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FATTY ACIDS AND ANTIOXIDANT ACTIVITY IN VEGETABLE OILS USED IN COSMETIC FORMULATIONS

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The objective of the work was to study the chemical content of a few vegetable oils and its correlation with their antioxidant activity following the use of oils in cosmetic and therapeutic purposes.

A number of vegetable oils (rose hip, flax, hemp, thistle, safflower, camelina) were analyzed by gas chromatography coupled with mass spectrometry (GC-MS), establishing the profile of unsaturated and polyunsaturated fatty acids. Antioxidant activities were determined by FRAP method (Ferric Ability Reducing of Plasma) and it has been attempted correlation with the composition ratio of linoleic acid (omega-6) and linolenic acid (omega-3). It was found that only the hemp oil exhibits the optimal value of this omega acids ratio.

Keywords: vegetable oils, GC-MS chromatography, antioxidant activities, FRAP method

1. Introduction

The importance of vegetable oils has increased in recent years, thanks to their content in fatty acids used to obtain renewable fuels and food, as well as pharmaceutical and cosmetical products. The development concerns of finding natural antioxidants used as natural supplements effective in the prevention of serious diseases, turned the attention of the researchers on the importance of omega-3.

These acids contained in cell membranes are useful to supplement and normalize imbalanced diets in adults and children and are much used in pharmaceutical technique and in cosmetics as carriers of active substances.

A number of vegetable oils (rose hip, flax, hemp, thistle, safflower, camelina) were selected for cosmetic use. The selection was based on their composition and its correlation with antioxidant activity.

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Recent studies [3] point out that rosehip oil contains polyunsaturated fatty acids omega-3 and omega-6 in a ratio (3-4):1 optimal in unbalanced diets, for improving cardiovascular function, boost with immune system, cell renewal and tissue regeneration being a good remedy for skin diseases, favoring rapid healing of wounds and protecting skin against harmful environmental factors.

More studied is flax oil which contains a variety of fatty acids [4-6], the ratio between omega-3 and omega-6 being 3:1, close to the optimal human body needs. There are clear evidences that flaxseed and flaxseed oil may lower cholesterol levels, help prevent certain chronic diseases, such as heart diseases and to stabilize cell membranes.

The hemp oil obtained from *Cannabis sativa* has an insignificant content of tetrahidrocannabiol (THC) incriminated as having a negative action of nervous system [7]. The hemp oil being rich in polyunsaturated fatty acids, is used for its properties of cholesterol lowering, in treating skin diseases, while hemp seeds are considered an interesting nutritional source [8-9].

The milk thistle oil contains unsaturated fatty acids especially linoleic and oleic acids, sterols, vitamin E (alpha-tocopherol) and exhibits, a high antioxidant activity [10-11].

Safflower oil contains a high quantity of polyunsaturated acids, over 80% (especially conjugated linoleic acid) and it is used for lowering the oxidative stress of the cells, maintaining the integrity of cell membranes. It destroy and eliminates fat cells harmful to the body, favors the reducing of the fat absorption, decreases the adipose tissue production, being used as a dietary supplement in diets for weight loss and treatment of cardiovascular diseases [12, 13].

The seed oil of camelina contains a huge amount (up to 45 per cent) of omega-3 and omega-6 fatty acids, as well as a unique antioxidant complex making the oil very stable and resistant to heat and rancidity [14]; it is used in particular like food supplement for animals and in dermatology to treat skin diseases [15].

The objective of this work is to study the content of the above mentioned oils and its correlation with the antioxidant activity in order to be used as liquid lipid matrix in new nanostructured lipid carriers [16-20].

2. Experimental Part

Materials and methods

The vegetable oils were obtained by cold press of the seed of rose hip, flax, hemp, milk thistle, safflower and camelina harvested from own organic crop of Hofigal SA.

Oil samples were analyzed for fatty acid composition by GC-MS method. Fatty acid composition was obtained by the trans-esterification of the triacylglycerols in the oil to their methyl esters. A gas chromatograph Termo – CG with a mass spectrometer DSQ P 5000 was used as detector. A Macrogol column 2000 was used with Φ = 0.25 mm, L = 30 m; gas carrier was Helium, flow = 1mL/min, temperature of injection = 25^{0}C, the column temperature = 250^{o}C. To identify peaks ordering NIST spectra library was available.

The antioxidant activity was determined by FRAP method (Ferric Ability Reducing of Plasma) [19]. The principle of this method consists in reducing the ferric complex of phenanthroline or tripiridiltriazine in the presence of oxidants, to ferrous colored complex with readable absorbance to λ=510 or 593 nm. We used oils acetone solutions consistent with literature data [19, 20].

3. Results and Discussion

The chromatograms shown in figures 1-6 reveal the richness of fatty acids in vegetable oils studied, and the figures 7-9 show the percentage content of the major unsaturated and polyunsaturated fatty acids: oleic acid (omega-9), linoleic acid (omega-6), linolenic acid (omega-3) in each type of the studied oil. To identify peaks ordering NIST spectra library was available.

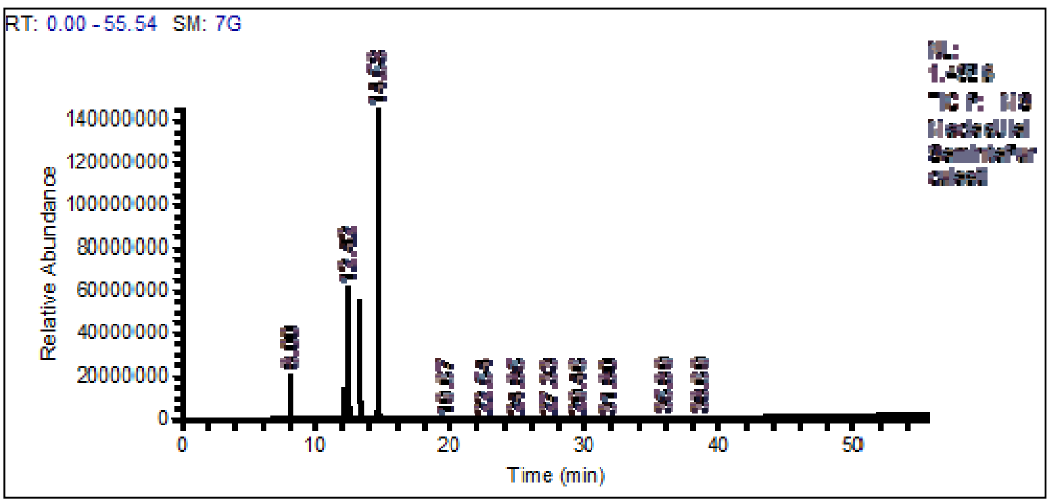

Fig 1. GC-MS chromatogram of rose hip oil

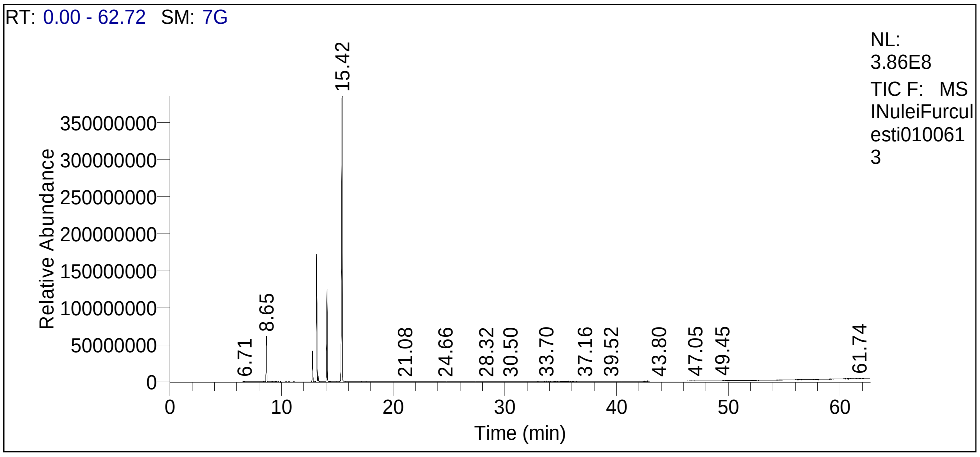

Fig. 2. GC-MS chromatogram of flax oil

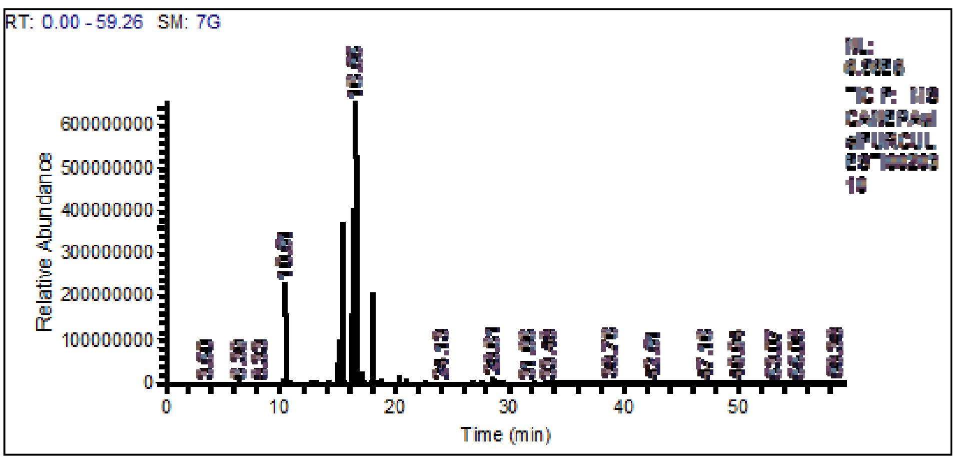

Fig. 3. GC-MS chromatogram of hemp oil

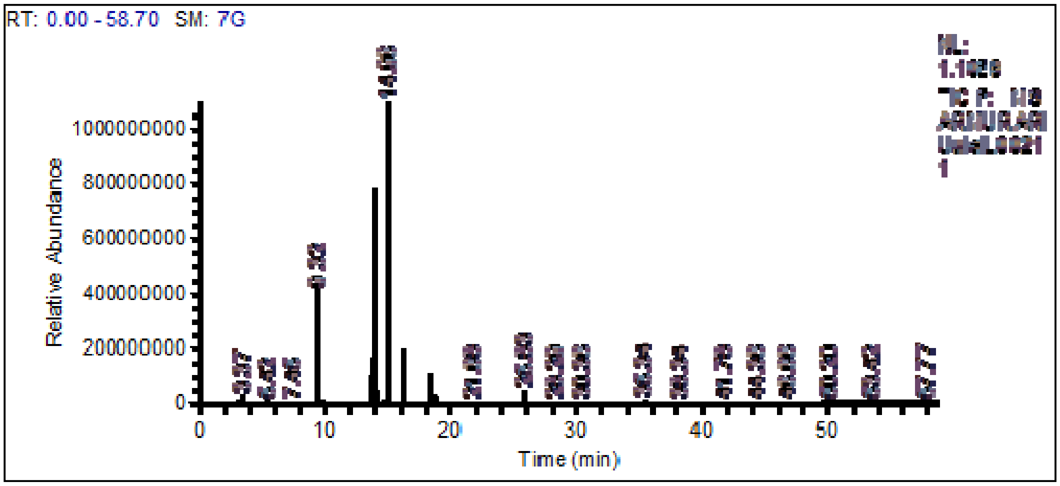

Fig. 4. GC-MS chromatogram of milk thistle oil

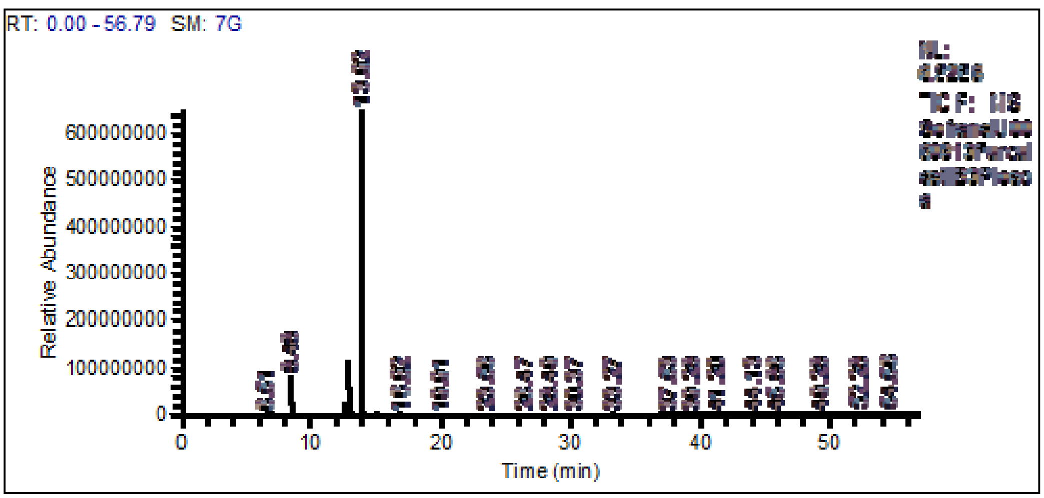

Fig. 5. GC-MS chromatogram of safflower oil

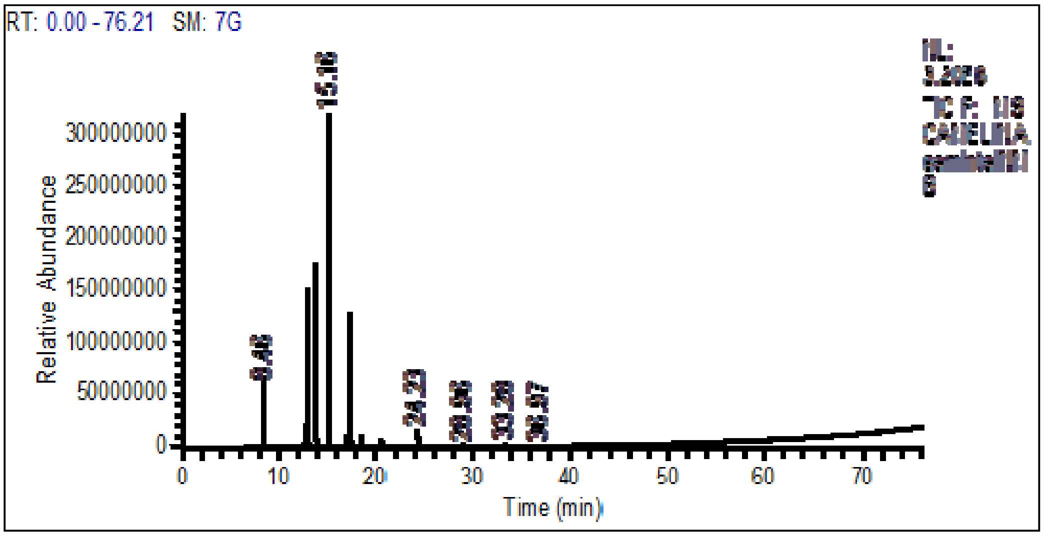

Fig 6. GC-MS chromatogram of camelina oil

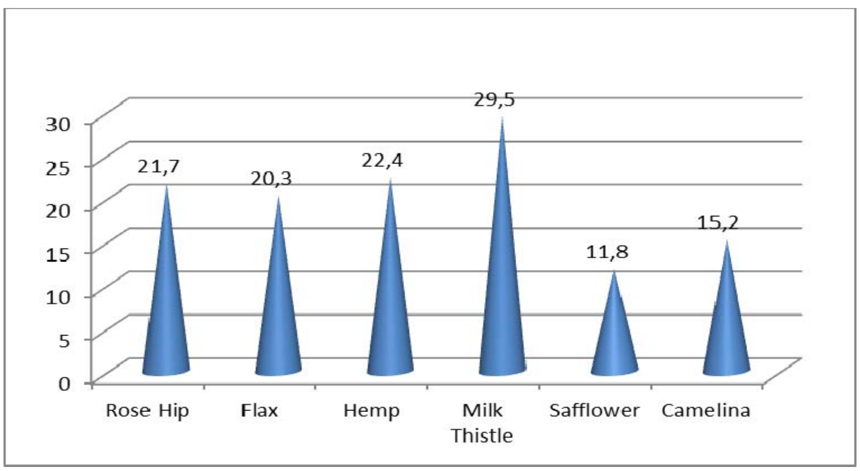

Fig 7. Content in oleic acid (omega-9) in different oils

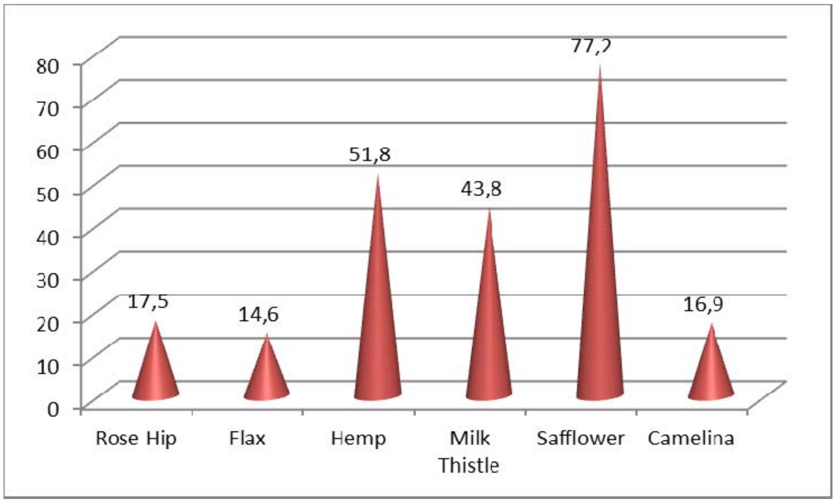

Fig 8. Content in linoleic acid (omega- 6) in different oils

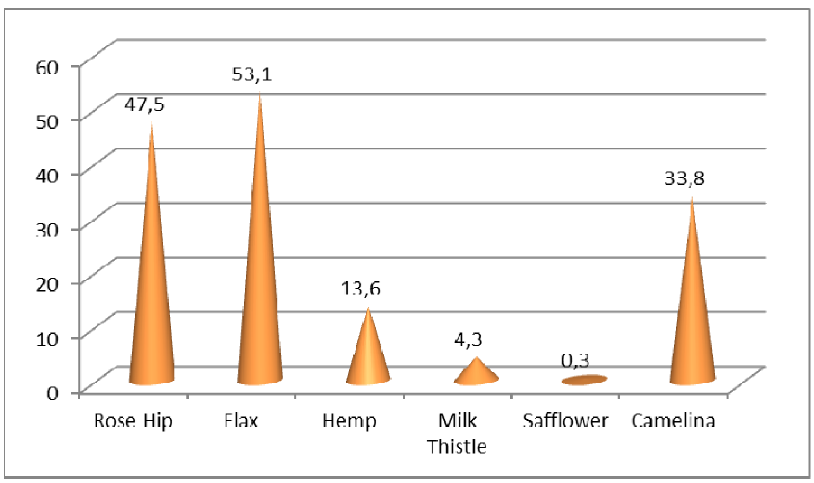

Fig 9. Content in linolenic acid (omega- 3) in different oils

One can be observed that the highest oleic acid content (Omega 9), 29.5 % was found in milk thistle oil, linoleic acid (Omega 6), 77.2 % in safflower oil and linolenic acid (Omega 3), 53.1% in flax seed oil, 47.5 % in rose hip oil and 33.8 % in camelina oil.

In accordance with literature data the optimum ratio in weight between the linolenic (omega-3) and linoleic (omega-6) acids must be: 1:1, 1: 2, maxim 1:4, for achieving a balanced diet to maintain cardiovascular health, strengthen immunity and tissue regeneration.

The Table 1 represents the values of this ratio for various oils and their antioxidant activities determined by the FRAP method.

Table 1

Gravimetric report: linolenic acid (omega-3)/ linoleic acid (omega-6) and antioxidant activities for various oils

No.	Oil Name	Report Omega-3:Omega-6	Antioxidant Activity [mg Fe/g sample]
1	Rose Hip	2.7:1	905.30
2	Flax	3.6:1	890.90
3	Hemp	1:3.8	506.70
4	Milk Thistle	1:10	550.30
5	Safflower	1:257	360.90
6	Camelina	2:1	1005.50

It was found that the rose hip oil, flax oil and camelina oil which present a higher percentage of linolenic acid (omega-3), have significant antioxidant activity determined by FRAP method. Hover, the hemp oil with the best ratio omega-3 la omega-6 (1:3.8), have a medium antioxidant activity.

One can be appreciated that these oils can be used in various products such as food supplements and dermato-cosmetics.

4. Conclusions

The study performed for evaluation of the content of rose hip, flax, hemp, milk thistle, safflower, and camelina by GC-MS measurements revealed the presence of a wide variety of unsaturated and polyunsaturated fatty acids, finding that the richest in oleic acid (omega-9) is the milk thistle, in linoleic acid (omega-6) is the safflower oil and in linolenic acid (omega-3) is the flax oil followed by rose hip oil and the camelina oil.

Determination of antioxidant activity by FRAP method (Ferric Ability Reducing of Plasma) showed high levels for camelina, rose hip, and flax oil.

The correlation the weight ratio (1:3) of linolenic : linoleic acids with the antioxidant activity allow the selection of these oils in order to be used for obtaining dietary supplements and various cosmetic formulations the most promising of them being the hemp oil.

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