Use of $\delta^{18}O$ authenticity thresholds to differentiate tomato passata from diluted tomato paste

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Abstract

Tomato passata, one of the ‘pillars’ of the Mediterranean diet, is a typical Italian product that by law must be obtained exclusively from fresh tomatoes. For this reason Italian law provides for use of the $\delta^{18}O$ of vegetal water to determine whether passata (Brix of up to 12) is genuine or has been obtained by diluting tomato paste (Brix higher than 12), although without any indication of reference limits. In this study an extensive dataset of over 1000 samples collected along the Italian tomato product production chain (tap waters, juices, passata, pastes) in different years (2004–2012), was investigated on the content of water $\delta^{18}O$. This parameter was shown to be statistically different in the four classes of products, increasing from water to juice and paste, in relation to the different degree of evaporation taking place during the preparation phase. Moreover, the $\delta^{18}O$ of vegetal water, due to the contribution of the lower $\delta^{18}O$ values of tap water during dilution, was highly effective in distinguishing genuine passata from watered down paste, also in the case of passata previously concentrated up to 11.9 Brix. In particular, two lower threshold values are proposed: $-1.4\%_{\text{o}}$ for ‘raw’ passata and $-2.9\%_{\text{o}}$ for passata previously concentrated up to 11.9 Brix. Although the use of $\delta^{18}O$ of vegetal water alone does not make it possible to discriminate between Italian and foreign products, an increasing trend in $\delta^{18}O$ values was shown in juices and passata samples as well as in tap waters, when moving from northern to southern Italian products, making it possible to predict good geographical discrimination for this parameter.

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1. Introduction

Tomato products are the most popular sauce ingredient for Italians, who use around 550 million kilograms a year (http://www.coldiretti.it). However, in the last few years, as an integral part of the “Mediterranean diet”, they have played an increasingly important part in the diet at global level. Currently, the tomato is the second most important vegetable crop in the world, after the potato, with production of about 159 million tons over an area of approximately 5 million hectares (FAOSTAT Database, 2011). Italy is the third largest producer of paste variety tomatoes in the world, with around 5 million tons (ISTAT Database, 2012), after the USA (around 12 million tons) and China (around 6.7 million tons) (Tomato news, June 2011, http://www.tomatonews.com), and one of the main exporters of tomato products, to the tune of 105 million tons, according to 2011 figures (USDA Foreign Agricultural Service – Gain Report n. IT1159). Tomato products are therefore of major importance for the Italian economy. To regulate such an important market and protect consumers, since 1984 the European Union, through EEC Regulation 1599/84 on processed products from fruits and vegetables, has defined tomato juice (Brix lower than 12) and tomato paste (Brix higher than 12) as directly obtained from fresh tomatoes. In line with the position of the European Union, Italian legislation (Ministerial Decree of 23 September 2005) provides further clarification and defines tomato passata as a product that must be obtained by mashing or chopping fresh tomatoes, usually by a process of