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### **Amino and fatty acid composition of the aerial parts of *Echinops albicaulis*, growing in Kazakhstan**

**Abstract.** The article discusses the results of amino and fatty acid analysis of the aerial part of *Echinops albicaulis*, collected during mass flowering in Malaysary area in 2015 Almaty region. The research was conducted at the laboratories of the Faculty of Chemistry and Chemical Technology of Al-Farabi Kazakh National University and Kazakh Academy of Nutrition. During research we determined the qualitative component composition and quantitative content of various amino and fatty acids in the aerial part of *Echinops albicaulis* of the Asteraceae. The research showed the predominance of proline, alanine, glutamic and aspartic acid in the elevated part of the amino acid, oleic and linoleic acid from fatty acids.

**Key words:** quantification, amino and fatty acids, *Echinops Albicaulis*, Asteroideae.

#### **Introduction**

There are different groups of biologically active substances in plants. It is important to know in what quantities they should be used for the medicine preparation.

To study the chemical composition *Echinops albicaulis*, the plant of Asteraceae family which is spread in the flora of Kazakhstan, was chosen by us. *Echinops albicaulis* – is a rather large genus of perennial, rarely one-biennial, spiny herbaceous plants, including about 190 species [1].

This species belongs to the of Asteraceae plants which is not well-studied, the study of qualitative and quantitative composition of *Echinops albicaulis* and the development of different preparations based on this plant is a burning issue. Amino acids – is the class of organic compounds containing amino and carboxyl groups. It has the properties of acids and bases, playing important roles in biological processes of the plant [4].

Among the amino acids, ten of them are essential and very necessary for the normal functioning of organism. The deficiency of amino acids disturbs the protein synthesis leading to different diseases. The article discusses the research results of the problems of qualitative composition and quantitative content of amino and fatty acids in *Echinops albicaulis*. Saturated and unsaturated higher fatty acids play an important role in nature. They are the part of glycerides which form the basis for cell membranes, so they

should be classified as biologically important compounds. The greatest biological activity was found to be shown by not individual lipids but the whole set of lipids. Although each class of lipid fraction show biological activity. The fats are always in a liquid state in the living plant. Plants accumulate the fats of many families, especially Asteraceae, cabbage family, celery, Rosaceae, Euphorbiaceae, Papaveraceae, Lamiaceae.

The process of creation and accumulation of fats depend on environmental factors and genetic features of species and varieties. Therefore, study of fatty acids of *Echinops albicaulis* is necessary. We made a comparing analysis of amino and fatty components composition in the aerial part of this plant.

#### **Materials and Methods**

Research material is the aboveground part *Echinops albicaulis* family Asteraceae, collected during flowering was determined in Malaysary areas of Almaty region.

The qualitative composition of amino acids set by chromatography (on paper and in a thin layer) in the presence of substances standards [2], and quantitative composition- by GLC method [3].

##### **Chromatographic conditions:**

- Temperature of the flame ionization detector – 300 ° C
- Evaporator temperature – 250 ° C
- Initial column temperature – 110 ° C

- Final column temperature – 250 ° C  
 - Column temperature programming ranged from 110 ° C to 185 ° C – 6 ° C a minute; from 185 ° C to 250 ° C – 32 ° C a minute. On reaching the column temperature of 250 ° C it should remain the same temperature until the full yield of all amino acids.

To separate amino acids we used a stainless steel column, of 400 to 3mm, which filled with a mixture of polar% from carbowax 0.31 m 20 0.28 5% Silar and 0.06% on Lexan hromasorbe WA-W-120-140 mesh. Counting of chromatogram is conducted by external Altex company.

#### Determining the number of amino acids was performed by GLC [5].

1 g of the analyte was hydrolyzed in 5 mL of 6N hydrochloric acid at 105 ° C for 24 hours in vessels under an argon stream. The resulting hydrolyzate was evaporated three times until dried on a rotary evaporator at 40-50 ° C and a pressure of 1 atmosphere. The resulting precipitate was dissolved in 5 ml of sulfosalicylic acid. After centrifugation (1500 rev / min) for 5 minutes, the supernatant was passed through a column of ion exchange resin by Dauks 50, H-8, 200-400 mesh, at a rate of 1 drop per second. The resin is then washed with 2.1 ml of deionized water and 2 ml of 0.5 N acetic acid; then the resin is washed until neutral pH.

For Amino acid elution from 3 ml 6 N NH<sub>4</sub>OH solution was passed through column at 2 drops per second. The eluate is collected in a round bottom flask together with distilled water, which is used to wash column to neutral pH. The flask content is evaporated until dried on a rotary evaporator under a pressure of 1 atm. and a temperature of 40-50 ° C.

After adding to the flask, 1 drop of a freshly prepared 1.5% SnCl<sub>2</sub> solution, 1 drop of 2, 2-dimethoxypropane and 2.1 ml of propanol saturated with hydrochloric acid, it was heated to 110 ° C, maintaining this temperature for 20 minutes and then the content was again evaporated in the flask on the rotary evaporator.

The next stage is the introduction of 1 ml of freshly prepared acylating reagent (1 volume of acetic anhydride, triethylamine, 2 volumes and 5 volumes of acetone) into the flask and it was heated at 60 ° C for 1.5-2 min. Then the sample is evaporated until dried on a rotary evaporator and were added into the flask 2 ml of ethyl acetate and 1 ml of saturated NaCl solution. The flask contents were well stirred as while two liquid layers were forming. Then we took upper (ethyl acetate) layer for the gas chromatographic analysis, which was performed on «Carlo-Erba-4200» (US-Italy) a gas-liquid chromatograph.

The results are shown in the Figure 1 and Table 1.

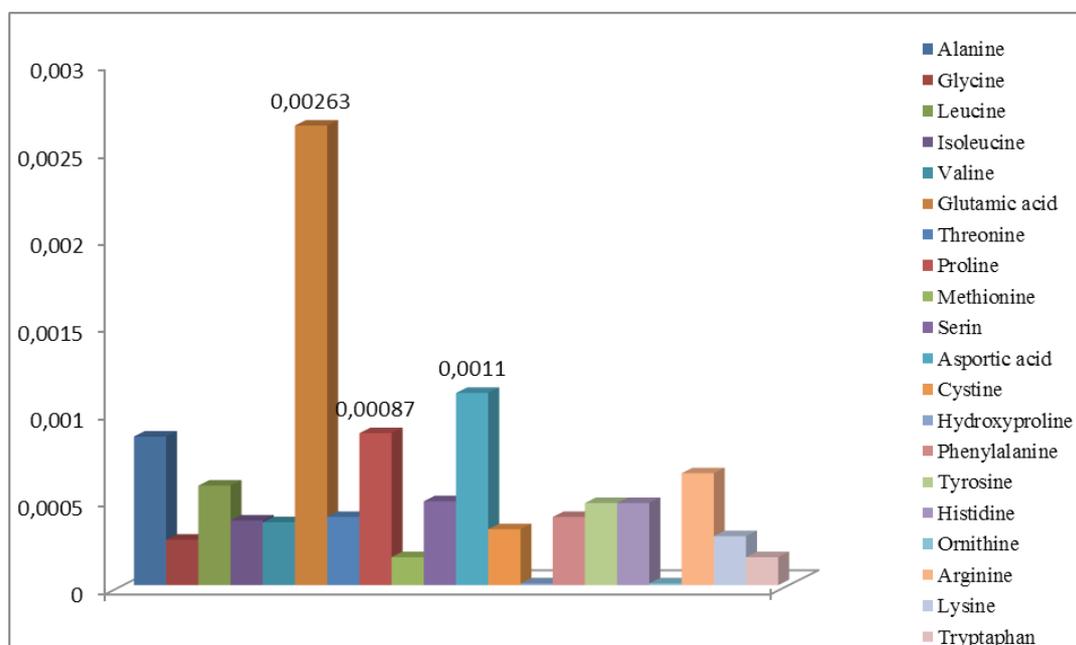


Figure 1 – The quantitative content of individual amino acids in the aerial part of *Echinops albicaulis*, in%

**Table 1** – The quantitative content of individual amino acids in the aerial part of *Echinops albicaulis*, in%

The name	Ratio,%	Name	Ratio,%
Alanine	0,85	Aspartic acid	1,1
Glycine	0,26	Cystine	0,32
Leucine	0,57	Hydroxyproline	0,01
Isoleucine	0,37	Phenylalanine	0,39
Valine	0,36	Tyrosine	0,47
Glutamic acid	2,63	Histidine	0,47
Threonine	0,39	Ornithine	0,01
Proline	0,87	Arginine	0,64
Methionine	0,16	Lysine	0,28
Serin	0,48	Tryptaphan	0,16

According to the results shown in the Table 1 and Figure 1, it can be concluded that the essential amino acids from the aboveground parts of *Echinops albicaulis*, contain large amounts of alanine, glutamic and aspartic acids.

It should be noted that the amino acids in the aerial part of *Echinops albicaulis* contains all the essential amino acids.

The results are shown in Table 2 and Figure 2

#### Determination of fatty acids was performed by GLC [5].

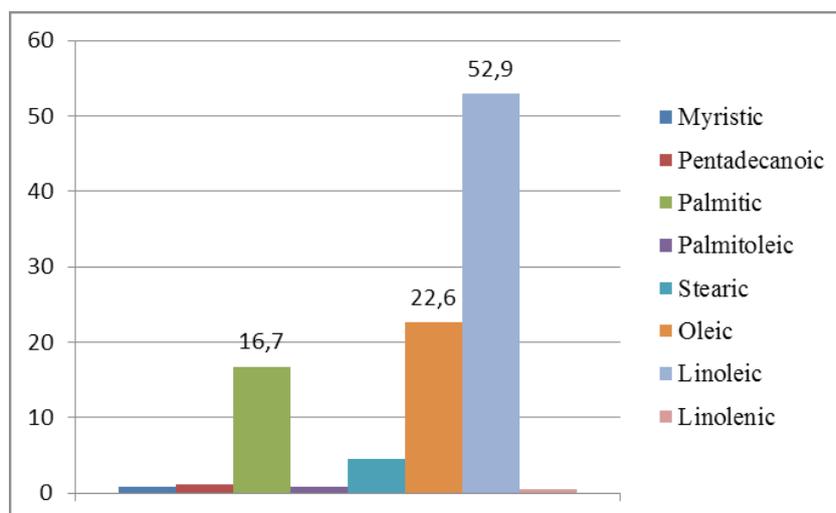
1 volume of sample is extracted by 20 times volume of chloroform-methanol (2: 1) for 5 minutes. Then the content is filtered through a paper filter to obtain a clear extract which is evaporated in a round bottom flask on a rotary evaporator at a bath tempera-

ture of 30-40 ° C until dried. Then, the flask is was filled with 10 mL of methanol and 2-3 drops of acetyl chloride and methylated at 60-70 ° C in a special system for 30 minutes. Then methanol is evaporated on a rotary evaporator and the sample is extracted from the flasks and 5 ml of hexane was injected into the gas chromatograph. Experiments were carried out on the device «Carlo Erbo-4200» (USA, Italy).

#### Conditions of chromatographic:

- Injector temperature – 188 ° C, temp. Detector – 230 ° C;
- Furnace temperature – 188 ° C, Analysis time – 1 hr;
- The contents of the column: polyetyleneglycoladipinat (20%) on the zeolite -545.

The results are shown in the Figure 2 and Table 2.

**Figure 2** – The quantitative content of the individual individual fatty acids in the aerial part of *Echinops albicaulis*, in%

**Table 2** – The content of individual fatty acids in the aerial part of *Echinops albicaulis*, in%

The name of acid	Symbol of acid	Ratio, %
Myristic	C <sub>14:0</sub>	0,84
Pentadecanoic	C <sub>15:0</sub>	1,1
Palmitic	C <sub>16:0</sub>	<b>16,7</b>
Palmitoleic	C <sub>16:1</sub>	0,9
Stearic	C <sub>18:0</sub>	4,5
Oleic	C <sub>18:1</sub>	<b>22,6</b>
Linoleic	C <sub>18:2</sub>	<b>52,9</b>
Linolenic	C <sub>18:3</sub>	0,5

The results of the research, showed that from the fatty acids in the aerial part of *Echinops albicaulis* dominate by quantitative content: linoleic, oleic, palmitoleic and palmitic acid, also an essential omega-6 linoleic acid, an amount of which is more than 50 %.

### Conclusion

1. The amino and fatty acid composition were studied in the aerial part of *Echinops abilcaulis* by GLC (Gas Liquid Chromatography), which are collected near Malaysary in Almaty region;

2. The aboveground part of *Echinops abilcaulis* is a source of many essential compounds, such as amino acids and fatty acids;

3. It is concluded that the aboveground part of *Echinops abilcaulis*, can be used as a medicinal plant for the production of new medicine

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