Variation of antioxidant activity and bioactive compounds in organic tomatoes after different types of processing

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INTRODUCTION

- Tomatoes (*Lycopersicon esculentum* L.) are vegetables essentially and widely consumed as components of diets all over the world. Tomatoes are abundantly rich in carotenoids such as lycopene and β – carotene but also in various polyphenols compounds and vitamins. Drying is widely employed to process tomatoes into products such as in powders, juice, cans, sachet and other forms in order to improve their shelf life by reducing moisture content which aids microbial decay [1].
- The aim of this study is to investigate the influence of pretreatment and drying process on antioxidant activity, total phenolics, flavonoids, L-ascorbic acid, and carotenoids contents in processed organic tomatoes (var. *Cher Ami*) harvested ripe in September 2019 from hi-tech glass greenhouse of BioCulture (Cluj, Romania).

MATERIALS AND METHODS

Drying treatments for organic tomatoes

Samples:

1. Slices of tomatoes

Drying treatments

- Blanching at 95 °C for 1.5 min
  - hot-air drying at 40 °C
  - hot-air drying at 70 °C

2. Freeze tomatoes

- Freeze-drying at -55 °C CHRIST LyoCube Alpha 4-8 dryer

Analyses of organic dried tomatoes

- ***Preparation of phenolic extracts***
  Extraction with 70% methanol at 1:10 solid to liquid ratio (w/v), three successive extractions.
- ***Total phenolic content (TPC) by Folin-Ciocalteu method***
  Phenolic extracts, vis. spectroscopy at 760 nm [2].
- ***Total flavonoid content (TFC)***
  Phenolic extracts, , absorbance measured at 510 nm [3].

Specord 210 Plus UV/VIS Spectrophotometer (Analytik Jena)

- ***DPPH radical scavenging activity (AA)***
  Methanolic extracts (70%, v/v, 0.1 mL) added to 0.2 mM DPPH/MeOH (2 mL), 25°C, vis. spectroscopy at 515 nm after 30 min. [4].
- ***Ascorbic acid by HPLC***
  Extraction with orthophosphoric acid (2%, v/v) at 1:10 solid to liquid ratio (w/v) [5].
  Detection at 244 nm.

HPLC Agilent 1200 Infinity Series (UV-DAD detector)

- ***Analysis of carotenoids by UPLC-PDA***
  Successive extraction of 200 mg tomato powder with water, MeOH and dichloromethane.
  Separation on a 250 x 4.6 mm i.d. YMC C30 column (35 °C), at 444 and 459 nm, mobile phase: methanol (A), methyl tert-butyl ether (B), 0.7 mL/min.

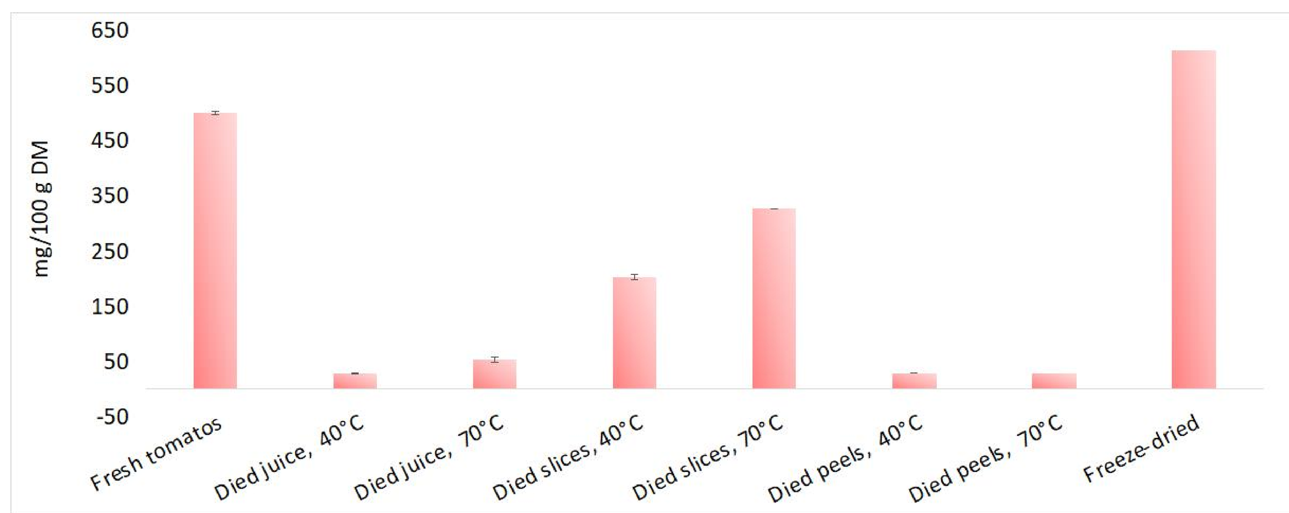
Waters ACQUITY UPLC (UV-PDA detector)

RESULTS AND DISCUSSIONS

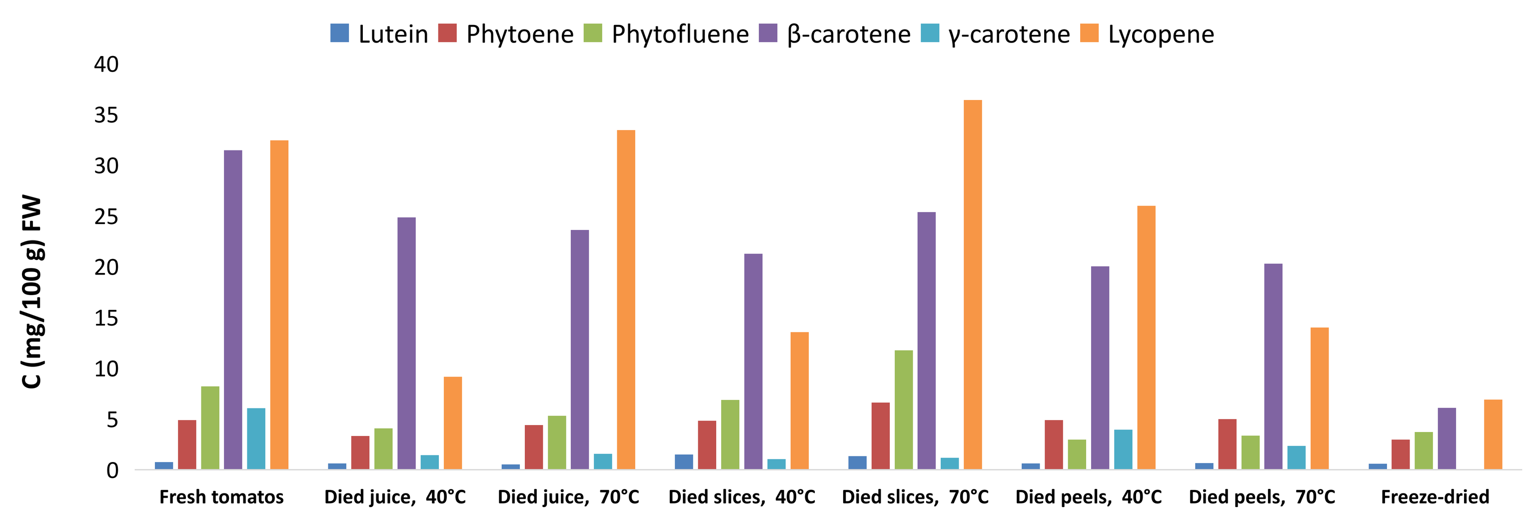
Variation of TPC, TFC and AA

- Higher amounts of TFC were found in the dried skins compared to dried slices and juice. The drying temperature didn't have a major influence on flavonoid content.
- The TPC decreased with more than 71.65 ÷ 80.14 % indifferent of processing method. The dried peels showed the lowest polifenol content (164.8 mg GAE/100 g DM at 40 °C; 170.6 mg GAE/100 g DM at 70 °C).
- AA showed variations between drying temperature and sample types (juice, peels, slices), the highest antioxidant activity was found in freeze-dried tomatoes (21.3 mM/100 g DM), mostly beeing influenced by a high content of ascorbic acid.

Variation of Ascorbic acid



Variation of carotenoids



- Lycopene was identified in the highest concentration followed by β-carotene, and lutein.
- The variation of lutein content didn't varied with the drying process. For blanched tomatoes dried at 70°C resulted in an increase of both total carotenoid content, β-carotene and lycopene content compared to their counterparts at 40°C.
- Highest L-ascorbic acid content was determined in the slices of tomato dried at 70°C and in the slices dried at 40 C, with a decrease compared to the fresh product to 65% from the initial content.
- Due to a more advanced processing protocol, the juice and peel had up 10 times less L-ascorbic acid, around 28.49 – 28.75 mg L-ascorbic acid/ 100 g dried matter.

CONCLUSIONS

- The novelty and the potential impact of this study is represented by the possibility to obtain value added products (natural additives and colourants) from organic tomatoes using technological processes with low costs and reducing the amount of waste resulted from the processing of fresh raw material.

ACKNOWLEDGEMENTS

"The authors acknowledge the financial support for this project provided by transnational funding bodies, being partners of the H2020 ERA-net project. CORE Organic Cofund and the cofund from the European Commission."

„This work was supported by a grant of the Romanian Authority for Scientific Research and Innovation. CCCDI – UEFISCDI, project number 4/2018 ERANET-COREORGANIC SusOrgPlus within PNCDI III."

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