Short communication

Brix degree and sorbitol/xylitol level of authentic pomegranate (Punica granatum) juice

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With regard to 45 pomegranate fruits from different regions and several domestic varieties, fruit weight was found to be 137.1–738.2 g, peel share 34.4–73.1%, aril share 26.9–65.6% and fruit juice yield 19.2–48.0%. Brix degree of pomegranate juice samples obtained from the aforementioned fruits changed from 12.2 to 17.8 and was lower than 14.0 in approximately 18% of the samples. Titratable acidity of pomegranate juice samples varied between 2.4 and 30 g/L and the formol number varied between 4.0 and 20.0. The sorbitol/xylitol content ranged between 16 and 423 mg/L, mostly lying between 51 and 200 mg/L with a frequency of 64%. The share of samples containing sorbitol/xylitol higher than 250 g/L is 7%.

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1. Introduction

Pomegranate is one of the major fruits, which has got attention since old times. Pomegranate has been discussed not only for its arils but also for its roots, barks, peels and flowers as well as its seeds (Lansky & Newman, 2007).

The most important reason for this attention is the antioxidant richness of pomegranate fruit. The main antioxidant components of pomegranate are anthocyanins, such as cyanidin, delphinidin and pelargonidin (Hernandes, Melgerajo, Tomas-Berberan, & Artes, 1999; Zhang et al., 2009) and ellagitannins, such as ellagic acid, punicalagin and punicalin (Lansky & Newman, 2007). Health related benefits attributed to pomegranate, including anticancerogenic and antiatherogenic effects, originated mainly from these compounds (Aviram et al., 2008; Lansky & Newman, 2007; Vardin & Fenercioglu, 2003).

The points mentioned above have raised the demand for pomegranate juice especially in the last decade. One of the two typical examples for that situation is the increase in pomegranate juice import of Japan from 3000 tons in 1995 to 32,000 tons in 1998 (Braun, 2005), and the other is the rapid increase of pomegranate import of Japan from 3000 tons in 1995 to 32,000 tons in 1998 (Alper, Bahceci, & Acar, 2005; Bayındırlı, Şahin, & Artık, 1994; Maskan, 2006; Tabur, Bakkal, & Yurdagel, 1987).

One of the basic criteria used for the definition of fruit juices is certainly brix degree. As it is well known, brix degree indicates the percentage of water-soluble solids in fruit juice and can be affected by many factors including variety, growth region, growth year and maturity level of the fruit. According to AIJN proposal, the minimum brix degree of pomegranate juice should be 14.0 (Anonymous., 2008).

Another criterion discussed in order to prove adulteration related to fruit juice is sorbitol/xylitol content. The reason for this is the differentiation on the sorbitol/xylitol content due to fruit species. The researches carried out by Washüttl, Riederer, and Bancher (1973) and Kauko and Soderling (1980) have shown that the distribution of sugar alcohol is very different among fruit and vegetable species. According to AIJN (Anonymous., 1990), the sorbitol/
xylitol content is specified between 2.5 and 7 g/L for apple juice, 10 and 25 mg/L for pear juice, 65 and 100 g/L for orange juice and 10 and 35 g/L for sour cherry juice (Anonymous, 1990).

There exists scarce information on the sorbitol/xylitol content in pomegranate. Richmond, Brandao, Gray, Markakis, and Stine (1981) reported that pomegranate fruit contains 3 g/kg sorbitol/xylitol. On the other hand, Fisher-Zorn & Ara (2007) found a maximum of 0.1 g/L of sorbitol/xylitol in freshly squeezed pomegranate juice. However, it was expressed that sorbitol/xylitol is not unique to pomegranate but it can also be formed by the microbial reduction of fructose in pomegranate juice (Jones & Silveira, 2004). In addition, it is also speculated that processes or changes, such as heating, enzymation and fermentation may cause an increase in the sorbitol/xylitol content of pomegranate juice.

Brix degree and the sorbitol/xylitol content are the basic criteria for the evaluation of fruit juice identity and authenticity. The aim of this study is to contribute to knowledge about the natural level of brix and sorbitol/xylitol in pomegranate juice.

2. Materials and method

2.1. Material

Research material is comprised of 45 pomegranate fruits obtained from different regions in 2007–08 season and 45 pomegranate juice samples obtained from those fruits. The varieties and growth region of pomegranate samples are given in Table 1.

Pomegranate juice samples were obtained by pressing pomegranate aril separately from the peel in a folded cloth using a laboratory press and samples were analysed within the same day.

2.2. Method

Some pomological properties, such as fruit weight, ratio of peel or aril (% w/w) and juice yield (% v/w) were determined in the pomegranate fruit samples.

Table 1: Varieties and regional distribution of pomegranate samples.

<table>
<thead>
<tr>
<th>Date</th>
<th>Variety</th>
<th>Region</th>
<th>Date</th>
<th>Variety</th>
<th>Region</th>
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<td>18.12.07</td>
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<td>Izmir</td>
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</tbody>
</table>

Some pomological properties of pomegranate fruit samples collected from different regions of Turkey are summarised in Table 2.

As it is seen in Table 2, fruit weight ranges between 137.1 and 738.2 g, peel ratio between 34.4% and 73.1% and aril ratio between 26.9% and 65.6%. Boz (1988) has found that fruit weight ranges between 42.6 and 320.5 g. According to Tabur et al. (1987), fruit weight ranges between 175 and 259 g and peel ratio between 28.0 and 39.2%. There are differences between the results, particularly in terms of fruit weight, and it may be caused by the differentiation of pomegranate varieties.

Juice yield varied from 50.9 to 78.8% for aril and from 19.2 to 48.0% for whole fruit. Findings related to fruit juice yield are compatible with that of other studies (Boz, 1988; Tabur et al., 1987).

3. Results and discussion

3.1. Some pomological properties of pomegranate fruit

Some pomological properties of pomegranate fruit samples collected from different regions of Turkey are summarised in Table 2.

In order to identify pomegranate juice samples, also titratable acidity and formol number were performed, besides brix degree and the sorbitol/xylitol content (Table 3).

Table 2: Some pomological properties of pomegranate samples (N = 45).

<table>
<thead>
<tr>
<th>Pomological property</th>
<th>Range of variation</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit weight g/a dot</td>
<td>137.1 – 738.2</td>
<td>374.9</td>
</tr>
<tr>
<td>Peel ratio % w/w</td>
<td>34.4 – 73.1</td>
<td>50.1</td>
</tr>
<tr>
<td>Aril ratio % w/w</td>
<td>26.9 – 65.6</td>
<td>49.9</td>
</tr>
<tr>
<td>Juice yield (based on whole fruit) % w/w</td>
<td>19.2 – 48.0</td>
<td>34.7</td>
</tr>
<tr>
<td>Juice yield (based on aril) % w/w</td>
<td>50.9 – 78.8</td>
<td>68.3</td>
</tr>
</tbody>
</table>
According to the findings given in Table 3, brix degree of pomegranate juice is between 12.2 and 17.8, titratable acidity is between 2.4 and 30.0 g/L. Those findings are similar to those of other studies (Boz, 1988; Fischer-Zorn & Ara, 2007; Velioğlu, Unal, & Cemeroğlu, 1997). Distribution of samples according to brix degree in several intervals is given in Table 4. In the provisional reference guideline for pomegranate juice (Anonymous, 2008), the minimum brix degree is defined as 14.0 for direct pomegranate juice and 15.0 for pomegranate juice obtained from concentrate. However, according to the data included in Table 4, brix degree of samples is concentrated in the range between 15.1 and 16.0, and frequency of samples with brix degree at and lower than 15.5 is 27% and the rate of samples with brix degree at and lower than 14.0 is 18%, which can be considered to be inconsistent with the minimum limit specified in AIJN provisional reference guideline for pomegranate juice, even if they are authentic.

The sorbitol/xylitol content in pomegranate juice samples is approximately 115.5 mg/L and it ranges between 16 and 423 mg/L (Table 3). The limit for sorbitol/xylitol specified by AIJN is a maximum of 250 mg/L (Anonymous, 2008). However, when the sample distribution at certain intervals of sorbitol/xylitol concentration is taken into account, the case is seen to differ from what it looks (Table 5).

According to the data presented in Table 5, the sorbitol/xylitol content of 7% of the samples was over 250 mg/L.

4. Conclusion

Fruit weight was found between 137.1 and 738.2 g, peel ratio between 34.4% and 73.1%, and aril ratio between 26.9% and 65.6% in 45 pomegranate fruit samples representing particular varieties and different regions of Turkey.

Mean brix degree of pomegranate juice samples was 15.6 and it varies between 12.2 and 17.8. However, brix degrees were at and lower than 14.0 in 18% of the samples and they were at or lower than 15.0 in 27% of the samples (Table 4). In this case, as defined in AIJN draft, a minimum brix degree of 15 corresponding to pomegranate juice obtained from the concentrate seems appropriate. But it will be more realistic that a minimum brix of 14 proposed for direct juice is replaced with a minimum brix of 13. In this point, it has to be taken into consideration that the minimum brix level for pomegranate juice established by CAC (Anonymous, 2005) is 12.

According to the findings, the sorbitol/xylitol content of authentic pomegranate juice samples varies from 16 to 423 mg/L (Table 3). These results do not support the hypothesis claims that pomegranate fruit does not contain sorbitol/xylitol by nature. On the other hand, the sorbitol/xylitol content in 7% of the samples (Table 5) exceeds the maximum sorbitol/xylitol limit of 250 mg/L in AIJN provisional reference guideline for pomegranate juice (Anonymous, 2008). Therefore, it is concluded that this maximum limit for sorbitol/xylitol in pomegranate juice cannot be manageable within the context of raw material and/or technology.

References


International Federation of Fruit Producers (IFU), Paris.


International Federation of Fruit Producers (IFU), Paris.


International Federation of Fruit Juices Producers (IFU), Paris.


International Federation of Fruit Producers (IFU), Paris.


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