

Glycerol – does it really contribute to mouthfeel?



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[Basic Wine](#)

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What is glycerol?

Glycerol is one of several polyols present in wine and the pure substance is a colourless, odourless, non-volatile sugar alcohol with a **slightly sweet taste and a viscous nature**. Pure glycerol is around 600 times more viscous than water¹ which explains why wines supplemented with glycerol in the laboratory become physically more viscous.²

What is the glycerol concentration in wine?

Quantitatively glycerol is a major component of wine and a survey of 447 South African wines showed that the final levels in **South African table wines ranged from 4.72 to 14.24 g/L**.³ However, glycerol concentrations **can reach >20 g/L** in late harvest wines which have been affected by *Botrytis cinerea*.⁴

How is glycerol formed?

After alcohol and carbon dioxide, glycerol is the most abundant product of **yeast fermentation** and its formation is linearly associated with ethanol production. Around 5 to 10 g/L of glycerol is produced by the yeast, with the concentration depending on several factors including yeast strain and fermentation temperature^{3,5}. In the case of *Botrytis cinerea* infected grapes, significant amounts of glycerol can be found in the **grape must** before fermentation, explaining the high levels of glycerol generally found in noble late harvest wines.⁶

Yeast strains that redirect their carbon metabolism away from ethanol production to other metabolites, such as glycerol have been investigated as a tool for the production of low-alcohol wines. However, by **increasing the formation of glycerol at the expense of ethanol** during fermentation, the redox balance in the metabolism of yeast cells is upset which results in high-glycerol/low-ethanol wine with unacceptable concentrations of other metabolites that have an unfavourable impact on the overall sensory quality of the wine. More work on this technology is thus needed.⁷

What can influence glycerol formation?

Several parameters including **pH, temperature, nitrogen source and the yeast strain** have been shown to influence the final glycerol levels in wines.⁸ Other factors such as the **ripeness of the grapes** and the **microbial flora** on the grape berries were also reported to affect glycerol levels in the resulting wine.⁶

How does glycerol contribute to the perception of wine?

It is widely believed that **mouthfeel and texture** properties are strongly dependent on the glycerol concentration in the wine and that higher glycerol levels, therefore, improve wine quality. However,

many of these reports are based on anecdotal and empirical evidence. Although increased glycerol levels in white wine predictably make them more viscous, there is **debate whether these increases are significant enough to be perceptible** to wine tasters.⁹

Studies showed that the perceived **viscosities of model wines** that differed in glycerol concentration by **5 g/L were differentiable**.¹⁰ However, varying the glycerol concentration within the **wine's realistic range of 5.2 to 10.2 g/L did not significantly affect the perceived viscosity of two dry Riesling wines and only marginally increased the perceived viscosity of a third wine**.¹¹ In another study⁹ **the addition of 6 g/L of glycerol did not increase the perceived oral viscosity of dry white wine**.

Therefore, despite its viscosity when in its pure form, **glycerol does not appear to affect the perceived viscosity of dry white wine**.⁹ Researchers estimated that a difference in white wine viscosity will only **become detectable at concentrations around 26 g/L** which, considering natural levels of glycerol in wines, suggests that **glycerol induced increases in the physical viscosity of wine are largely imperceptible**. It was also estimated that the perceived viscosity of white wine with a glycerol concentration at the high-end range (12.5 g/L) would only be 1% higher than the perceived viscosity of an equivalent wine that is low in glycerol (5 g/L).⁹ If this is the case, **differences in oral viscosity would be hard to perceive in the 5 to 10 g/L range typical of dry white wines**.

In another study, the contribution of **glycerol, ethanol and sugar** to the perception of viscosity and density of model wine solutions was examined. The effects of individual components on perceived viscosity and perceived density were studied using 5, 20 or 50 g/L glycerol; 3, 7 or 15% v/v ethanol and 0, 80, 150 or 250 g/L sugar concentrations. The physical viscosity and density of the model wines were measured. Results showed that across the range of concentrations investigated, **sugar influenced the perception of viscosity and density the most while ethanol had a moderate effect. Most importantly, results showed that the contribution of glycerol was nominal**.¹⁰

Is there a relationship between glycerol levels and adjudged wine quality?

Results from a survey³ of 447 commercial South African wines entered into the Veritas wine awards showed a **significant relationship between glycerol concentrations and adjudged wine quality** for the following wine styles:

- dry white
- off-dry white
- special late harvest
- noble late harvest

Wine quality could not be significantly associated with glycerol concentrations in the **dry red wines**. For the **dry white and off-dry white wines, the glycerol content between the bronze medal wines differed significantly from the wines scoring silver, gold, and double gold**. But there was no significant difference in the glycerol concentration of the three upper tier medals. The researchers reported that despite the positive statistical association, the observed differences between the mean glycerol concentrations of dry white and off-dry white wines of different quality ratings **were too small to be of any practical value**.

Do glycerol levels differ according to wine classification?

A **large difference in glycerol concentrations between the different South African wine classifications was reported**³. The statistically significant difference in glycerol content between the various classifications can be summarised as follows:

- dry white (6.82 g/L) and off-dry white wines (6.55 g/L) < dry red wines (10.49 g/L)
- special late harvest wines (8.26 g/L) < noble late harvest wines (15.55 g/L)
- dry white (6.82 g/L) and off-dry white wines (6.55 g/L) < special late harvest wines (8.26 g/L) and noble late harvest wines (15.55 g/L)
- **no difference** between dry white (6.82 g/L) and off-dry white wines (6.55 g/L)

Is there a relationship between glycerol levels and geographical origin, vintage, cultivar, yeast strain and wine style used?

No significant association between the final glycerol concentration in the 447 South African commercial wines and the **vintage, geographical origin or yeast strain** could be established.³

What was interesting though, was the large range of glycerol concentrations reported for a single yeast strain. In laboratory settings, the amount of glycerol produced from a single yeast strain using a

synthetic must is relatively constant delivering relatively small variations, while in a commercial setting, the range of glycerol concentrations formed was significant. For instance, glycerol concentration in wines fermented with VIN13 ranged from 5.30 to 9.32 g/L, while the yield in synthetic must was 4.80 ± 0.42 g/L. This highlights the **influence of external factors on the production of glycerol**.

There was a significant difference in the mean glycerol levels of three white varieties: Chardonnay, **Sauvignon blanc**, Chenin blanc. **Sauvignon blanc had a significantly lower mean glycerol concentration than those of either the Chardonnay or the Chenin blanc in both the dry white and the off-dry white categories**. For the dry red category, the Shiraz wines had a significantly lower mean glycerol level compared to the Cabernet Sauvignon, Pinotage or Merlot wines.

Conclusion

The inability of tasters to detect any change to the oral viscosity of dry white wines resulting from increased glycerol (concentration range typically encountered in the wine category) may simply reflect the **insignificant effect glycerol has on the physical viscosity of wine**.⁹ Realistic increases in glycerol would probably not be perceived by even the most experienced tasters.² Against this background it is **quite possible that the perceived contribution of glycerol to mouth-feel can easily be over-emphasized while the contribution of alcohol and residual sugar should not be overlooked**.

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