

Effect of maceration duration, heat treatment, and barrel aging on water-soluble vitamin content in Teran wines

Sara Rossi¹, Ena Bestulić¹, Tomislav Plavša¹, Karin Kovačević Ganić², Natka Ćurko², Ana-Marija Jagatić Korenika³, Sanja Radeka¹

¹Institute of Agriculture and Tourism, Karla Huguesa 8, 52440 Poreč, Croatia (sara@iptpo.hr), ²University of Zagreb, Faculty of Food Technology and Biotechnology, Pierottijeva 6, 10000 Zagreb, Croatia, ³University of Zagreb, Faculty of Agriculture, Department of Viticulture and Enology, Svetošimunska cesta 25, 10000 Zagreb, Croatia

Introduction

Among the nutrients required for the many physiologic functions essential to life, in wine we find vitamins as well. Vitamins are groups of highly complex compounds, organic in nature, present in foodstuffs in traces, essential for normal metabolism and absence of these nutrients cause disorders whereas, resupply of these nutrients can cure the deficiency symptoms. These essential nutrients cannot be synthesized in the organism, either at all or not in sufficient quantities, and therefore their intake through diet is necessarily vital. Grapes contain many vitamins, and most of them are located in the grape skin, which is the reason why red wines are higher in those levels than white wines are. Just few vitamins appear to be directly biologically active; as a result, a metabolic conversion to another species or a binding to a given protein often stands as necessary in order for the vitamin to become metabolically active. Vitamin metabolic function concern coenzyme activities in diverse pathways, reduction-oxidation systems, antioxidant activities, membrane integrity, cellular signaling, cellular protection, and yeast respiration. Water-soluble vitamins, including ascorbic acid and B-group thiamine, pyridoxine, niacin and riboflavin, are important compounds in grapes and wine products, although only present in minute amounts in these matrices.



Materials and Methods

The objective of this study was to determine the effects of four winemaking techniques on water-soluble vitamin content and estimate the changes in their range during the barrel aging of Teran red wines. The study covered seven days of maceration as a control treatment (TM7), prolonged 10-day maceration (TM10), prolonged post-fermentative 21-day maceration (TM21), and 48-h pre-fermentative maceration heat treatment at 45 °C followed by eight-day standard maceration (TPHT). The fermentation of all treatments was conducted at 24 °C. Accordingly, all the wine samples were aged in oak barrels for six months. Vitamins were analyzed using high-performance liquid chromatography with UV-Vis diode array and single quadrupole mass detector equipped with electrospray ionization interface.



Results



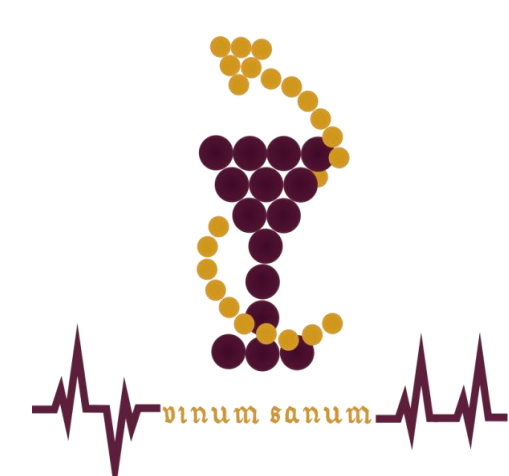
Different small letters above bars represent statistically significant differences among young and aged wines separately, different capital letters above bars represent statistically significant differences between young and corresponding aged wine, with respect to the total B-complex vitamin content, both at $p < 0.05$ obtained by one-way ANOVA and LSD test.

The thiamine (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), pyridoxine (vitamin B6), and ascorbic acid (vitamin C) were determined. Total B-complex vitamin content of young Teran wines significantly increased with prolonged skin contact. Furthermore, the results showed that significantly the highest content of total B-complex vitamins was detected in TM21 wine, followed by TM10 treatment. Regarding the vitamin C concentration in young Teran wines, there were no statistical differences between TM7, TM10, TM21 treatments, while TPHT treatment showed a significantly lower concentration. Wine barrel aging significantly reduced the level of all investigated vitamins except vitamin B6, which remained stable in all treatments.



Conclusion

Based on the obtained results it can be assumed that prolonged maceration treatments may result in wines with added value regarding the noted increase in the vitamin content and could thus contribute to the diversification of the wine market. The further application of prolonged maceration techniques in the production of Teran and other red wines could therefore be recommended.



Acknowledgments

This study was funded by Croatian Science Foundation under the projects VINUM SANUM (IP-2018-01-5049) and (DOK-2018-09).

57th Croatian and 17th International Symposium on Agriculture, Vodice, Croatia, June 19-24, 2022

