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Rosé wine volatile composition and the preferences of Chinese wine professionals

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ABSTRACT

Rosé wine aromas range from fruity and floral, to more developed, savoury characters. Lighter than red wines, rosé wines tend to match well with Asian cuisines, yet little is known about the factors driving desirability of rosé wines in emerging markets such as China. This study involved Chinese wine professionals participating in blind rosé wine tastings comprising 23 rosé wines from Australia, China and France in three major cities in China. According to the sensory results, a link between the preference, quality and expected retail price of the wines was observed, and assessors preferred wines with prominent red fruit, floral, confectionery and honey characters, and without developed attributes or too much sweetness. Basic wine chemical parameters and 47 volatile compounds, including 5 potent thiols, were determined. Correlations between chemical components, sensory attributes and preference/quality/expected price were visualised by network analysis, revealing relationships that are worthy of further investigation.

1. Introduction

Rosé wine is produced from red grape varieties such as Cabernet Sauvignon, Grenache and Pinot Noir, but without the extensive maceration on grape solids that is usually associated with red winemaking. This produces "blush" coloured wines of different styles, with vibrant fruit and floral characters, or more spicy and savoury notes, and varying levels of residual sugar (sweetness), balanced by the acidity of the wine. These sensory aspects are important to wine quality and are underpinned by the chemical constituents arising from the grapes, fermentation and maturation. In particular, volatile compounds impacting on wine aroma can be related to quality judgements of wine (Sáenz-Navajas et al., 2015).

Rosé wine, which accounted for about 9% of the world's wine production (24.1 million hectolitres in 2011) (FranceAgriMer, 2013), is becoming more popular around the world, with global consumption increasing by about 17% in the decade to 2012. France is the leading producer of rosé wine, followed by Italy, the United States of America and Spain, which together account for almost three quarters of global production (FranceAgriMer, 2013). Furthermore, Europeans are the largest consumers of rosé

Abbreviations: DA, descriptive analysis; TA, titratable acidity; PCA, principal component analysis; PC, principal component; NA, network analysis.

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wine (with France accounting for about half this volume), but interest has grown significantly in New World wine countries as well; e.g. in 2011, 12.9% of world rosé consumption was attributed to the United States of America (FranceAgriMer, 2013). Rosé wine has even grown to about 60% of all wine consumption in smaller countries like Tunisia or Uruguay (FranceAgriMer, 2013). In keeping with the global popularity of rosé wines, events have been held during the summer months in Australia to promote chilled rosé wine as an alternative to white wine. Although aimed at local consumers, emerging global markets also need to be better understood and targeted further.

Over the past ten years Asia has become one of the main focal points for wine producers because of the great potential it offers in terms of the sheer volume of consumers. Being a relatively new market requires effective promotional strategies, which may be regarded as a wine producer's top priority, but this requires knowledge of consumer preferences and expectations (Lockshin, 2014). Within Asia, China is an obvious choice for producers seeking to expand their consumer base. From 2000 to 2012, wine consumption in China grew 67% (International Organisation of Vine and Wine (OIV), 2013) and 16.8 million hectolitres of wine was consumed in 2013 (International Organisation of Vine and Wine (OIV), 2014). Despite this volume being slightly lower (around 4%) than the figure for 2012, China was still the fifth largest wine importer in 2013 (International Organisation of Vine and Wine (OIV), 2014).

Undoubtedly the Chinese wine market has entered a period of slower progression after the initial dramatic growth. Nonetheless, sales of imported bottled wines are still increasing, likely as a result of a burgeoning middle class and deeper understanding of wine (Lockshin, 2014), thereby suggesting this young market is gradually maturing. For the Australian wine industry, establishing new segments in emerging markets is always important and China is no exception, becoming Australia's third largest market for bottled wine exports (by value) since 2012 (Wine Australia, 2014). As such, developing the exports of Australian rosé wine, which can be characterised by sensory traits (Wang, Capone, Wilkinson, & Jeffery, 2016) likely to be desired by Chinese consumers, should be a focus for the Australian industry. As a starting point, the opinions of Chinese wine professionals, from winemakers and educators, to retailers and journalists, will be influential in understanding this market, but to the best of our knowledge there had been no reports on the impressions of such experts towards rosé wine from Australia or elsewhere to date.

The purpose of this study was therefore to gain the first insight into the preferences of Chinese wine experts towards different rosé wines, through wine tastings conducted in three cities in mainland China. Wines were predominantly from Australia, but several from China and France were included for comparison, and chemical compositions were investigated to correlate the volatile components and basic wine chemistry with sensory outcomes determined by the experts. Results from the study were visualised using a novel application of network analysis to the field of wine science.

2. Materials and methods

2.1. Chemicals

All chemicals, standards and solutions used in this study were the same as specified in a previous study (Wang et al., 2016).

2.2. Wine selection

Twenty-three rosé wines were studied, comprising different grape varieties from vintage 2013 and 2014 (Supporting Information, Table S1). Eighteen Australian rosé wines (provided by producers) were selected as they represented different rosé styles based on the results from previous sensory descriptive analysis (DA) (Wang et al., 2016). Two traditional rosé wines produced in Provence, France were purchased from a bottle shop in Australia and encompassed different price points (AU$9 and AU$45). Three rosé wines originating from two Chinese wine regions were donated by producers and selected based on input from Chinese wine professionals. All wine samples were stored at 15 °C before sensory and chemical analyses. Except for the three Chinese wines, all wines were shipped from Australia with each wine checked for faults before every tasting.

2.3. Basic wine composition

All measurements were performed in duplicate (Supporting Information, Table S1). Ethanol content, titratable acid (TA), pH and residual sugar (glucose + fructose) were determined as described previously (Wang et al., 2016). Malic and lactic acids were measured with an Agilent Series 1100 HPLC (Agilent Technologies, Forest Hill, VIC, Australia) equipped with a vacuum degasser, quaternary pump, thermostated column oven, refractive index detector and diode array detector. Separation was achieved using an Aminex HPX-87H column (300 mm × 7.8 mm; Bio-Rad, Gladesville, New South Wales, Australia) at an operating temperature of 60 °C. The injection volume was 20 μL and the isocratic mobile phase was 2.5 mM aqueous H_2SO_4 at a flow rate of 0.5 mL/min. Data acquisition and processing were conducted with Agilent ChemStation software (Version # 3.0.1 B) and analyte quantitation was performed at 210 nm using external standards.

2.4. Quantitative analysis of aroma volatiles

2.4.1. GC–MS analysis of major volatiles

Solid-phase microextraction (SPME) coupled with gas chromatography–mass spectrometry (GC–MS) was used to identify and quantify major volatiles. Sample preparation, extraction conditions and GC–MS method were the same as previously reported in Wang et al. (2016) and samples were analysed in duplicate. Overall, 42 aroma volatiles were identified based on their retention index (RI) and mass spectral library match; quantitative data was obtained for 36 calibrated compounds, whereas the remainder were semi-quantified and expressed as equivalent to other calibrated compounds.

2.4.2. HPLC–MS/MS analysis of polyfunctional thiols

3-Mercaptohexan-1-ol (3-MH),[1] 3-mercaptohexyl acetate (3-MHA), 4-mercapto-4-methylpentan-2-one (4-MMP), furfurylthiol (FFT) and benzyl mercaptan (BM) were quantified by high-performance liquid chromatography–tandem mass spectrometry (HPLC–MS/MS) in duplicate as previously described (Capone, Ristic, Pardon, & Jeffery, 2015).

2.5. Chinese wine professional panel tasting

Sixty-two Chinese wine professionals, who met one or more criteria that defined them as wine experts (Parr, White, & Heatherbell, 2004), were recruited to take part in one of three blind rosé wine tastings conducted in three major cities of China – Beijing

[1] The correct IUPAC prefix for thiol is now "sulfanyl" as in 3-sulfanylhexan-1-ol (3-SH), 3-sulfanylhexyl acetate (3-SHA) and 4-methyl-4-sulfanylpentan-2-one (4-MSP). "Mercapto" was the previous prefix and is more common in the literature. Both prefixes (and respective abbreviations) are used in current literature when referring to these specific compounds and we have chosen to use the more common terms in this case.