Dynamic characterization of wine astringency profiles using modified progressive profiling

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Background

Wine **astringency** is important for quality and consumer acceptance. Perception of this mouthfeel is dynamic and can be separated further into unique **textural sub-qualities**. **Quantitative data** on wine astringent sub-qualities however are lacking. Previous progressive profiling (PP) examined mouthfeel sub-qualities at a single time point; here we report a modified version which uses 10 sec time periods.

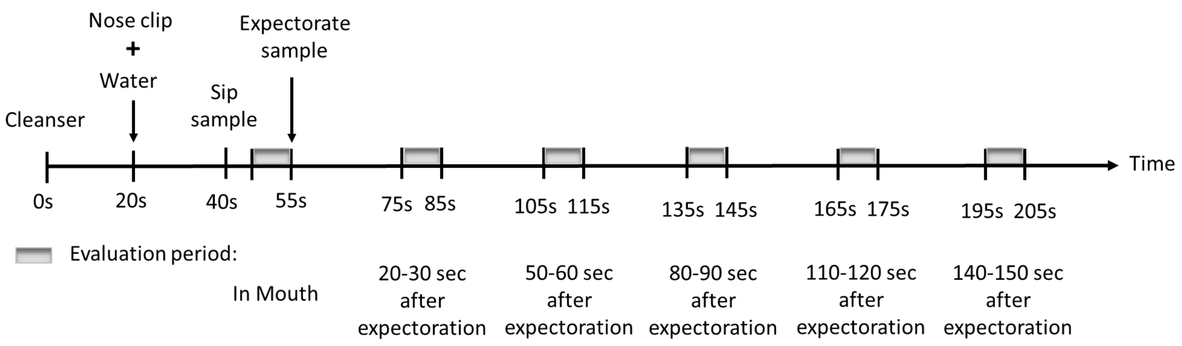
Aims

- Characterise the **dynamic astringency profiles** of Australian red wines using a modified PP method.
- Determine any **correlations** between mouthfeel attributes and chemical measures.

Materials and Methods

- ***Sensory assessment by modified PP (n=8):***

7 red wine astringency attributes were defined: ***overall astringent intensity* (*OAI*) and 6 sub-qualities; *pucker, mouth coat, dry, grippy, adhesive* and *graininess.*** 13 commercial red wine samples from 11 Australian wine regions covering 11 different grape varieties (including two blends) were evaluated in duplicate.



- ***Chemical Measures:***

Basic wine composition:
- pH
- Titratable acidity (TA)
- Alcohol level
- Density
- Glucose
- Total residual sugar (TRS)

Phenolic profiles :
- Total tannin concentrations
- Total phenolic concentrations
- Tannin mDP (Mean degree of polymerization)
- Molecular mass of tannins (MM)
- Percentages of sub-units in tannins (epigallocatechin and epicatechin gallate)

Results

- ***Modified progressive profiling***

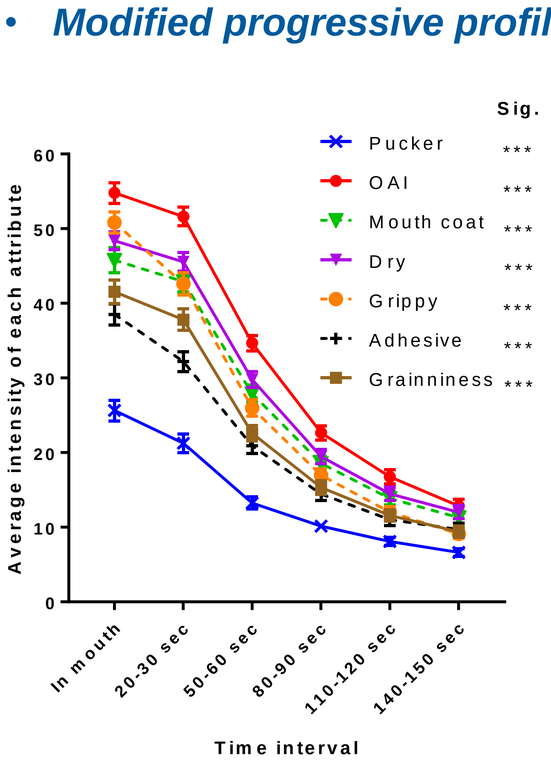


Fig. 1: Mean attribute intensities (± S.E.) as a function of time. Symbols *** denote for $p < 0.001$.

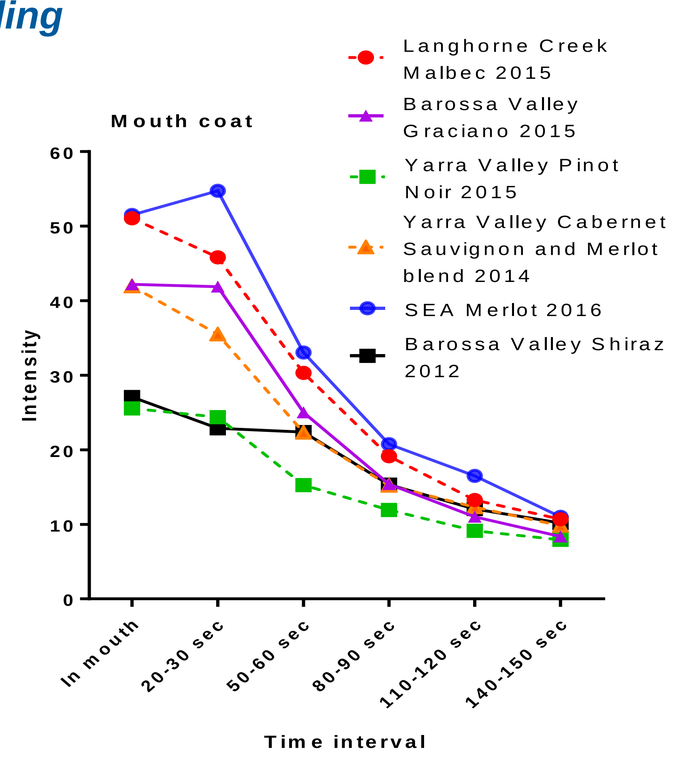


Fig. 2: Dynamic intensity of sub-sample of wines on Mouth Coat.

1. Data was analysed with **repeated measures ANOVA** with interactions.

All 7 sub-qualities significantly reduced in mean intensities with time (Fig. 1).

A significant time × sample interaction was detected for *overall astringency intensity*, *mouth coat* and *grippy,* indicating perception of these attributes changed differently across time by wine. For e.g., Mouth coat for Malbec and Merlot (Fig.2) showed a similarly high intensity when the samples were evaluated in mouth. However, the intensity of Malbec decreased immediately after wine expectoration, but Merlot increased.

2. Individual attributes at each time point were further analysed with **univariate ANOVA** and **partial omega-squared** (ω_p^2) **effect sizes** were computed (Fig. 3).

Greatest discrimination of wine at each time interval differed by attribute. For e.g. in mouth, *grippy* had most impact, followed by *mouth coat* 20 sec after expectoration, then *OAI, drying* and then *grippy* at the final time period. Furthermore, the relative importance of each astringent sub-quality varied at different evaluation periods.

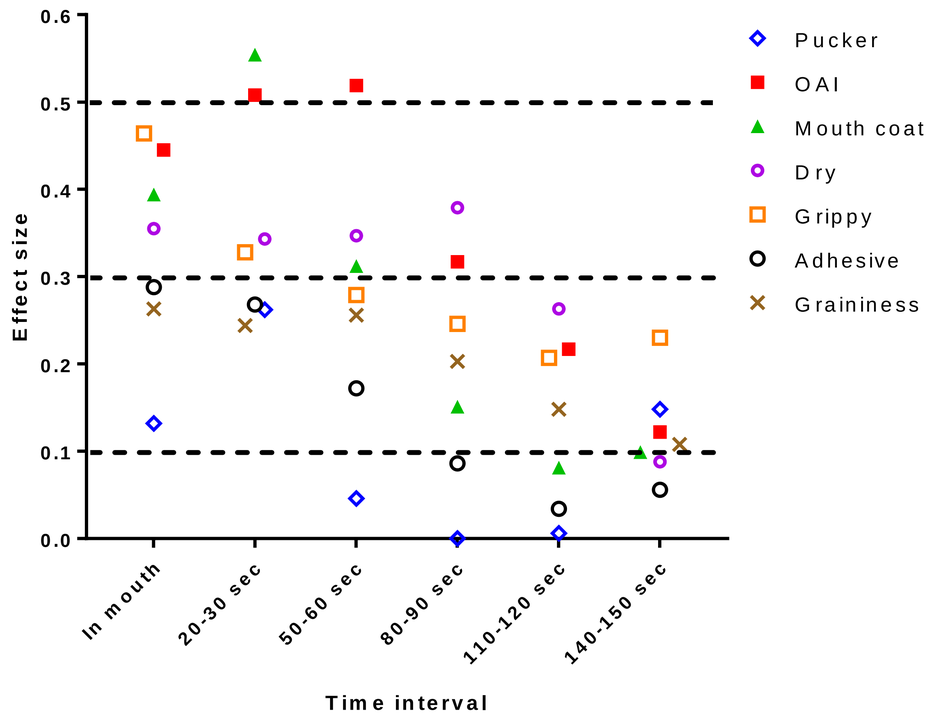


Fig. 3: Effect sizes (ω_p^2) for each sensory attribute at each evaluation period of all 13 red wines. The dotted lines at the values of 0.1, 0.3 and 0.5 interpreted as small, moderate and large effect sizes, respectively.

3. The sample loadings for all significantly different sensory attributes from six time intervals were analysed. The sample configuration demonstrates that **texture differences** between red wines can be **distinguished** by modified PP, even though the differences are **subtle**.

- ***Correlations between sensory and chemical data***

Attributes at time intervals with the highest effect sizes were **correlated** with chemical measures of the wine (Fig. 4).

Wine tannins (including total tannin concentration, percentage of epigallocatechin, tannin mDP and MM) were highly correlated with *OAI*. The intensity of *dry* was influenced by pH, total tannin concentration, tannin mDP and MM. The alcohol level positively related to the sub-qualities of *mouth coat* and *adhesive*. *Pucker* was negatively correlated with wine sugars.

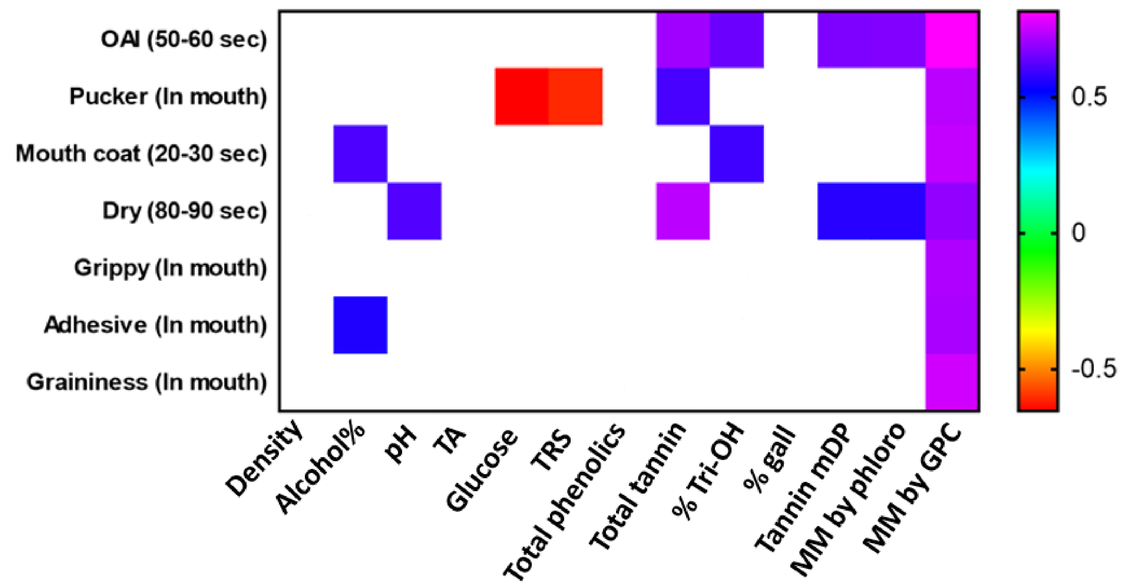


Fig. 4: Correlation matrix (Pearson) between sensory and chemical data of 13 red wines. Values in figure were different from zero with a significance level alpha=0.05. No colour for a value means no significant correlation was found.

Conclusions

a) This study was the first to utilise progressive profiling to evaluate dynamics of astringency sub-quality intensities of red wines made from different grape varieties.

b) The wines differed in astringency sub-quality (mouth coat and grippy) intensity development over time but these were positively related to the overall astringency intensity.

c) An enhanced understanding of the relationships between subtle wine astringency sub-qualities and chemical composition was gained.

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