Summary 206

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Effect of polyphenols on the perception of key aroma compounds from Sauvignon Blanc wine

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• *Methoxypyrazines* (e.g. isobutyl methoxypyrazine, IBMP) and *thiols* (e.g. mercaptohexanol, 3MH, and mercaptohexyl acetate, 3MHA) are two categories of compounds which contribute to the distinctive flavor or Sauvignon blanc (SB). Also, like most white wines, Sauvignon blanc contains three main types of polyphenols: *flavanols* (e.g. catechin), *hydroxycinnamic acids* (e.g. caffeic acid), and *flavonols* (e.g. quercetin).

• In a previous work coauthored by Dr. Ebeler, it was observed that the addition of polypyhenols to a wine caused a significant reduction in the concentration of the aroma compounds measured in its headspace. Building on Dr. Ebeler's research, the current authors decided to study the effect of polyphenols not only on the concentration of the main SB aroma compounds, but also on their individual perception as judged by a trained panel.

• The authors conducted the experiment in a diluted, non-SB white wine (to lower the concentrations of naturally-ocurring polyphenols and ethanol, this latter known to mask volatile compounds and cause excessive panelist fatigue). To start out, the authors measured the *thiol* and *methoxypyrazine* content of this wine (chromatograph-mass spectrometer), as well as its polyphenol content (reverse-phase high pressure liquid chromatography). To this diluted wine, they then added each of the types of polyphenols to be tested (commercially-available catechin, caffeic acid, and quercetin) at specific concentrations.

• The tasting panel consisted of 15 judges experienced in tasting SB. All the sessions consisted of difference tests, that is, the panelist were always presented with a set of coded *pairs of wines.* In the first part of the sensory test, one of the wines in each pair contained increasing amounts of each of the volatile compounds, but no polyphenols. The idea was to determine the **lowest concentration at which the panelist could perceive a difference in aroma** (called *sensory perception threshold*).

• In the second part, this process was repeated, but this time the wines contained one of the polyphenols under study. Then the researchers compared the thresholds obtained in the first and the second parts. **If the original sensory threshold had increased by the addition of the polyphenol, the polyphenol in question acted as a *suppressor*; and if the original sensory threshold had decreased, the polyphenol acted as an *enhancer*.**

• **Results:**
1) **IBMP**: Perception of IBMP was suppressed by both catechin and caffeic acid, and somewhat by quercetin. A suggested mechanism is the formation of non-covalent bonds between the –OH groups on the polyphenols and the methoxypyrazine, thus lowering its volatility in the headspace.

2) **3MH**: Whereas catechin and quercetin suppressed the perception of 3MH, caffeic acid showed the opposite effect. The authors suggest that caffeic acid may have suppressed other aroma compounds in the wine that initially were masking 3MH aroma.

3) **3MHA**: Unlike 3MH, addition of each type of polyphenol had practically no effect on perception of 3MHA (this compound differs from 3MH in that the –OH has been esterified with acetic acid). Previous studies had shown that 3MHA is significantly higher in New Zealand SB than in SB from other regions of the world. This, coupled to the lack of suppression of 3MHA by polyphenols, may prove the crucial role of 3MHA in New Zealand SB.

4) **Ethyl decanoate**: Perception of the ester ethyl decanoate was reduced by all three of the polyphenols tested. (This corroborates previous research from Dr. Ebeler which showed that gallic acid minimizes the sensory perception of ethyl decanoate).

• Some discussion highlights:
_ the degree of correlation between the sensory intensity of a given compound and its chemical concentration is called its *coefficient of determination*. The authors noticed that the higher the coefficient of determination of a compound, the lower its suppression by polyphenols;
_ because extended contact of skins and seeds with a juice is bound to extract more catechin and quercetin, the use of free-run juice is likely to accentuate the passion fruit SB character in a wine;
_ analytical equipment can measure concentrations of volatile and non-volatile compounds, but it cannot measure the effect on human perception of the interactions between these compounds. For this reason, the authors believe that chemical analyses should always be coupled to scientific sensory testing.

This study showed how non-volatile compounds (catechin, caffeic acid, quercetin) played a role in the sensory perception of several compounds in wine (IBMP, 3MH, 3MHA). However, non-volatile compounds other than polyphenols can also suppress wine aroma (ethanol is one example), and there are also more compounds responsible for SB aroma than thiols and pyrazines (for example, esters). In the authors' own words: "Considering that a wine can consist of 40 or more aroma-active compounds, this makes for a complex puzzle. Understanding the interaction of non-volatile compounds and their effects on volatile aroma compounds enhances the prediction of flavor profiles from chemical analysis, and aids winemakers in producing a wine with a desired aroma profile".

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