Compositional variation amongst Australian sparkling white wines


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Introduction:
The Australian sparkling white wine segment encompasses (i) fruit-driven styles of sparkling wine, typically derived from either carbonation or the Charmat method, and (ii) more complex sparkling wines, which exhibit toasty, yeasty, bready notes, attributable to bottle fermentation and/or lees ageing undertaken during production via the transfer method or Méthode Traditionnelle (analogous with the Méthode Champenoise for Champagne). This study aimed to investigate compositional differences (i.e. basic chemistry, aroma and flavour volatiles, proteins, polysaccharides and amino acids) and foaming properties between fifty Australian sparkling white wines produced via the four key production methods and exhibiting diverse sensory profiles.

Materials and Methods:
Fifty Australian sparkling white wines produced via the four key production methods, i.e. Méthode Traditionnelle (MT, n=20), transfer (Tr, n=10), Charmat (Ch, n=10) and carbonation (Ca, n=10), were analysed to determine: (i) basic wine parameters (pH, TA, alcohol, residual sugar and total phenolics); (ii) aroma and flavour volatiles, by gas chromatography-mass spectrometry (GCMS); (iii) organic acids, proteins, polysaccharides and amino acids, by high performance liquid chromatography (HPLC); and (iv) foamability (foam height after pouring, rate of foam collapse and foam collar remaining after collapse).

Results and Discussion:
Méthode Traditionnelle wines generally had higher TA and alcohol content, but lower residual sugar and total phenolics, compared to other sparkling wines (Table 1). Wines produced by carbonation possessed the highest total amino acid content (Table 1); with levels that were significantly different (p<0.05) to wines produced via the other methods of production. The variation observed was mainly driven by proline, which was the most abundant amino acid present in the wines.

Table 1. Chemical composition (ranges and mean) of Australian sparkling white wines based on production method.

<table>
<thead>
<tr>
<th>Production Method</th>
<th>pH</th>
<th>TA (g/L)</th>
<th>Residual Sugar (g/L)</th>
<th>Alcohol (% abv)</th>
<th>Phenolics (au)</th>
<th>Proteins (mg/L)</th>
<th>Total amino acids (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Méthode Traditionelle</td>
<td>2.9–3.4 (3.2)</td>
<td>6.4–9.6 (8.0)</td>
<td>0.5–13.1 (8.8)</td>
<td>11.2–13.0 (12.3)</td>
<td>0.3–4.9 (2.2)</td>
<td>6.9-161.3 (66.9)</td>
<td>460-1542 (849)</td>
</tr>
<tr>
<td>Transfer</td>
<td>3.1–3.5 (3.2)</td>
<td>5.8–7.6 (6.9)</td>
<td>3.9–15.8 (12.0)</td>
<td>11.0–13.1 (12.0)</td>
<td>0.9–4.3 (2.4)</td>
<td>5.6-78.9 (29.7)</td>
<td>602-1168 (931)</td>
</tr>
<tr>
<td>Charmat</td>
<td>3.2–3.5 (3.3)</td>
<td>6.1–7.4 (6.8)</td>
<td>8.5–19.0 (14.0)</td>
<td>11.0–12.2 (11.6)</td>
<td>0.5–4.3 (2.9)</td>
<td>7.6-71.1 (34.9)</td>
<td>665-1254 (976)</td>
</tr>
<tr>
<td>Carbonation</td>
<td>3.1–3.4 (3.3)</td>
<td>6.4–9.2 (7.6)</td>
<td>7.9–13.5 (12.4)</td>
<td>10.3–12.5 (11.1)</td>
<td>2.5–5.8 (4.7)</td>
<td>9.1-88.8 (34.6)</td>
<td>465-1924 (1274)</td>
</tr>
</tbody>
</table>

Wine proteins and polysaccharides are of interest as they are known to influence sparkling wine foaming properties1-2 and therefore perceptions of quality3. Méthode Traditionelle wines, on average, had significantly (p<0.05) higher protein content compared with the other wines (Table 1), which likely explains the higher foaming capacity observed for Méthode Traditionelle wines upon pouring (Table 2). While the average total polysaccharide content was similar regardless of production method, bottle fermented wines (i.e. MT and Tr) contained a higher percentage of yeast-derived mannoproteins, while Charmat and carbonated wines (Ch and Ca) contained more RG3 (Figure 1). Chemometric analysis of volatile data indicated that Méthode Traditionelle and transfer wines exhibited comparable volatile compositions, as did Charmat and carbonated wines (Figure 2); the major differences being attributable to the concentrations of esters (hexyl, isoamyl and phenethyl acetates; ethyl decanoate) and acids (decanoic and sorbic acid).

Conclusions:
The chemical composition of Australian sparkling white wines varied according to their production method. Méthode Traditionelle and transfer wines generally had similar chemical properties, as did Charmat and carbonated wines. Chemical data will now be used in conjunction with sensory profiles and consumer preference data to better characterise the Australian sparkling white wine market and to identify key markers of sparkling wine quality.

References: