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Influence of some thermal treatments on carotenoids content of carrots (*Daucus carota* L.)

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Abstract

Through this work we followed the influence of some thermal treatments on the carotenoids content of carrots. Carrots were analyzed fresh and after blanching, boiling, freezing raw and freezing blanching prior. Carotenoids content of the samples was determined spectrophotometrically. As raw material were used carrots from the domestic market, Flam variety. The highest carotenoid content was recorded for raw carrot (82.716 mg / g). By boiling for 20 minutes, the content of carotenoids in carrot remains only 28% (23.209 mg /g). Frozen carrot also lose the contents of carotenoids, leaving only 33.8% (27.961 mg /g). The lowest content of carotenoids(20.196 µg/g) was found in carrots blanched and then frozen for 2 months at -18˚C.

Keywords: carotenoids, carrot, thermal treatments, spectrophotometry.

1. Introduction

Carrot (*Daucus carota* L.) is grown for its thickened roots that are consumed fresh, cooked, dried, preserved and in the form of juices. Belongs to the *Apiaceae* family and comes from the Mediterranean and South - West Asia, where it grows in the wild flora. Carrot is considered one of the most valuable vegetable because of its food value and that can be eaten fresh all the time of year. It is an important source of carotenoids, especially β-carotene, while being the vegetable product which first carotenoids were isolated in 1831 by Wackenroder [1-3].

In most varieties of orange carrots predominant hydrocarbon carotenoids, especially β-carotene, while xanthophylls represents 5-10% of total carotenoids. Were obtained by selecting some varieties of carrots containing three times more lycopene than β-carotene. In yellow varieties of carrots, xanthophylls content is higher than that of the hydrocarbon carotenoids. Also, by genetic improvement research succeeded in obtaining new varieties of carrots in which the total carotenoid content increased from 60-120 µg/g, at 310- 370 µg/g [2-4]. It has been reported that processing methods can results in degradation of carotenoids [5-6].

The aim of this study was to analyze the influence of different types of heat treatment (blanching, boiling, freezing raw and freezing blanching prior) on the content of carotenoids in carrot.

2. Material and methods

As raw material were used carrots from the domestic market, the variety *Flam*.

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We determined the content of carotenoids in raw carrots, boiled carrots (20 min.), raw- frozen carrots (freeze two months, approx. -18˚C) and carrot frozen (freezing two months, approx. -18˚C) after blanching (30 min. at 80C).

2.1. Extraction and purification of carotenoids. In order to obtain the carotenoid extracts, vegetable weighed sample was triturated with quartz sand over which was added a solvent mixture of petroleum ether: acetone: ethanol 96% (6: 3: 1, v: v: v). The samples were centrifuged at 3000 rpm for 5 min., after which the extract (supernatant) was decanted into a brown glass bottle, repeating the centrifugation operation with new portions of the solvent, until complete exhaustion of the vegetable material. The combined carotenoidic extracts were then subjected to concentration in vacuo at 35 °C in a rotary evaporator (Model RV-05, 1-B, basic, Japan Shimadzu) to a small volume (15-20 ml) [7].

The obtained raw extract was treated with 40 ml of petroleum ether and left overnight (16 hours) at a temperature of -10 °C. The precipitated sterols were removed by centrifugation for 10 minutes at 2000 rpm. The supernatant was then concentrated in vacuo on a rotary evaporator at 35 °C to a small volume (10-15 ml) [2-4].

The extract remaining after the removal of sterols was further subjected to saponification in order to remove lipids and esters by treatment with 40 ml 20% alcohol solution of potassium hydroxide and leaving overnight (16 hours) at room temperature under an atmosphere of nitrogen and in the dark. Carotenoids were then back-extracted with petroleum ether in a 500 ml separatory funnel, washed several times with a saturated sodium chloride solution and then with distilled water until complete removal of the soaps and alkali. The combined ether extracts were passed over anhydrous sodium sulfate to remove traces of water and then concentrated under vacuum at 35 ° C in a rotary evaporator until complete removal of the solvent. Carotenoids obtained were redissolved in a volume of petroleum ether and stored in brown bottle at -20 ° C under an atmosphere of nitrogen, to be then subjected to analysis [3,4].

2.2. Spectrophotometric determination of total content of carotenoids in extracts. For the spectrophotometric determination of the total carotenoid content of the extracts obtained was used a UV-VIS spectrophotometer JASCO V-670 model.

Was used 1 cm cuvette and the absorbances of the samples were determined in petroleum ether, at the wavelength: λ = 450 nm; for compensation was used petroleum ether.

Estimate the total amount of carotenoids in samples by this method was performed using the formula [2-5,8,9]:

$$\mu g \text{ carotenoids/g vegetal material} = \frac{A \cdot V \cdot 10^4}{A^{1\%}_{1cm} \cdot m}$$

where:
A - is the absorbance at the given wavelength;
V - volume of extract analyzed (ml);
$A^{1\%}_{1cm}$ - specific absorption coefficient of β-carotene in petroleum ether (2592);
m - mass of the sample (g).

3. Results and discussion

The results of the determinations of total carotenoid in the samples are shown in Figure 1

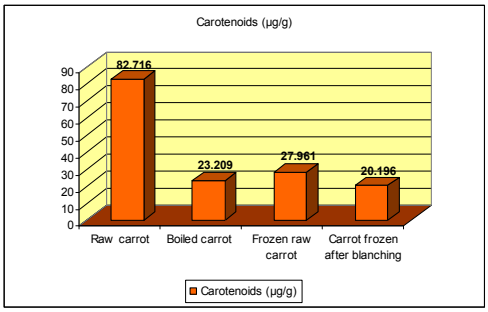

Figure 1. Total carotenoids content of the samples

Analyzing the results, we find that the highest carotenoid content was recorded for raw carrot (82.716 µg/g) - a value which falls within the area referred to literature data for raw carrots [3,5,8,9].

By boiling for 20 minutes, the content of carotenoids in carrot, still only 28% (23.209 µg/g) - Figure 2.

Raw carrot frozen for 2 months also lose the contents of carotenoids, leaving only 33.8% (27.961 µg/g)), these compounds being in a higher concentration than in the boiled carrot sample.

Therefore, boiling affects more than freezing the content of carotenoid compounds in carrots. In the case of carrot blanched and then frozen two months, we find the lowest content of carotenoids, these destroying the largely (75.58%) after these thermal treatments.

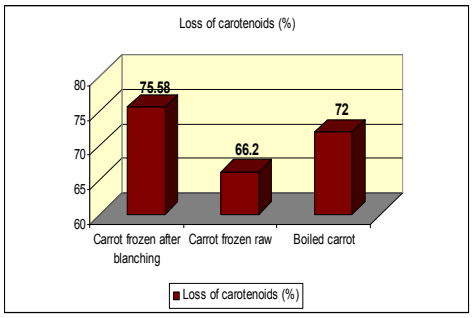

Figure 2. Loss of carotenoids on samples subjected to heat treatments

4. Conclusions

Of this research paper the following conclusions can be drawn:

- The highest carotenoid content was recorded for raw carrot.
- By boiling for 20 minutes, the content of carotenoids in carrot, still only 28%.
- Raw carrot frozen for 2 months also lose the contents of carotenoids, leaving only 33.8%, these compounds being in a higher concentration than in the boiled carrot sample.
- In the case of carrot blanched and then frozen two months, we find the lowest content of carotenoids.
- Losses of carotenoids for each carrot samples that were subjected to heat treatment are greater than 65%.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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