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EFFECTS OF PROCESSING TREATMENTS IN CAROTENOIDS AND VITAMIN C CONTENTS FOR DIFFERENT ORGANIC TOMATO VARIETIES

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Abstract: This study investigates the effects of different processing treatments (hot air at 40 and 70 °C with and without blanching or milling) on the carotenoids and vitamin C contents of diverse organic tomato varieties: Citrina, Golden Jubiléé, Tigrella, Red Cherry, Red Peach, and Roman Speckled. Lycopene was identified in the highest amount, followed by β -carotene. Lutein showed a lower content, which was almost similar in all tomato powders. The high lycopene and β -carotene contents were determined in tomato powders obtained by milling before drying at 70 °C. In powders obtained from tomato dried at 70 °C after blanching and dried, both lycopene and β -carotene appear in lower concentrations than those blanched and dried at 40 °C. This study shows that there were variations in the content of carotenoids that depend on the drying method as well as the processed varieties.

Introduction: The utilization of organic products as sources for natural ingredients has been a great preoccupation in the recent years due their high-quality value and reduced impact on environment, human, plant, and animal health. Organic tomatoes are a good source of natural microconstituents such as carotenoids, phenolic compounds, folates and ascorbic acid. Processed tomatoes into powders as a result of drying process are used as functional ingredient by food processors because of easily preservation and storage.

The present study aims to investigate the effects of different processing treatments (hot air at 40°C and 70°C, with and without blanching or milling) on the carotenoids and vitamin C contents of powders obtained from organic tomatoes.

Material and methods: For this study, six varieties of organic tomatoes such as Citrina, Golden Jubiléé, Tigrella, Red Cherry, Red Peach, and Roman Speckled were harvested at the optimal harvest time stage from the organic farm in conversion Nasul Roșu Romania in July-August 2018. Two types of processing treatments were applied to organic tomatoes: (1) hot-air drying at 70 °C of finely milled tomatoes for 50 s at 9000 rpm in a knife mill and (2) hot-water blanching pretreatment which consisted of dipping of tomato slices in hot-water with a temperature at 95 °C for 1.5 min followed by hot-air dried at 40 °C and 70 °C. The drying process was performed in a dehydrator Excalibur 9.

Analysis of ascorbic acid by HPLC: The identification and quantification of ascorbic acid was realized through High Performance Liquid Chromatography (HPLC) using the adapted method from Chanforan et al., (2012). An Agilent Technologies 1200 chromatograph equipped with an UV-DAD detector was used for vitamin C analysis. Chromatographic separation was performed using a ZORBAX XDB-C18 (4.6 x 50 mm, 1.8 µm i.d.) column at 30 °C, with identification at 244 nm.

Extraction and analysis of carotenoids: Dried tomatoes were extracted with methanol and dichloromethane in ratio of 1:5:5 (w/v/v). For each sample the extraction was repeated two more times with dichloromethane. All three supernatants were combined, evaporated to dryness under N₂ (25 °C) and the dried extract was dissolved in methanol-tetrahydrofuran (50:50, v/v). Analyses were performed with a chromatograph ACQUITY UPLC I Class - Waters (Waters, Milford, MA) coupled to an UV-Vis diode-array detector on a 150 x 4.6 nm RP C30, 3 µm YMC column kept at 35 °C. Carotenoids were detected at 444, 285 and 366 nm and identified by retention time and UV-Vis spectra.

Results: Qualitative analysis showed the presence of β-carotene, lycopene, lutein, phytoene, phytofluene and γ-carotene in Red Cherry, Red Peach, and Roman Speckled (Figure 1). All carotenoids mentioned above, with exception of γ-carotene, were identified in Roman Speckled and Tigrella. For yellow tomato variety Citrina, only β-carotene, lycopene and lutein were detected.

The type of drying treatment affect the carotenoid content in tomatoes. It was observed, in the case of the dried tomato slices, that the β-carotene and lycopene appear in lower concentrations compared with dried tomatoes after milling, as a result of the oxidative processes that are carried out in cells, especially at 70 °C (Figure 2). The vitamin C content is present in higher amounts in blanched tomato slices dried at 40 °C compared to dried milled tomatoes.

Discussion: This study reports that there were variations in carotenoid and vitamin C content which depend on both drying method and the form of raw material to be processed. Regarding the impact of blanching process, the blanched tomatoes dried at 70 °C showed an increase of carotenoids content compared to their counterparts at 40 °C. A contrast variation was observed for vitamin C.

Conclusions: The results showed that tomato milling before hot-air drying at 70 °C increases carotenoids extractability through cell membrane disruption. This knowledge is of further interest in organic food processing sector given the new data on the impact of drying treatments in carotenoids and vitamin C contents for different organic tomato varieties. These results could serve as the basis for the development of novel natural food additives and colourants from organic raw materials.

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Disclosure of Interest: None Declared

Keywords: ascorbic acid content, carotenoids, drying process, HPLC, organic tomato

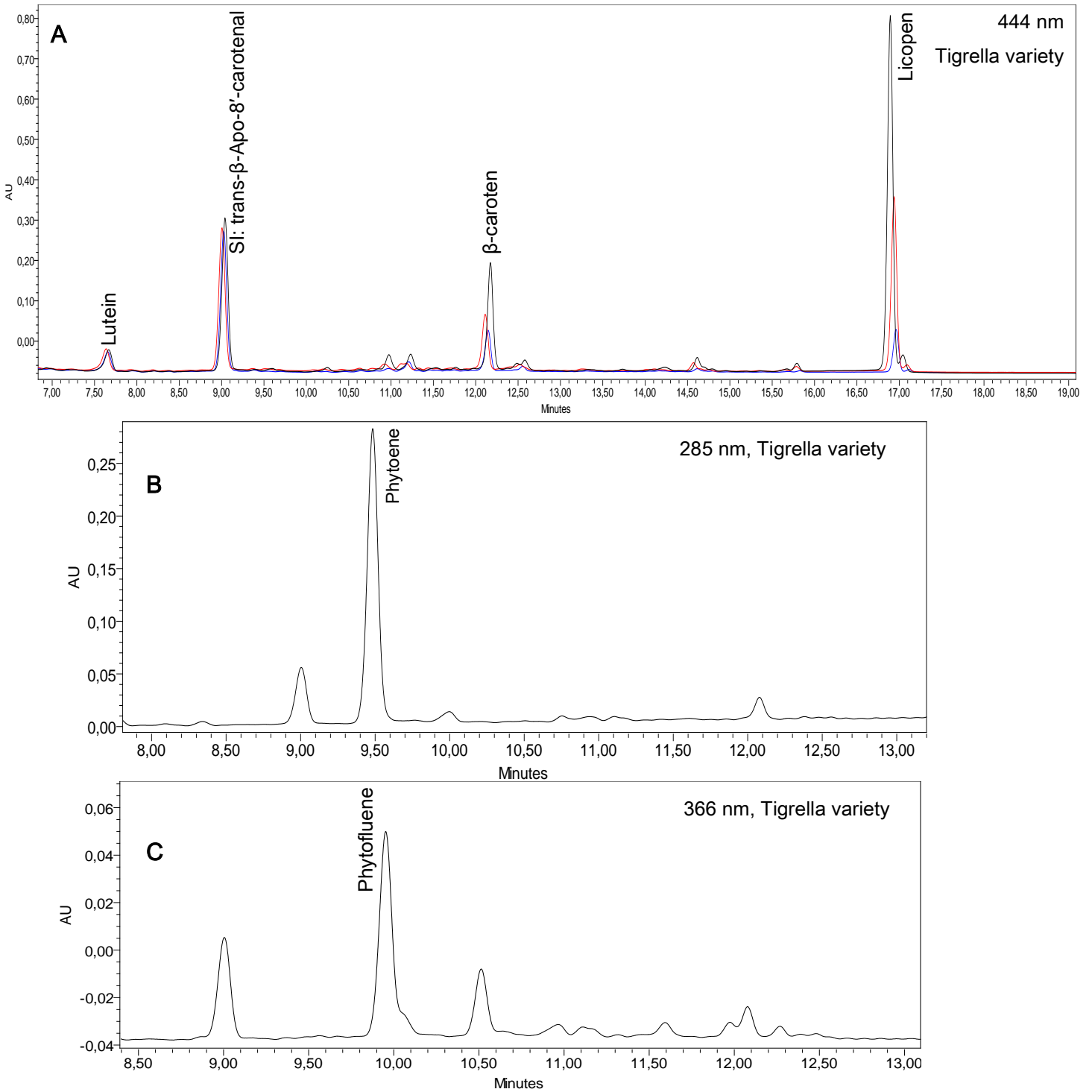


Figure 1. A - Chromatographic carotenoid profile of organic tomato powders (—: without blanching, 70 °C; - - -: with blanching, 40 °C; ---: with blanching, 70 °C); B – Chromatogram of Phytoene at 285 nm; C - Chromatogram of Phytofluene at 366 nm

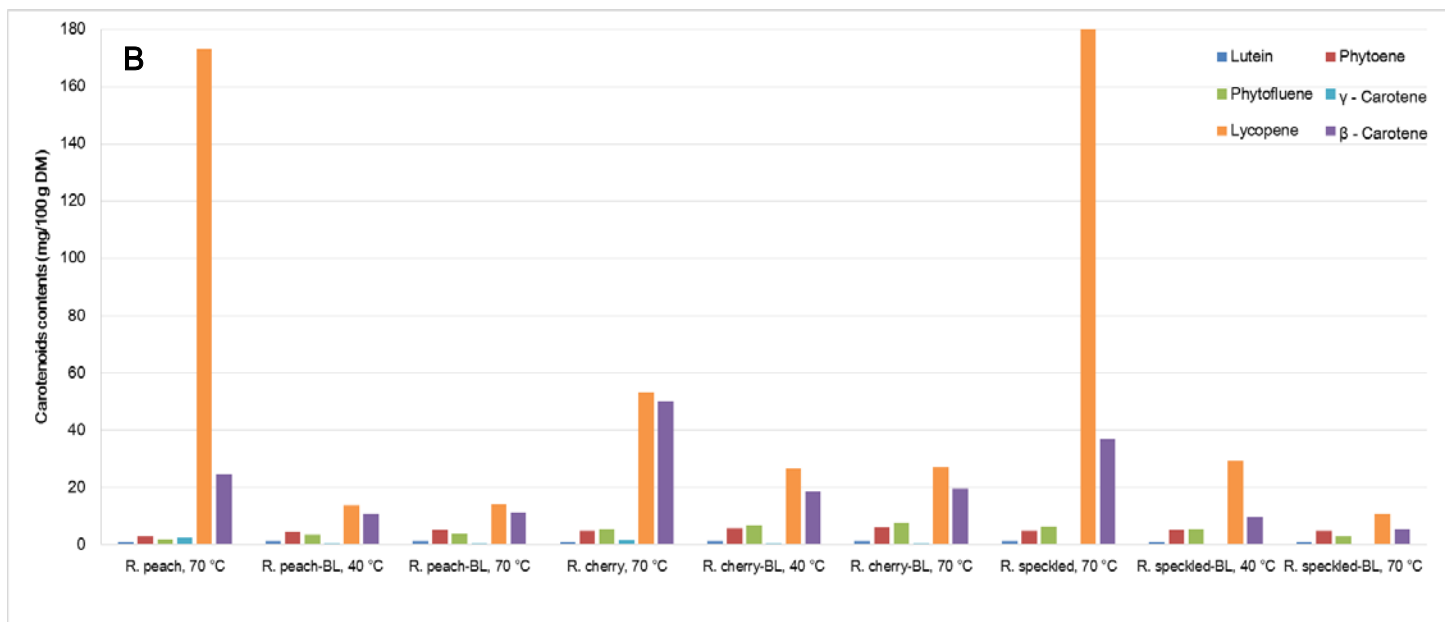
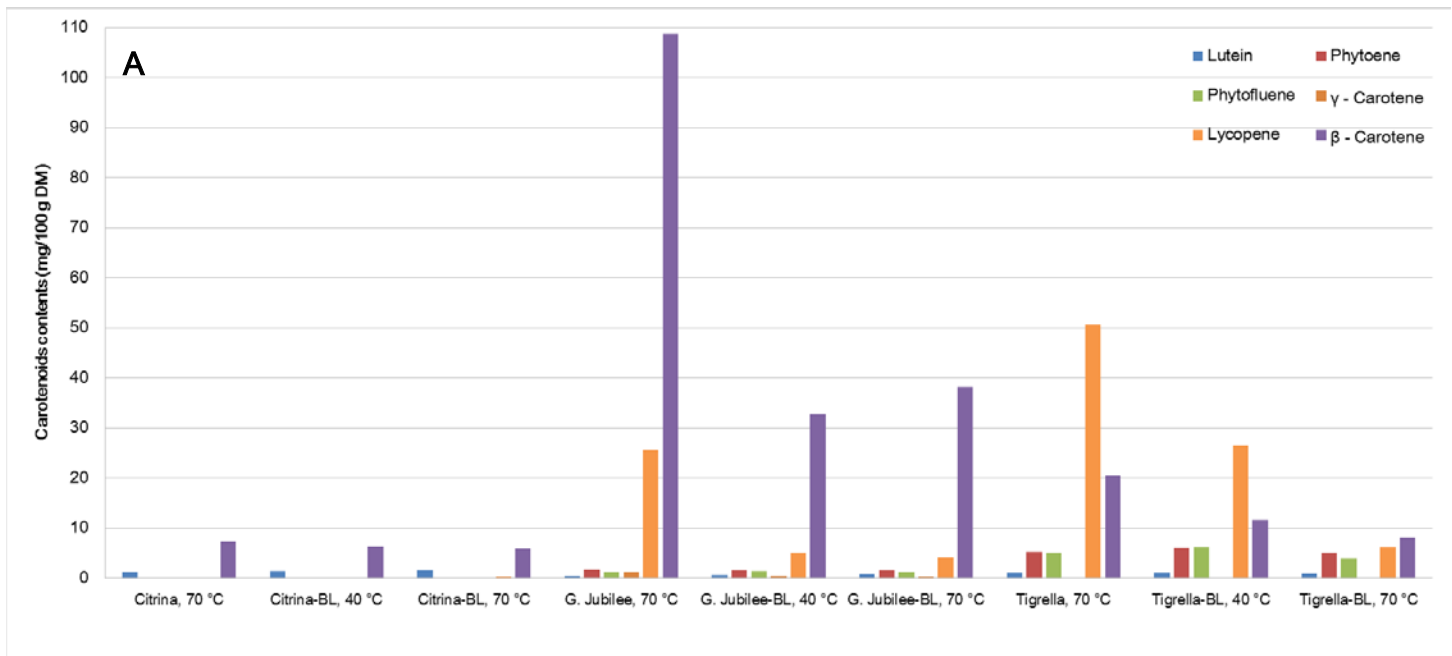


Figure 2. Carotenoid composition in Citrina, Golden Jubileé, Tigrella, Red Cherry, Red Peach and Roman Speckled organic tomatoes. DM: Dry Matter.