Evolution of sugars and organic acids patterns during the elaboration of pomegranate varietal wines

Mena-Parreño P.J., Gironés-Vilaplana A., Martí N., García-Viguera C.

in

Melgarejo P. (ed.), Valero D. (ed.).
II International Symposium on the Pomegranate

Zaragoza : CIHEAM / Universidad Miguel Hernández
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 103

2012
pages 287-290

Evolution of sugars and organic acids patterns during the elaboration of pomegranate varietal wines

P. Mena-Parreño*, A. Gironés-Vilaplana*, N. Martí and C. García-Viguera***

*Departmento de Ciencia y Tecnología de Alimentos, CEBAS-CSIC, Apdo. 164
E-30100 Espinardo, Murcia (Spain)
**Unidad Mixta JBT Corp.-IBMC, Universidad Miguel Hernández, E-03312, Orihuela, Alicante (España)

Abstract. Pomegranate is usually earmarked for arils fresh consumption and also used by food industry for the elaboration of juices and jams. Pomegranate wine constitutes a new alternative for the use by producers of second qualities and over-ripe fruits of this typical Mediterranean crop, with the subsequent environmental benefits. Hence, with the aim of developing new pomegranate-derived drinks, the evolution of sugars and organic acids patterns from different varieties throughout the winemaking stages was assessed. Noticeable changes were occurred for these compounds during wine elaboration, especially along fermentation period. In addition, a significant role of the cultivar used in the organic acids profile was noted.

Keywords. *Punica granatum* – Wine-making – Fermentation.

I – Introduction

Pomegranate fruits are usually earmarked for arils fresh consumption and are also used by food industry for the elaboration of juices, jams, and various other processed products. Nevertheless, large quantities of deteriorate second qualities and over-ripe pomegranate fruits are often not available in optimal conditions for consumers and, hence, are wasted as by-products. Therefore, with the aim of minimizing production losses and generating more profits with along a sustainable use of wastes, new uses and methods for pomegranate processing should be developed. In this sense, pomegranate wine elaboration may result in a promising alternative to employ underused fruits. Actually, many studies on fruit wine production have been performed in recent years as well as their possible therapeutic properties have been assessed. Likewise, some pomegranate fermented products have demonstrated to possess multiple beneficial implications on health management (Schubert *et al*., 1999; Sezer *et al*., 2007).

Taking into account the great diversity existing among the sensorial and phytochemical properties of pomegranate cultivars (Mena *et al*., 2011), differences in the final quality of pomegranate varietal wines should be expected. Furthermore, it is important to note that changes in the general composition of food products may determine consumer acceptance and preference. Organic acids affect to the organoleptical properties of musts and wines (Kelebek *et al*., 2009). Likewise, despite some works concerning pomegranate fermented juices have been performed, there is no substantial information on pomegranate wine composition, apart from studies covering all stages of the pomegranate winemaking process. Consequently, the purpose of this work was to produce and investigate the promising prospects of pomegranate wines as novel quality drinks. Research was focused on changes occurring to compounds with a technical relevance such as sugars and organic acids during the winemaking of different pomegranate varietal juices.

II – Material and methods

Second quality pomegranate fruits from cv. *Wonderful* and *Mollar de Elche*, harvested in Alicante region (SE Spain) during the 2010 season, were provided by "Cambayas Coop. V." (Elche, Alicante, Spain). Pomegranates were cut in halves and juices of each cultivar were obtained by pressure with a laboratory pilot press. *Wonderful* and *Mollar de Elche* freshly prepared juices were also mixed using the same proportion (v/v) of each one to study the behaviour of the blended juice, labelled as *Coupage*.

In general, the process of producing pomegranate wine followed the production procedures of grape wine. Juices were kept in vessels affixed with an airlock where 60 mg/l of potassium metabisulfite and 200 mg/l of a fermentation activator containing ammonium phosphate were added. Next, fermentation was started after yeasting (300 mg/l), and the temperature was kept at 22 ºC ± 1 during the fermentation process, considered complete when the total soluble solids content was stable for 3 days more after day 6. Once fermentation was finished, the wines were clarified and racked for one day at 4ºC. Then, the wines were transferred to new vessels, 60 mg/l of potassium metabisulfite were added, and they were stored to stabilize them for 10 days in darkness at room temperature (Duarte *et al*., 2010). All samples were done in triplicate. Samples were taken from each vessel at sampling time and stored frozen (-20ºC) until analyzed. Organic acids and sugar were determined simultaneously as described by Mena *et al.* (2011).

III – Results and discussion

Pomegranate juices presented glucose and fructose as major sugar components, being the fructose concentration higher than the glucose one in all the varietal juices (Fig. 1). The content of these carbohydrates was drastically reduced throughout the fermentation time (Fig. 1, stage **α**) and degradation kinetics for both sugars were similar. Nonetheless, while glucose was almost disappeared (0.02-0.06 g/100ml, for *Wonderful* and *Mollar de Elche* wines, respectively), fructose residues remained after the end of the winemaking process (0.20-0.29 g/100ml, for *Mollar de Elche* and *Wonderful*, respectively), as it happens to other fruit wines (Kelebek *et al.*, 2009; Kim *et al*., 2008). Moreover, it is important to note that there were not differences among varietal wines assayed with regard to the sugar conversion rate.

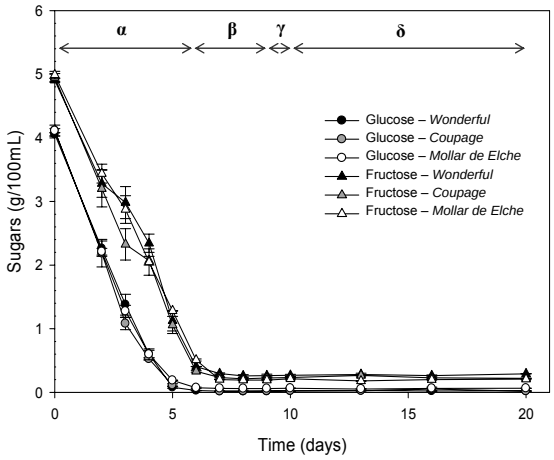

Fig. 1. Evolution of sugars in wines made from different pomegranate varieties during the winemaking. Winemaking stages: α, alcoholic fermentation; β, end of the alcoholic fermentation; γ, racking and clarification; δ, stabilization. Error bars are presented as SEM.

Both organic acids profile and concentration of *Wonderful* and *Mollar de Elche* juices were according to previous report (Mena *et al.*, 2011). *Coupage* juice presented intermediate values as it was expected (Fig. 2). Concerning pomegranate wines, changes in organic acids pattern were happened during winemaking procedures. Citric acid showed similar values in both varietal juices and wines, remaining almost constant, despite fluctuations in their concentrations were found throughout the different stages of wine elaboration (Fig. 2-A). Thus, citric acid values of pomegranate wines were close to the values of the juices and were 1.29, 0.64, and 0.28 g/100ml for *Wonderful*, *Coupage*, and *Mollar de Elche* wines, respectively. On the contrary, malic acid underwent noticeable changes during the winemaking process. Amounts of all varietal juices were around 0.30 g/100ml; however, malic acid was depleted rapidly until 0.10 mg/100ml within the fermentation period (Fig. 2-B, stage **α**) and, then, it was kept for all the samples during the rest of elaboration procedures (Fig. 2-B, stages β, γ, and δ). With respect to pomegranate minor organic acids, negligible variations took place for tartaric acid (Fig. 2-C) although a considerable increase was noted for acetic acid in some varietal wines (Fig. 2-D). In fact, pomegranate juices lacked of acetic acid and its occurrence was registered at the fermentation period. Moreover, great augments of acetic acid were found in *Wonderful* and *Coupage* fermented juices (0.008 and 0.005 g/100ml, respectively) whereas a slight one was found in *Mollar de Elche* one (Fig. 2-D, stage **α**). Later, a reduction in the content was done for all the varieties followed by the maintenance of the acetic acid levels in *Wonderful* and *Coupage* wines after wine racking and clarification since acetic acid in *Mollar de Elche* wines was disappeared previously (Fig. 2-D, stages **β**, **γ**, and **δ**).

On the whole, while citric and tartaric acids remained almost constant, malic acid was decreased owing to compositional variations during fruit wine elaboration (Kelebek *et al.*, 2009; Kim *et al.*, 2008). As a result of the malic acid degradation, the predominance of malic acid over citric acid in *Mollar de Elche* juice was reverted in *Mollar de Elche* wine but not in *Wonderful* and *Coupage* ones where citric was always the major organic acid. Likewise, regarding acetic acid formation, a significant role of the cultivar used on winemaking was noted.

IV – Conclusions

The elaboration of pomegranate wine from different varieties has been proved as a new and suitable way of industrialization for second qualities and over-ripe fruits. Noticeable changes in both sugars and organic acids patterns were described. Moreover, a significant role of the cultivar used together with a marked influence of winemaking procedures was noted.

References

Duarte W.F., Dias D.R., Oliveira J.M., Vilanova M., Teixeira J.A., e Silva J.B.A. and Schwan R.F., 2010. Raspberry (*Rubus idaeus* L.) wine: Yeast selection, sensory evaluation and instrumental analysis of volatile and other compounds. *Food Research International* 43: 2303-2314.

Kelebek H., Selli S., Canbas A. and Cabaroglu T., 2009. HPLC determination of organic acids, sugars, phenolic compositions and antioxidant capacity of orange juice and orange wine made from a Turkish cv. Kozan. *Microchemical Journal* 91: 187-192.

Kim Y.S., Jeong D.Y. and Shin D.H., 2008. Optimum fermentation conditions and fermentation characteristics of mulberry (*Morus alba*) wine. *Korean Journal of Food Science and Technology* 40: 63-69.

Mena P., García-Viguera C., Navarro-Rico J., Moreno D.A., Bartual J., Saura D. and Martí N., 2011. Phytochemical characterisation for industrial use of pomegranate (*Punica granatum* L.) cultivars grown in Spain. *Journal of the Science of Food and Agriculture* 91: 1893-1906.

Schubert S.Y., Lansky E.P. and Neeman I., 1999. Antioxidant and eicosanoid enzyme inhibition properties of pomegranate seed oil and fermented juice flavonoids. *Journal of Ethnopharmacology* 66: 11-17.

Sezer E.D., Akçay Y.D., Ilanbey B., Yildirim H.K. and Sözmen E.Y., 2007. Pomegranate wine has greater protection capacity than red wine on low-density lipoprotein oxidation. *Journal of Medicinal Food* 10: 371-374.

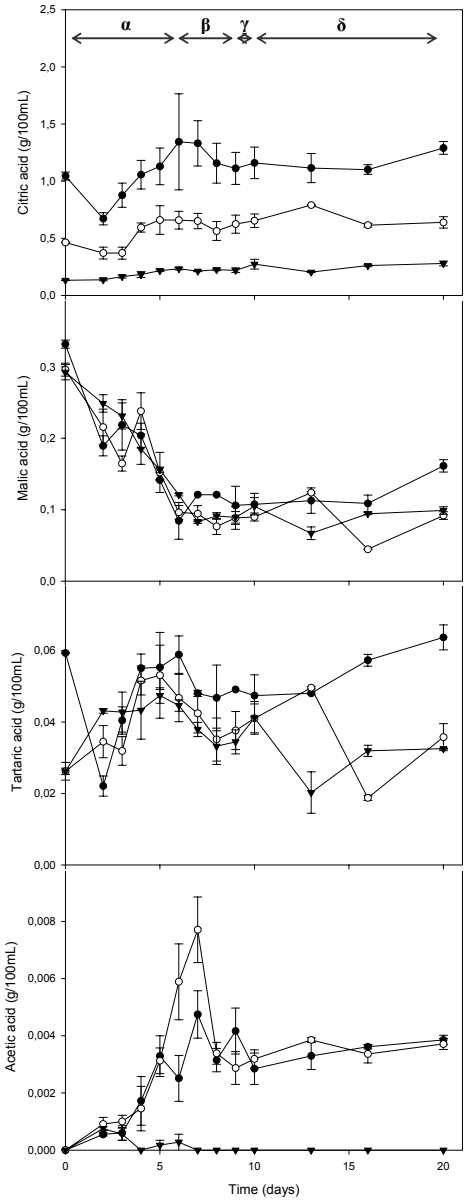

Fig. 2. Evolution of organic acids in wines made from different pomegranate varieties during the winemaking. (A) Citric acid, (B) Malic acid, (C) Tartaric acid, (D) Acetic acid. *Wonderful* (●), *Coupage* (○), and *Mollar de Elche* (▼). See winemaking stages in Fig. 1. Error bars are presented as SEM.