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VARIATION OF BIOACTIVE COMPOUNDS IN ORGANIC OCIMUM BASILICUM L. DURING FREEZE-DRYING PROCESSING

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INTRODUCTION

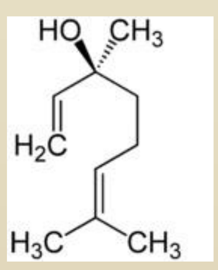
- Consumer demand for organic processed products that keep more of their original fresh plant characteristics has increased in the last years. Fresh herbs (especially Lamiaceae) usually contain 75–80% water, and these water levels need to be lowered to less than 15% for preservation (Ghasemi Pirbalouti et al., 2013).
- The chemical composition of *Ocimum basilicum* L. consists of a wide and varying array of volatile compounds, depending on variations in chemotypes, leaf and flower colors, aroma and origin of the plants (Lal Saran et al., 2017; Vînătoru et al., 2019). Methyl eugenol, methyl chavicol, methyl cinnamate, eugenol, and linalool are generally the main constituents of the basil essential oil Pistelli et al., 2020).
- Drying is by far the most widely used preservation method, as drying inhibits microbial growth, and is also the easiest way to preserve chemical composition. The quality standard for dried products is freeze drying, which preserves the overall appearance of the original product (Telfser et al., 2019).
- This study assessed the variation in bioactive compounds (chlorophyll content, total phenolic content, antioxidant activity and volatile oil content) using freeze-drying technology as the processing method for organic basil leaves.

MATERIALS AND METHODS

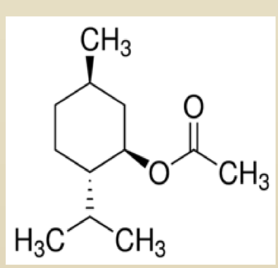
***Ocimum basilicum* L. samples**

- ***Moisture determination***
  - 0.5 g of fresh sample was dried until constant mass in a Sartorius thermobalance at 105 °C.
- ***Chlorophylls a and b, and of total carotenoids content***
  - extraction according to Lichtenthaler & Wellburn (1983) using acetone 80% as solvent and expressed as µg/mL of extract.
- ***Essential oil extraction and GC-MS analysis***
  - hydro-distillation for 3 h in a Clevenger-type apparatus.
  - analyzed by GC-MS) by using a Agilent 6890 GC coupled with a 5973 Network single quadruple mass spectrophotometer detector in Electron Ionization (EI) mode and 7673 injector on a HP-5MS capillary column (30 m × 0.25 mm id, 0.25 µm film thicknesses).
- ***Total phenolic content (TPC)***
  - methanolic (70%, v/v) extracts
  - absorbance measured at 760 nm
  - Specord 210 Plus UV/VIS spectrophotometer
- ***DPPH radical scavenging activity***
  - methanolic (70%, v/v) extracts
  - absorbance measured at 515 nm
  - Specord 210 Plus UV/VIS spectrophotometer

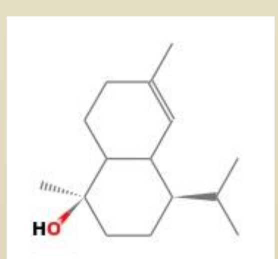
Chemical structure of the main essential oil constituents



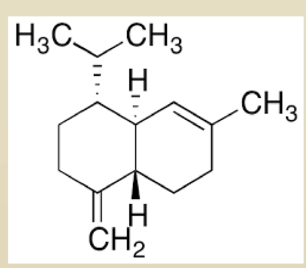
Linalool



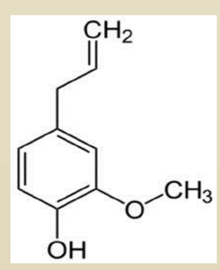
Methyl chavicol



α-epi-Cadinol



γ-Cadinene



Eugenol

CONCLUSIONS

- The changes in volatile oil constituents during freeze-drying vary due to the different boiling points of the compounds. Although freeze drying is one of the most recommended techniques for herbs drying, significant changes can occur in the chemical composition of the essential oil of *Ocimum basilicum* L.
- No significant changes in chlorophyll content was observed. Given the high content of phenolic compounds and antioxidant activity of dried leaves, the freeze-drying is a sustainable processing technique for preservation of phenolic compounds and antioxidant activity.

RESULTS AND DISCUSSIONS

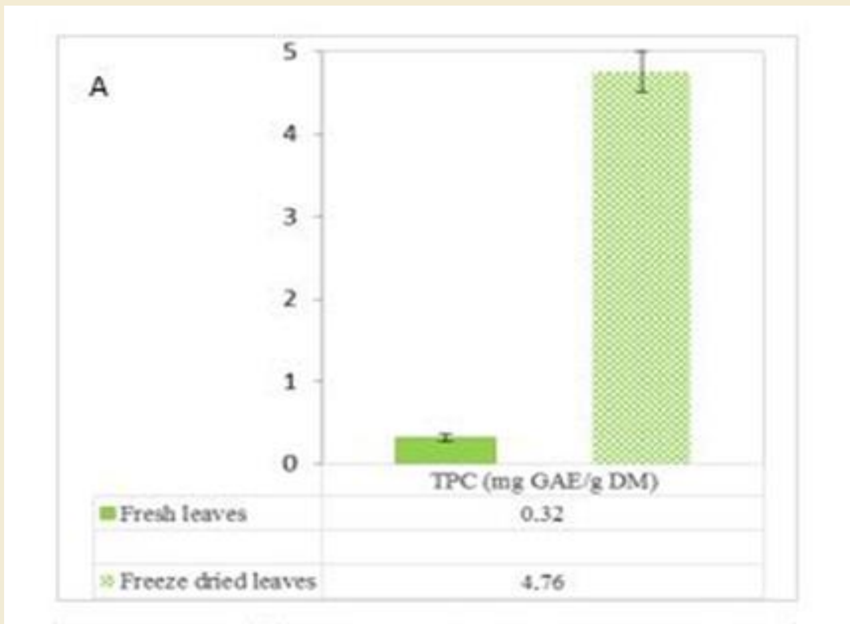
Fresh samples showed a moisture content loss of 86.8% after freeze-drying. The remaining powder (13.2% of the fresh sample), showed a residual moisture of 4.14 %.

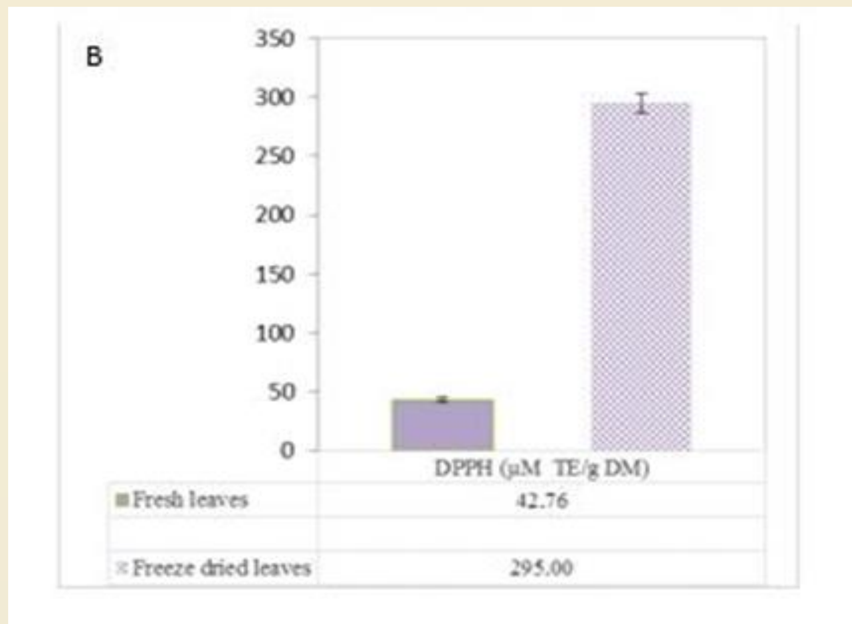
Determination of foliar pigments (chlorophyll a, chlorophyll b, carotenoids)

	Fresh leaves	Freeze-dried leaves
Chlorophyll a (mg/g DM)	6.31 ± 0.63	5.27 ± 0.39
Chlorophyll b (mg/g DM)	2.12 ± 0.11	2.06 ± 0.20
Total Chlorophyll (mg/g DM)	8.43 ± 0.74	7.33 ± 0.59
Total carotenoids (mg/g DM)	1.53 ± 0.15	1.07 ± 0.08

- The chlorophyll a content decreased with 16.5% and chlorophyll b with 2.7 % after drying, resulting in an approximately total decrease of 20% of total chlorophyll content in freeze-dried leaves.
- The carotenoids content decreased 43% in freeze-dried leaves compared to fresh leaves.

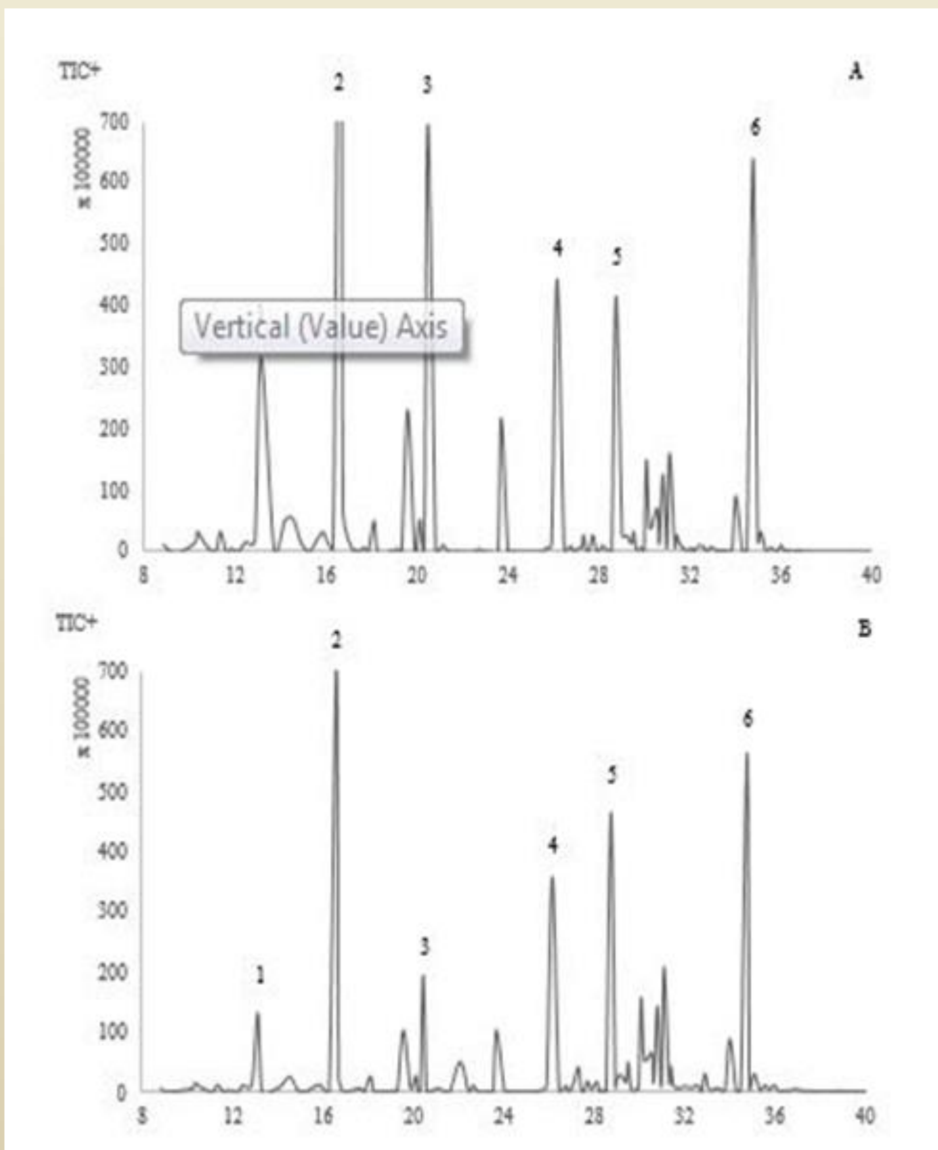
Variation of Total phenolic content (A) and antioxidant activity (B) of common basil leaves





- The highest TPC was found for freeze-dried leaves (4.76 mg GAE/g DM) compared to only 0.32 mg GAE/g DM for fresh leaves.
- In the case of the antioxidant activity, the trends are similar to the one observed for the total phenolic content. Freeze dried leaves remains the samples which display higher antioxidant activity (295.00 µM TE/g DM) compared to fresh leaves (42.76 µM TE/g DM).

Essential oil chemical composition of fresh basil leaves (A) and freeze-dried basil leaves (B)



1) 1,8 Cineole; 2) Linalool; 3) Methyl chavicol; 4) Eugenol; 5) α-Bergamotene; 6) α-epi-Cadinol.

- The essential oil extraction yield of the basil samples was 0.067% w/w for fresh leaves and 0.158% w/w for powdered leaves.
- 61 compounds were identified in both fresh and freeze-dried leaves.
- More than 50% of the total chemical composition of fresh leaves essential oil was composed of linalool 27.59%, methyl chavicol 11.43%, α-epi-cadinol 10.52% and eugenol 7.30%.
- The concentration of the main constituents for freeze dried leaves: linalool 18.14%, α-epi-cadinol 14.30%, eugenol 9.11%, γ-cadinene 5.28%, and methyl chavicol, 4.93%.
- Essential oil of *O. basilicum* L. processed by freeze-drying shows a decrease in monoterpenes hydrocarbons (1.11%) and oxygenated monoterpenes (20.42%).
- The compound with higher molecular mass and boiling point maintained its concentration, whereas sesquiterpene hydrocarbons decreased with 14.43% and oxygenated sesquiterpenes with 5.85%.
- Other chemical compounds maintained similar concentrations for fresh leaves (9.61%) and freeze dried leaves (10.86%).

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