

Effect of Different Storage Conditions on Hazelnut Quality

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Abstract

The aim of this study was to evaluate the effect of different storage conditions on the quality of the hazelnut cultivar 'Tonda Gentile delle Langhe'. The traditional method of in-shell nut storage, in storage room at ambient temperature, was compared with preservation of shelled nuts in refrigerated room at 4°C and 55% RH with or without modified atmosphere (1% oxygen, 99% nitrogen).

In order to evaluate nut quality, the following parameters were considered: humidity, lipid content, total phenolic content and antioxidant capacity of the seed; acidity and peroxide value of the oil. The results showed that the acidity and the peroxide value were the most discriminating parameters. After one year of storage, the acidity of hazelnuts stored at ambient temperature (0.47% oleic acid) was higher than the value considered the acceptable limit after storage (0.40% oleic acid), while the storage at low temperature permitted to maintain a low level of acidity and lipid oxidation, with the best performance in modified atmosphere (0.13% of oleic acid and 0.11 mEq O₂/kg). In conclusion, the in-shell storage of hazelnuts at ambient temperature was able to preserve the kernel below threshold limits of acidity and oxidative degradation up to a period of 8 months; the application of refrigeration was necessary to maintain a high quality up to one year. The use of modified atmosphere is recommended for a longer period of storage.

INTRODUCTION

Italy follows Turkey as the second largest producer of hazelnuts (*Corylus avellana* L.) in the world. Italian hazelnut cultivars are largely appreciated by the food industry, in particular for confectionery, due to their quality and sensory characteristics. In defining the quality of hazelnuts for the food industry as well as for the in-shell market and direct consumption, the aptitude to storage is a very crucial aspect. Hazelnuts have high and valuable quantities of nutrients and fat is the predominant component. The resistance to oxidation of lipids is frequently associated with the shelf-life of fatty foods, therefore, an increasing interest is directed to the study of compounds (e.g., natural antioxidants) and/or techniques (e.g., storage and processing methods) that can arrest or slow their degradation. Since the hazelnut marketing is generally distributed for a period of over one year after harvest, the role of storage conditions is of extreme importance. Low temperature and modified gaseous atmosphere (saturated with N₂ and/or CO₂) are storage techniques commonly applied to control enzymatic and chemical peroxidation, and to preserve health-promoting constituents in foodstuffs. Data regarding the optimization of storage techniques for hazelnut are still scarce, although some papers discussed the effect of postharvest handling and storage on chemical and physical characteristics of the nuts (San Martin et al., 2001; Mencarelli et al., 2008).

This work focuses on the evaluation of the effects of three different storage

conditions on the chemical characteristics of ‘Tonda Gentile delle Langhe’ hazelnuts harvested in 2009 and preserved for one year.

MATERIALS AND METHODS

The experiments were carried out on in-shell and shelled hazelnuts of the ‘Tonda Gentile delle Langhe’ cultivar harvested in Piedmont. The in-shell hazelnuts were stored for one year in storage room at ambient temperature, while kernels were cold stored (4°C, 5% RH) with or without modified atmosphere (1% oxygen, 99% nitrogen). The analyses were performed on the product at harvest and after eight and twelve months of storage.

Moisture and fat content were determined in accordance with AOAC methods (AOAC, 1990). Peroxide value (PV expressed as mEq of active O₂/kg oil) and acidity (expressed as weight percentage of oleic acid) of the oil were determined following the European Official Methods of Analysis for olive oil. The kernel extracts were obtained as reported in a previous work (Ghirardello et al., 2009). The total phenolic content (TPC) of kernel extracts was assayed spectrophotometrically by means of the Folin-Ciocalteu method, as modified by Singleton and Rossi (1965). To determine the antioxidant capacity of the extracts, the DPPH• (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay (RSA) was performed by the method described by von Gadov et al. (1997). All analyses were made in triplicate. The data were statistically analysed by ANOVA and the averages were compared by Tukey’s test.

RESULTS AND DISCUSSION

The kernels’ moisture content was stable during the storage period, except for in-shell nuts at the twelfth month (Fig. 1). Similarly, lipid content was very stable and did not change significantly (mean values ranged from 61.3 to 65.4% oleic acid). In opposition, there was a significant effect of storage time and modality on the indices of stability of the lipid fraction. As expected, acidity and peroxide value increased with storage in all samples. After 8 months, the in-shell hazelnuts showed higher acidity and PV in comparison with cold stored kernels (Fig. 2). At the twelfth month of storage, the acidity (0.47% oleic acid) of the nuts stored at ambient temperature was higher than the value considered as limit of acceptability after storage for the superior extra virgin olive oils (0.40% oleic acid), while the storage at low temperature permitted to maintain a low level of acidity and lipid oxidation, with the best performance in modified atmosphere (0.13% of oleic acid and 0.11 mEq O₂/kg).

The total phenolic contents showed a 15-25% decrease over time but differences among samples under different techniques of preservation were not statistically significant. At the same way, a decrease of 25-40% of the initial value of antioxidant capacity was observed after 12 months without significant differences among storage conditions.

CONCLUSIONS

This study has confirmed the effectiveness of low temperature in delaying the quality decay of hazelnuts preserving, in particular, their lipid fraction. Nevertheless, it was also confirmed that, when the storage is conducted at ambient temperature, the shell is able to protect the kernel from oxidative degradation for a period of about 8 months from harvest. Refrigeration was required to maintain a high quality for longer times of storage and was effective up to one year. The use of modified atmosphere is a further improvement of the technique and could allow the extension of the storage over one year.

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Literature Cited

- AOAC. 1990. Official Methods of Analysis (17th ed.). Association of Official Analytical Chemists, Washington, DC.
- Ghirardello, D., Zeppa, G., Belviso, S. and Gerbi, V. 2009. Determination of total phenolic content in hazelnut kernel extracts and their antioxidant capacity – Evaluation of spectrophotometric methods. Proceeding 2 EuroFoodChem XV – Food for the Future, Copenhagen, Denmark, 5-8 July 2009, p.142-145.
- Mencarelli, F., Forniti, R., Desantis, D. and Bellincontro, A. 2008. Effetti delle atmosfere inerti e della temperatura nella conservazione delle nocciole. Ingredienti Alimentari VII, agosto:16-21.
- San Martín, M.B., Fernández-García, T., Romero, A. and López, A. 2001. Effects of modified atmosphere storage on hazelnut quality. J. Food Process. Pres. 25:309-321.
- Singleton, V.L. and Rossi, J.A. 1965. Colorimetry of total phenolics with phosphomolybdc-phosphotungstic acid reagents. Am. J. Enol. Vitic. 16:144-158.
- von Gadow, A., Joubert, E. and Hansmann, C.F. 1997. Comparison of antioxidant activity of aspalathin with that of other plant phenols of Rooibos tea (*Aspalathus linearis*), α -tocopherol, BHT and BHA. J. Agric. Food Chem. 45:632-648.

Figures

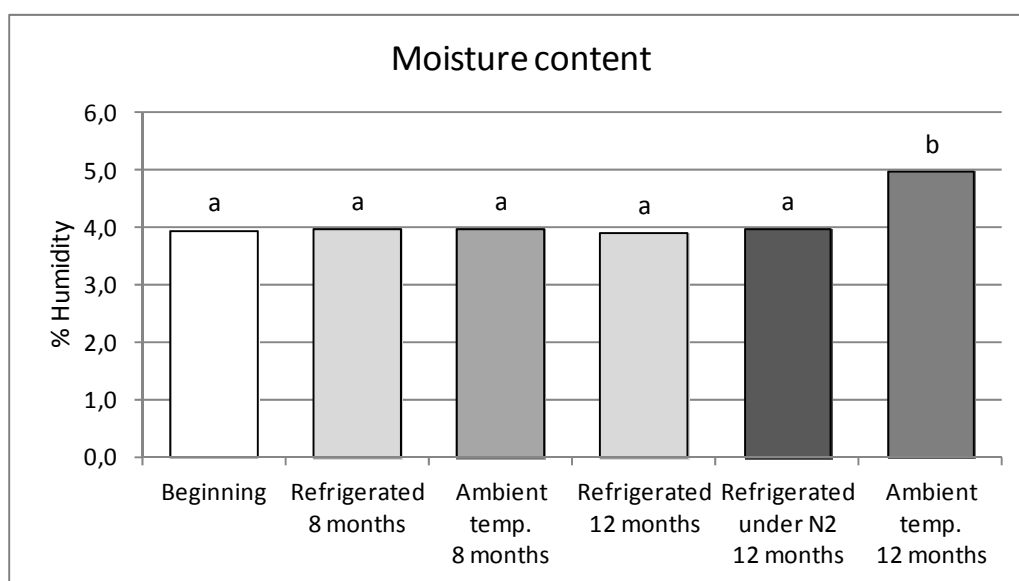


Fig. 1. Changes of water content in the kernels during the storage period.

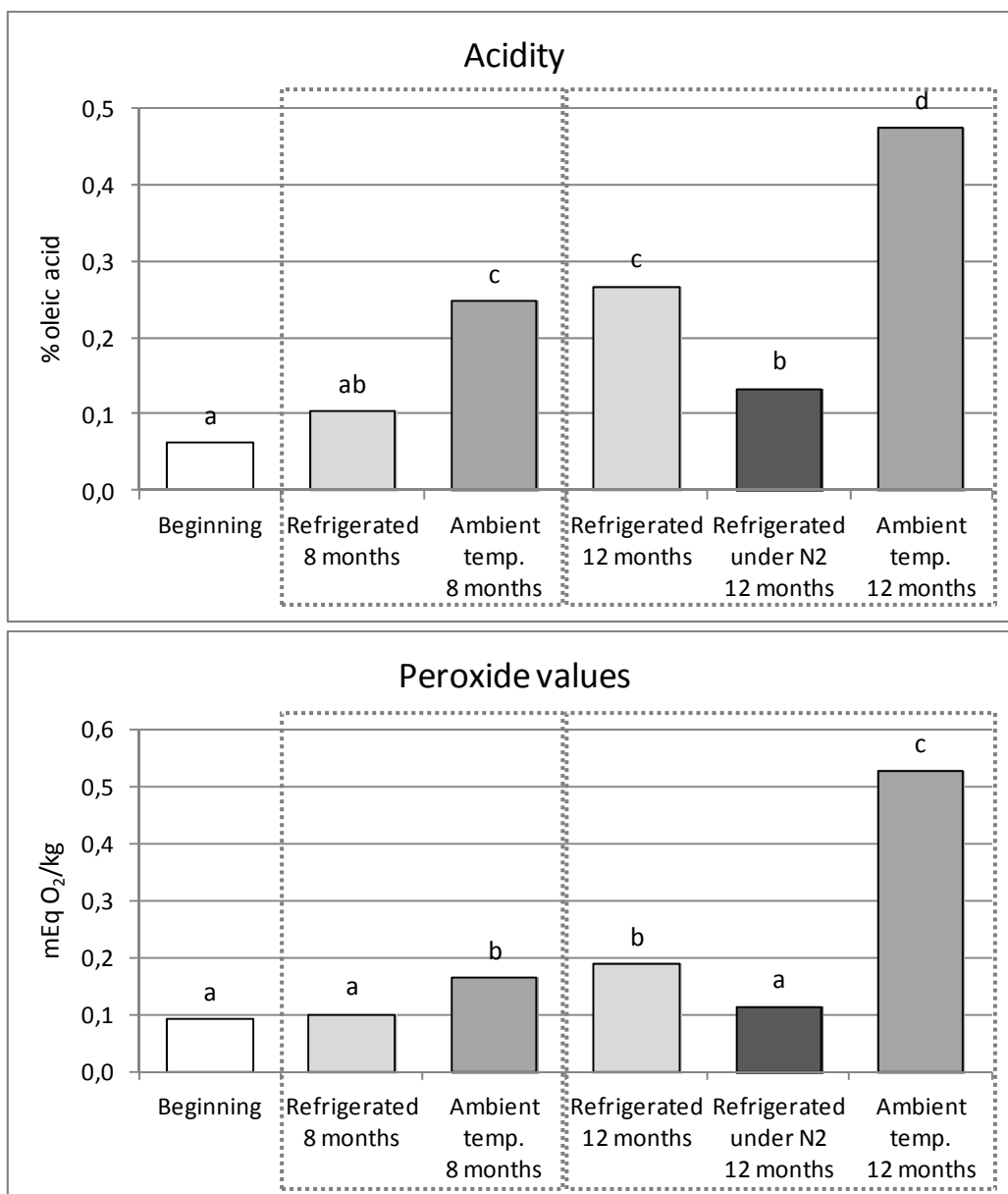


Fig. 2. Changes of acidity (% oleic acid) and peroxide value (mEq O₂/kg) of the oils during the storage period.