considered a medicinal plant.

Conclusions

The composition of lipids and fatty acids of the plant Nepeta Olgae Regel (L.) was studied. As a result of research it was established for the first time, that the above-ground part of plants Nepeta Olgae Regel (L.) growing in Uzbekistan Namangan region, contains 5,54 % neutral and 6,12 % polar lipids. Neutral lipids contain 88.87% mg% carotenoids, polar lipids are dominated by glycolipids.

From HL, HB was extracted, which makes up the biological active components; mainly phytosterols.

For the first time, gas chromatography method applied to the lipids of plants Nepeta Olgae Regel (L.) detected 18 compounds that were attributed to fatty acids. The proportion of saturated fatty acids was 11 compounds (41.21%). Unsaturated fatty acids accounted for 7 compounds (58.79%). It was established that unsaturated (indispensable) acids prevail in LC, which cause oily, mobile, glycerine-like liquid lipids Nepeta Olgae Regel (L.)

Nepeta Olgae Regel (L.) extracts were characterized by a high content of polyunsaturated acids, which determines their potential biological activity.

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