Effects of freezing, drying and storage on biological properties of tomato and carrot by-products

Helena Araújo-Rodrigues[1], Débora A. Campos[1], Ivo Rodrigues[2], Manuela Pintado[1,*]

[1]Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa/Porto, Rua Diogo Botelho, 1327, 4169-005 Porto, Portugal. [2]Departamento de Ciência e Tecnologia Alimentar, Instituto Politécnico de Coimbra, Escola Superior Agrária, 3045-601 Coimbra, Portugal. * mpintado@porto.ucp.pt

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Rationale

- Vegetables and fruits have an interesting nutritional profile, rich in bioactive metabolites, holding a high antioxidant potential and health-associated benefits in chronic, cardiovascular, neurological and some cancer diseases[1].
- Tomato and carrot are some of the most consumed fresh and cooked vegetable worldwide[1].
- Numerous studies have reported high levels of bioactive compounds in tomato and carrot and consequent antioxidant activity, for instance, lycopene, phenolics, flavonoids and vitamin E; and anthocyanins, phenolics and carotenoids, respectively[1].
- Besides their biological and functional properties, the shorter shelf life due to their high-water content (>80%) coupled to their seasonality nature, leads to extensive food losses and waste[2].
- The valorization of vegetables and fruits by-products to develop value-added products and the application of preservation methods is of utmost importance to combat food losses and waste.

Aim

Study the impact of freezing (-20 °C) and drying (hot air) as well as the storage time on some biological properties of tomato and carrot by-products

which do not comply with size and shape commercial standards

Materials and methods

Cherry tomato *(Solanum lycopersicum var. cerasiforme)*

Baby carrot *(Daucus carota subsp. sativus)*

Washing and disinfected (NaOCl)

A. Grind and freezing storage (-20 °C)

A. Sampling points: Fresh, M0 (24 h after freezing) and consecutive months (M1, M2, M3, M4, M5 and M6)

Storage: 6 months

B. Drying (hot air: 80 °C, 1 m/s) and vacuum storage

B. Sampling points: DM0 (day 0 of storage) and every two months (DM2, DM4, DM6)

Carotenoid profile (HPLC-DAD)

Preparation of methanolic extracts:

5 g of pulp or dry by-product

Ultra turrax

50 mL MeOH 80% (30 s and 12000 rpm)

Stirring (RT 2 h)

Centrifugation and filtration

Methanol evaporation

Resuspension dH_2O + 2% of maltodextrin

Lyophilization

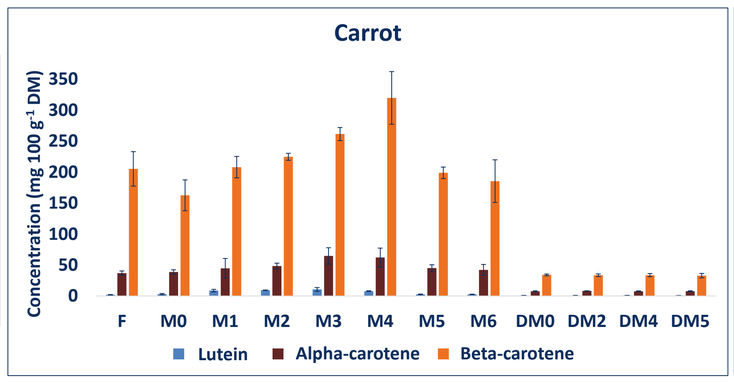
Total phenolic compounds (TPC)

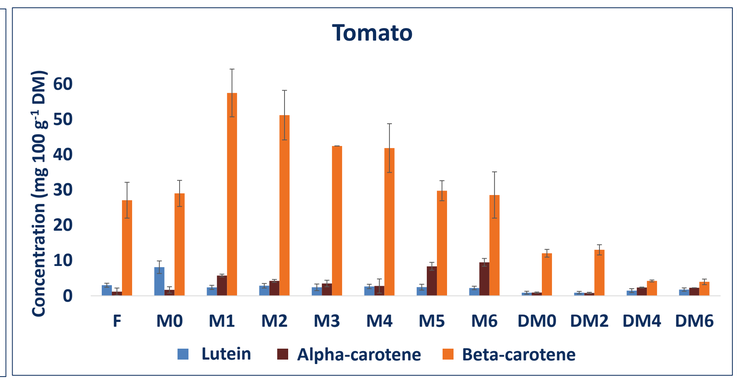
Antioxidant activity- AO (ABTS, DPPH, ORAC)

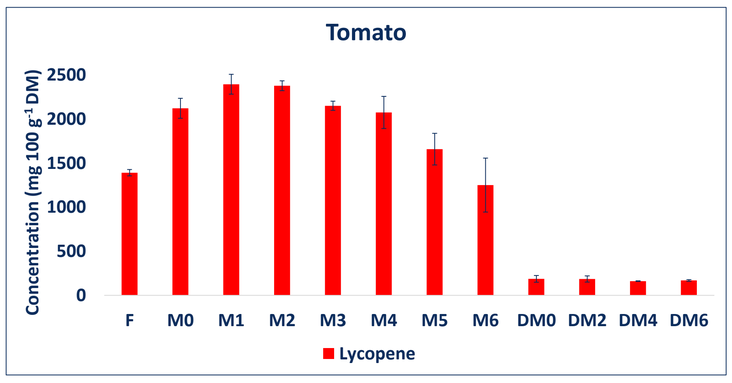
Polyphenolic profile (HPLC-UV/Vis)

Results and discussion

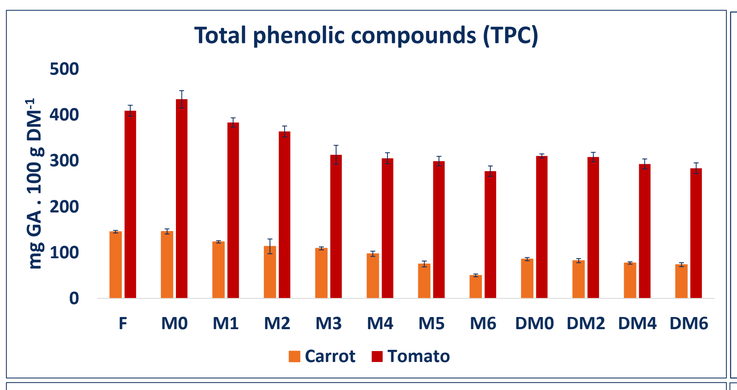
Carotenoid profile

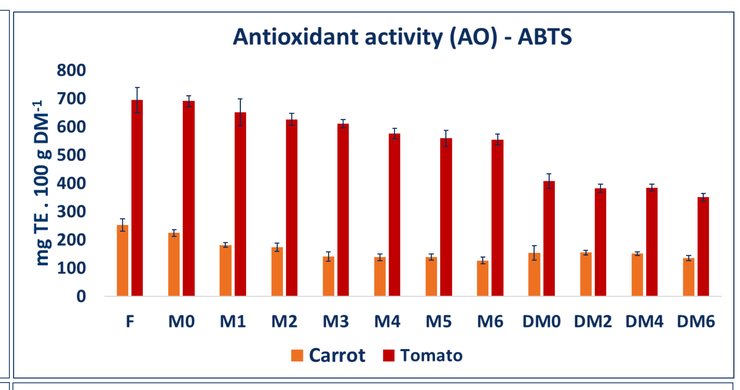


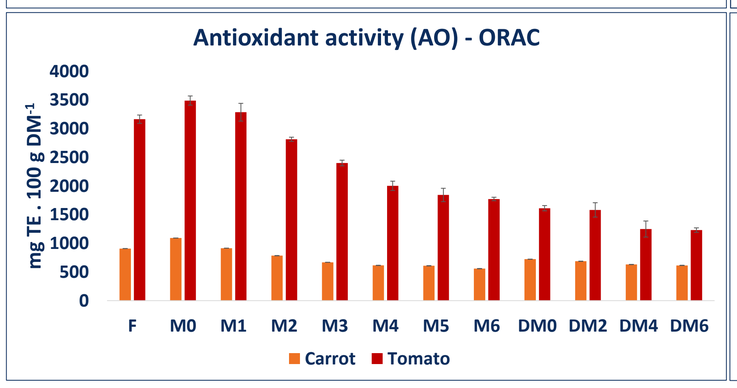


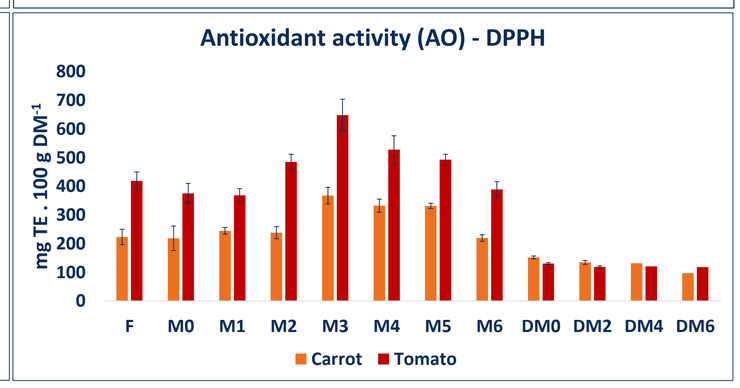


TPC and AO









Polyphenolic profile

- The behavior of carrot and tomato polyphenolic chromatograms at 280, 320 and 350 nm (during both storage approaches) aligned with the TPC results.
- The results suggested a decrease in polyphenolic content during freezing and drying compared with fresh vegetables as well as no significant variations during storage of dry by-products.

Polyphenolic identification:

- **Carrot:** Some hydroxycinnamic acids such as, chlorogenic, p-coumaric, isoferulic and transferulic acids.
- **Tomato:** Chlorogenic acid, p-coumaric, sinapic acid and other hydroxycinnamic acid derivatives and flavonols such as, rutin and some flavanols.

Conclusions

- Most prevalent carotenoids in tomatoes and carrots were lycopene and beta-carotene, respectively.
- During the freezing storage, TPC and AO (by ABTS and ORAC) decreased, while AO by DPPH and carotenoid content increased during the first months, but then it decreased.
- The drying process negatively affected the carotenoid content compared with the fresh vegetables but there were no significant variations during storage time, which indicated high stability of the dry product.
- The results of the carotenoid profile corroborated and aligned with AO results from DPPH.
- Generally, the polyphenolic content decreased during freezing and drying while during dry storage no significant variations were detected, validated the TPC results.

References

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