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# Lipid Profile And Antioxidant Properties of Selected Pear Cactus (Opuntia Ficus- Indica) Ecotypes From Southern Greece

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**ABSTRACT**

The lipid profile was determined in selected ecotypes of Cactus pear (Opuntia ficus indica), and this research focused on the antioxidant properties of seeds from Cactus pear fruits. Using the methodology of methyl esters the composition of fatty acids of seeds was determined and in the case of antioxidant properties the known technique of Trolox Equivalent Antioxidant Capacity (TEAC) was used. The trolox evaluation assay was applied in aqueous - organic extracts and their residues. The seed oil composition of cactus pear fruits was studied at harvest time. Linoleic acid (70.03%) was the dominant fatty acid, followed by oleic acid (20.11%) and palmitic acid (11.86%), respectively. Among cactus pear seeds, polyphenols contribution to antioxidant properties ranged from 37.9% to 42% for TEAC values. According to the results, the seeds of Cactus pear are a good source of useful lipids and antioxidants.

**Keywords:** Opuntia spp., Cactus Pear, Phenolics, lipids Profile.

## INTRODUCTION

The cactus pear, also known as prickly pear (*Opuntia spp.*) is a native of tropical regions of the Americas, where 300 different species can be found. Over time it began to grown at different parts of Europe, especially in the Mediterranean, as well as in Africa and Australia[1,2]. Due to the ability of the plant to adapt to different environmental conditions, the prickly pear can be grown in a variety of soils and areas (lowlands, coastal areas, plateaus etc). The cactus pear fruit is an oval, elongated berry of approximately 67-216 g weight. They offer a wide spectrum of colors from white, yellow, orange, red, and purple based on betalains and contain about 85% water, 15% sugar, 0.3% ash and less than 1% protein [4]. The fruits and other parts or plant organs are exploited in various ways (fresh fruits, fresh cladodes, jams, alcoholic beverages, soft drinks etc) and in different sectors such as production of organic fertilizers, colours, biogas, medicines, cosmetics, animal feed etc. For this reason there is a growing demand for Prickly pear cactus products which are quite promising for the future of farming[5]. In Greece there is no systematic plantation of pear cactus, however, there are approximately 100,000 scattered plants occurring mostly in several parts of southern Greece [6]. Polyphenols have received much attention lately as a major category of natural antioxidants. These bioactive compounds show a great variety of physiological properties, such as antioxidant properties and are protective for the function of the human body[7]. Polyphenols exist as free extractable compounds solubilized by aqueous organic solvents and as bound (less extractable) types of compounds that remain in their extraction residues[8,9]. Recent studies have used an alkaline hydrolysis process, acid hydrolysis, or enzymatic digestion to extract

various compounds from plant tissues [10,11]. It needs to be stressed that significant amounts of bioactive compounds remain in the extractable residue as non extractable polyphenols [12,13,14]. These non extractable polyphenols constitute the major part of dietary polyphenols as reported by the study of dietary polyphenols in cereals, fruits, vegetables, nuts, and legumes. Few Studies have been reported on the non extractable polyphenols compared to those on the extractable polyphenols [15,16]. There are no studies addressed to the determination of antioxidant properties in aqueous-organic extracts and residues of Cactus pear seeds. The aim of this research was to determine the seeds' lipids profile, to give more information about total polyphenols (extractable –non extractable) and to evaluate the antioxidant properties of seeds from colored ecotypes of Cactus pear, presenting a scientific signal by these data for consolidation of the above mentioned genetic material at a local industrial level.

## MATERIALS AND METHODS

### Plant material

Fruits of *Opuntia ficus-indica* from native populations of Messinia's coast places were collected. Mature fruits were collected from three different ecotypes from well developed plants with colored flesh. The collected fruits were classified according to flesh color in Red Samples, Purple Samples and Orange Red Samples. Thus, a number of 30 randomly selected fruits from each color sample were washed and drained. Spines and peels of fruits surface were removed under running tap water. The processed fruits were cut into half and introduced into a pulper-finisher to separate the seeds from the pulp. Seeds were washed under running water several times on a screen, dried at ambient temperature and weighed.

### Analytical procedures

The oils were analyzed by gas chromatography-mass spectrometry (GC-MS) using an Agilent mass selective detector coupled with an Agilent gas chromatograph. The MS operating parameters were as follows: ionization potential, 70 eV; ionization current, 2 A; ion source temperature, 200°C, resolution, 1000.Mass units were monitored from 30 to 450 m/z. The oil components were identified by comparison of their retention times and mass spectra with the NIST mass spectral library23. The chromatographic conditions were identical to those used for GC analysis.

### Extractions and antioxidant properties

Total phenolic compounds were extracted as it has been described[17], with minor modifications as follows. Aqueous - organic extracts (extractable polyphenols) and their residues (non-extractable polyphenols) were isolated and studied.

### Aqueous- organic extract

About 3 – 4 g of samples were placed in a test tube and 25 mL of acidic methanol/water (50:50

**Table 1: Fatty acid profile of the oil extracted from seeds of color flesh fruitsCactus pear (selected sample of seeds from colored fruits)**

| Samples | Fatty acids | | |
|---|---|---|---|
| | Palmitic acid C16:0 | Oleic acid C18:1 | Linoleic acid C18:2 |
| Red sample1 | 13.3±4.6 | 19.3±1.4 | 63.5±11.7ab |
| Purple sample2 | 12.5±6.9 | 23.7±5.1 | 62.9±9.5a |
| Orange-red | 12.9±3.2 | 18.5±3.2 | 61.5±6.2ab |

*mean ± SD: Average value of triplicate analysis (±standard deviation)

**Table 2: Equivalent Antioxidant Capacity (TEAC) values (mmol/kg d.w.) of selected seeds *.\Cactus pear (selected sample of seeds from colored fruits)**

| Samples | Aqueous-organic extract | Residue |
|---|---|---|
| Red sample 1 | 113.3±4.6ba | 69.5±11.7ab |
| Purple sample 2 | 125.3±6.9a | 85.6±9.5a |
| Orange-red sample 3 | 104.3±3.2c | 76.5±6.2ab |

* mean ± S.D.; a–c: Anova, Duncan Test: within samples of each type of seeds, by columns, means followed by different letters are significantly different ($p < 0.05$).

v/v, pH 2) were added. The tubes were vortexed at room temperature for 3 min, followed by shaking in a water bath at room temperature for twelve hours. The tube was centrifuged at 2500g for 10 min, and the supernatant was recovered. Twenty milliliters of acetone/water (70:30, v/v) were added to residue, followed by vortexing, shaking and centrifugation. Both methanolic and acetonic extracts were combined and centrifuged at 3500g for 15 min. The resulting supernatant was transferred into tubes and directly used for the determination of antioxidant capacity.

**Residue**

Residues were left in a ventilating and heating apparatus (max temperature 25 °C), until dryness. Briefly, 300-400 mg of the residue were mixed with 20 mL of methanol and 2 mL of concentrated sulfuric acid (18 M). The samples were gently stirred for 1 min and were shaken in a water bath at 85 °C for 24 h. The samples were then centrifuged (3000g for 10 min), and the supernatant was recovered. After two washings with minimum volumes of distilled water and re-centrifuging as necessary, the final volume was taken up to 50 mL. The tube was centrifuged at 3500 g for 20 min and transferred into the tubes and directly used for the determination of antioxidant capacity.

**Antioxidant Properties Determination**

Antioxidant properties have been determined in both aqueous -organic extracts and their residues using the methodology of Trolox Equivalent Antioxidant Capacity (TEAC).

***Statistical Analysis***

All analyses were performed in triplicate. Data are presented as mean ± Standard Deviation (SD). Statistica for Windows statistical package was used to perform One-Way Analysis of Variance (ANOVA).

## RESULTS AND DISCUSSION

Several studies have been reported on prickly pear seeds considering them as an unexploited source of oil obtained from the seeds and constituting 5.7% of the dry seeds material. In Table 1 the fatty acid profile is shown with reference mainly to the amounts of linoleic acid. The amount of linoleic acid in the three different samples of *Opuntia ficus-indica* oil was higher than that found in the majority of commonly consumed oils such as corn, soybean and cotton seed and close to that of safflower oil [18]. In general, the higher level of unsaturation and particularly the high level of linoleic acid in conjunction with the absence of linolenic acid, which adversely affects the stability of the oil, indicated that *Opuntia ficus-indica* seeds might be an excellent potential source of oil.

In Table 2 TEAC values (mmol/kg d.w.) of aqueous-organic extracts (combining two extraction cycles) and the corresponding residues of selected seeds are shown. For colored fruits seeds, TEAC values ranged from 113.3 ± 4.6 to 125.3 ± 6.9 mmol/kg d.w. in aqueous-organic extracts and from 69.5 ± 11.7 to 85.6 ± 9.5 mmol/kg d.w in the residues. In the present work the antioxidant capacity (TEAC values) of hydrolysable polyphenols ranged from 37.9% to 42%. The purple samples showed the highest Equivalent Antioxidant Capacity (TEAC) values. As reported in the literature, non extractable polyphenols are more abundant compared to extractable polyphenols in many foodstuffs [13]. High antioxidant capacity of hydrolysable phenolics was found in the residues of aqueous-organic extracts in cereals [12] and walnuts [19,20].

## CONCLUSION

This study demonstrated that cactus seeds could be considered as a source for natural phenolic antioxidants giving information for total polyphenols (extractable –non extractable). The trend towards natural ingredients and products of health promotion is likely to increase. The data of the present work show evidence that cactus pear oil might be a potential nutraceutical and could be used as a new source of oil from untapped fruits of Pear cactus native population. Pear cactus (*Opuntia ficus-indica*) seeds might be an excellent potential source of oil. In the future, prickly pear cultivation can be expected to increase if there is a demand for production of fruit juices or other industrial products.

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