Alternatives to Oak Barrel Maturation: Influence on Composition, Sensory Properties and Consumer Acceptance of Wine

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Abstract

The aim of this research was to investigate the use of oak alternatives by the wine industry, and specifically, to explore their influence on the composition, sensory properties, and consumer acceptability of wine. A detailed online consumer questionnaire was administered nationally to wine consumers to explore their knowledge of and attitudes towards the use of oak during winemaking. Within the sample population surveyed (n=1015), four distinct consumer segments were identified, each with significantly different attitudes towards the use of oak alternatives for wine maturation. A segment of more knowledgeable consumers, who appreciate and value traditional barrel maturation, held slightly negative views of wines produced with oak alternatives. However, a second cluster comprising less knowledgeable consumers were accepting of the use of oak alternatives, provided wine quality was not affected. The results from this study have advanced our understanding of consumer attitudes towards innovative oak technologies and provide justification for the use of oak alternatives by winemakers, who can now tailor their wines to better meet the expectations of specific segments of their target market.

A maturation trial was subsequently established to examine the effect of different storage vessels on wine composition and sensory properties. The specific objective of the trial was to compare vessels comprising three different panel types, i.e. stainless steel, plastic and oak wood panels, and the potential for each to produce wines of comparable composition and quality to those aged traditionally in barrels. The outcomes of the 12 month trial demonstrated that the different storage vessels each imparted oak characters to wine and therefore afford winemakers an alternative method for the oak maturation of wine. In a second maturation trial, traditional and alternative oak maturation regimes were employed to age Cabernet Sauvignon wines and the effect of each treatment on the composition, sensory properties and consumer acceptance of wine investigated. Acceptability scores from 116 consumers revealed no significant differences in consumers' overall liking of each wine, but

segmentation based on individual liking scores identified three distinct clusters comprising consumers with significantly different wine preferences. Multivariate data analysis revealed the sensory attributes driving wine preference for each consumer segment. These results further justify wine producers' use of alternative oak maturation regimes to reduce production costs and achieve wine styles that appeal to different segments of the consumer market.

To gain a holistic view of consumer preferences for oak attributes in wine, a third consumer study was undertaken to investigate the effect of key oak aromas on consumer emotions. Consumers (n=116) were asked to rate their liking of eight oak-derived aromas and to then consider how different oak aromas make them feel. Consumers scored each aroma favourably, but spice and chocolate were liked most, and smoky and coconut aromas were liked least. Segmentation of consumer liking scores revealed three segments which differed in their liking of and emotional response to different oak aromas, but differences were subtle. This study showed oak aromas generally elicited positive emotions, but broader classes of aromas, e.g. oak derived aromas versus fruit aromas (e.g. citrus, berry or tropical fruit), may elicit stronger emotional responses than individual oak aromas.

An additional study reporting the convenient, low-cost preparation of isotopically labelled volatile wine phenols, using microwave-assisted deuterium exchange, was also conducted. The development of a method that incorporates deuterium atoms on the aromatic ring offers significant benefits for quantitative GC-MS analysis by stable isotope dilution analysis, i.e. improved accuracy and reproducibility, and this study complemented the aforementioned consumer research.

Declaration

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