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IMPACT OF DRYING CONDITIONS ON THE POLYPHENOLIC COMPOSITION OF HAZELNUT (*Corylus avellana* L.)

Monica Locatelli[1], Fabiano Travaglia[1], Matteo Bordiga[1], Jean Daniel Coïsson[1], Daniela Ghirardello[2], Davide Bardone[3], Marco Arlorio[1]

[1]Dipartimento di Scienze del Farmaco, Università degli Studi del Piemonte Orientale, Novara, Italy
[2]Department of Agriculture, Forest and Food Sciences (DISAFA), University of Turin, Grugliasco (TO), Italy
[3]aizoOn Technology Consulting, Turin, Italy
Tel.: +39 0321 375774 Email: monica.locatelli@uniupo.it

Abstract

The impact of drying conditions on the phenolic composition of hazelnuts was assessed. Tonda Gentile Romana hazelnuts (harvest 2017) were dried at 20, 30, and 40 °C, applying two air fluxes, until reaching a moisture content of ca. 6%. Phenolic compounds were characterized for the total content and the antioxidant activity; individual phenolic acids and flavanols were quantified by HPLC-DAD. Dried hazelnuts were compared with the corresponding fresh sample and evaluated after a 6 months storage.

***Keywords**: hazelnut, drying, polyphenols, antioxidant activity, shelf-life*

1. Introduction

Among the processes to which hazelnuts are subjected prior of consumption or transformation in other derived food products, drying is a crucial step necessary to preserve chemical, nutritional and microbiological quality of the product. After harvest, fresh hazelnuts must be dried to moisture levels lower than 6% wt in order to guarantee optimal storage (Giraudo *et al.* 2018). Hazelnuts have very interesting nutritional properties; they are lipid-rich foods containing several bioactive compounds, among which antioxidant polyphenolic compounds. Thermal treatments, particularly roasting, have been proved to have a detrimental impact on phenolic composition (Locatelli *et al.* 2015); even if drying can be considered a conservative *mild* process, its effect on this component should be more deeply investigated. For this reason, in the present work we assessed how different drying conditions can affect the phenolic composition of hazelnuts.

2. Material and method

2.1 Samples. Tonda Gentile Romana hazelnuts (harvest 2017) were dried in a pilot plant at three different temperatures (20, 30 and 40 °C) applying two air fluxes (v_{min}, v_{max}), until reaching a moisture content of about 6%. Hazelnuts were analysed immediately after drying (t_0) and after a 6 month storage at 20 °C in vacuum-sealed aluminium bags (t_1).

2.2 Samples preparation and analysis. Polyphenolic extracts were obtained from unshelled finely ground defatted hazelnuts. Each sample was extracted in triplicate using methanol as solvent. The total phenolic content was determined using the Folin-Ciocalteu method and expressed as gallic acid equivalent (GAE); the antioxidant activity was evaluated using the DPPH radical scavenging assay and expressed as Trolox equivalent (TE). Individual phenolic acids (protocatechuic, *p*-hydroxybenzoic, vanillic and caffeic acid) and flavanols (catechin, epicatechin, procyanidins B_1 and B_2) were quantified by HPLC-DAD through the corresponding calibration curves (Shimadzu LC-20A Prominence chromatographic system equipped with a diode array detector). Hazelnuts' moisture was determined using a thermobalance and the final results expressed on a dry weight (dw) basis.

2.3 Statistical analysis. Significant differences were estimated by analysis of variance (ANOVA) followed by Tukey's test ($p<0.05$). Statistical analysis was performed using R software version 3.3.2.

3. Results and discussion

Unshelled hazelnuts were firstly characterized before the drying process. Their total polyphenolic content was 1.47±0.02 mg GAE/g hazelnut (dw) and the antioxidant activity was 0.43±0.02 mg TE/g. Among the phenolic compounds identified by HPLC-DAD, procyanidin B_1 was the most abundant (119±13 μg/g), followed by protocatechuic acid (32±4 μg/g) and vanillic acid (10±1 μg/g); concerning monomeric flavanols, the catechin content was higher than that of epicatechin (12±1 and 4.7±0.6 μg/g, respectively). The other compounds identified are present in lower concentrations. After drying a significant decrease of the polyphenolic content and the antioxidant activity was observed in all the operative conditions considered, not evidencing substantial differences depending on temperature or air flux. After 6 month of storage a further decrease was observed (Figure 1). Individual phenolic compounds presented different and specific behaviours both considering drying and storage impact. Specifically, *p*-hydroxybenzoic acid significantly increased after drying, while other compounds decreased or remained unchanged; conversely, during storage only protocatechuic acid showed a significant reduction.

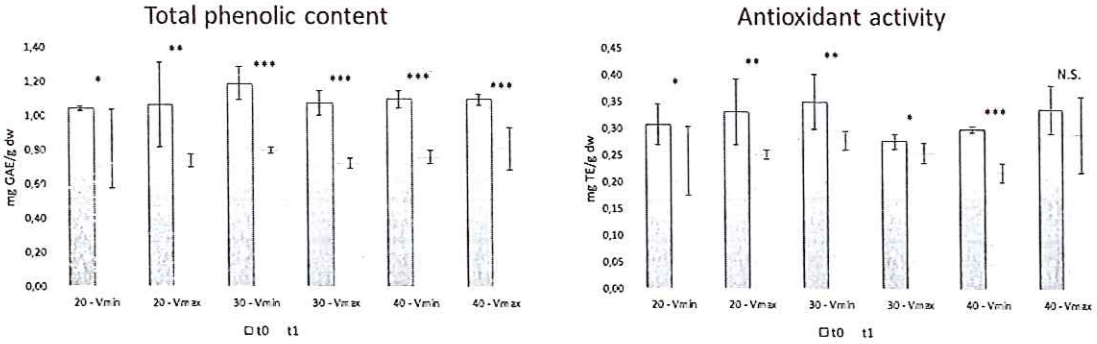

*Figure 1. Total phenolic content and antioxidant activity of dried hazelnuts during storage. Significant differences between t_0 and t_1 are represented as *($p<0.05$), **($p<0.01$) and ***($p<0.001$); N.S.: non significant.*

4. Conclusions

In conclusion, the obtained results indicated a general negative effect of drying on the hazelnut phenolic component, even when the process was performed at the lowest temperatures. Total phenolic content and antioxidant activity generally not varied depending on the different operative conditions, but decreased after 6 months storage. Finally, different phenolic acids and flavanols presented specific behaviours, evidencing the importance of profiling individual compounds.

5. References

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