In-mouth flavour release from non-volatile grape-derived precursors

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Introduction Glycosides are non-volatile, odourless compounds in grape berries which can transfer into wine and break down during vinification to release free volatiles. It has been reported that the release of smoke-related volatile phenols from glycosides can occur during tasting, most likely through the action of salivary bacterial enzymes. However, the role of naturally occurring grape-derived glycosides in wine remains unknown.

Aim To determine whether grape-derived glycosides contribute to wine flavour.

Glycoside characterisation Glycosides were isolated from Riesling and Gewürztraminer grapes and wine, washed to remove volatiles and phenolics and characterised. Liquid chromatography-mass spectrometry confirmed the presence of monoterpene glucosides, including geranyl glucoside, and monoterpene disaccharides such as geranyl vicianoside, which were highly abundant in the Gewürztraminer extracts. When the glycosides were incubated with saliva (Figure 1), the important fruity/floral monoterpenes geraniol and linalool were among the released volatiles.

Figure 1. Examples of monoterpene glycosides geranyl glucoside (a) and geranyl vicianoside (geranyl α-c-arabinofuranose-β-D-glucoside) (b) found in grape and wine extracts, and examples of hydrolysis products geraniol (c) and linalool (d).

Sensory time-intensity studies (Figure 2)

• Glycosides were assessed in model wine (10.7% v/v alcohol, pH 3.50), in the presence or absence of wine volatiles.
• The glycosides gave a significant lingering fruit flavour at elevated concentration (five times the original wine concentration).
• Mean panel data showed no statistically significant flavour due to glycosides at single strength.
• However, individual responses were highly variable, with approximately half (6/11 and 5/12) of the panelists rating ‘fruity/floral’ flavour for the glycosides.
• Some judges rated glycosides+volatiles as having significantly higher flavour compared to the volatiles alone (see Judge 1, Riesling, Figure 2), even at wine-like concentrations.

Figure 2. Time intensity curves for two of the judges who perceived flavour from glycosides at wine-like concentrations. The least significant difference (LSD) is shown, P= 0.05.

Conclusion Breakdown of odourless grape-derived glycosides during wine consumption can play a role in fruit flavour intensity and lingering aftertaste. Enhancing the glycoside pool in wines is likely to have a positive effect on wine flavour. The large variation in sensory responses to the glycosides across individuals provides a new insight into the reasons for differences in sensory and preference responses to wines.

Examining individual variability in flavour response from glycosides (Figure 3)

• 39 subjects tested.
• Three glycosides were tasted individually in water.
• Triplcate presentations, randomised order over a number of days.
• Control samples were included.
• Rating of ‘fruity/floral’ or ‘smoky’ flavour.
• Positive responses for each judge were determined by one-way analysis of variance.

Figure 3. The proportion of judges who responded to the three types of glycosides.

• Many response patterns were observed.
• The largest group (28%) responded to all of the glycosides.
• The second largest group (23%) did not perceive flavour from any of the glycosides.
• 77% of the judges were able to detect flavour from at least one of the glycosides, suggesting that the ability to experience flavour from grape-derived glycosides is widespread.

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