

Letter to the Editors

Alcohol in Wine

Does alcohol have a flavor? Definitely, but not a well defined one. Try a non-alcoholic beer and there is clearly something missing. A person's flavor perception has three components: tactile, gustatory and olfactory. Alcohol has a pronounced tactile effect in your mouth, the familiar burn. Indeed, consuming very high proof alcohol is quite painful. In addition, alcohol is capable of activating sweet and bitter taste receptors on the tongue. Some people get a distinct sense of sweetness from vodka. It may not be possible to have a completely "dry" wine even if the sugar levels are well below detection threshold because the alcohol gives it some sweetness. Alcohol has also been described to have a bitter taste (Scinska *et al.*, 2000). Some people who are labeled "supertasters" possess genes that cause them to experience the taste of bitterness much more powerfully than others. These people also drink less alcohol (Duffy, 2004).

Whether the flavor of alcohol has an olfactory component is hard to say but at best, it is very mild. Many people feel that vodka has an aroma but that is probably from traces of congeners left over from distilling. "Pure" alcohol is so strong that the discomfort from consuming it prevents any reflection on whether it has flavor or not. I suppose someone could mix 99.9% alcohol and distilled water and nose it but I have seen no references to such a trial.

It is no secret that in the last 20 years or so the alcohol levels in wine have been rising across the world. Could it be due to climate change? Probably not. Some vineyard areas that experienced little increase in average temperature had large increases in alcohol levels over the last 20 years and vice versa. By comparing the increase in alcohol content in vineyard areas around the world which have experienced different degrees of warming, it is possible to estimate the contribution of global warming to the rise in alcohol in wine (Alston *et al.*, 2011). It accounts for only a minor portion of the increase.

Actually, the reason for the increase in the percentage of alcohol in wine is pretty clear. It is a byproduct of changes in grape cultivation brought about by increased scientific understanding and perceived market demand. In short, the definition of grape "maturity" has changed. Ages ago people judged the ripeness of their grapes by tasting them. More recently it has become possible to measure the actual sugar content so you could aim to harvest at, say, 23.5 Brix, the old California standard.

Multiply the Brix by 0.55 and you get an approximation of the resulting alcohol content of the wine ($0.55 \times 23.5 = 12.925\%$).

In the old world, where nature was not always cooperative, viticulturalists always felt pressure to harvest as soon as possible because a heavy rain could ruin a whole year's production. Now that we have meteorological forecasts for a week in advance it is less dangerous to allow the grapes to mature further. In California, which depends on irrigation, harvesting can be put off as long as you want. The theory the winemakers work on is that longer hang time will result in greater concentration of the "phenolic" contents of the grapes, the compounds that give wine its flavor. In addition, the tannins become "softer", which means less harsh. Of course, the sugar content continues to go up, hence more alcohol. Another casualty is the acid content which decreases. A low acid wine tastes dull. Adding natural grape acids, however, is simple.

So what do high alcohol wines taste like? It's hard to divorce the alcohol component from the other excesses in these wines. The major difference is in the sense of irritation of the mucous membranes. That is why such wines are referred to as "hot". The difference in sweetness between a 13% and a 14.5% alcohol wine, low to begin with, is probably undetectable as is the change in bitterness. Same for the olfactory component, whatever that is. So it is just the burn that makes these wines seem unbalanced but you can get used to that. It is probably not the increased alcohol in newer wines but the style of the wine itself that is controversial. Of course, higher alcohol causes you to get tipsy faster. You may or may not approve of that.

It is possible to remove excess alcohol from wine by a process called "reverse osmosis" (Vinovation). Under pressure, the wine flows past a fine filter which allows only the water and alcohol plus a few other minor things to get through. The "goodness" of the wine is left behind. You then distill the alcohol off and return the water to the wine. (Returning water from another source would be illegal under the law.) The opposite is possible, too. You can return the alcohol and discard the water in order to correct an overly dilute wine. The whole process is extremely high tech and seems intuitively to be beyond the permissible boundaries of manipulation of a natural product. But my objections have become muted since I learned that one of my favorite Bordeaux chateaux uses reverse osmosis and I love their wines.

Clark Smith, who runs Vinovation, the most prominent California provider of reverse osmosis and other high tech services, can line up somewhere around 18 glasses that contain the same wine but differ only by the amount of alcohol in gradations of 0.1% (Schneider, 2007). Smith maintains that a taster will find about 3 or 4 "sweet spots", alcohol levels at which the wine tastes best. The winemaker must choose which of these is the style he wants to distribute to his segment of the market. Tasters claim to notice different qualities in wines as close to one another as 0.1% alcohol. This sounds like nonsense to me. If the wines are truly the same

except for a slight difference in alcohol content I would expect neighboring samples to be indistinguishable.

Admittedly, it is possible that different levels of alcohol may affect the release of volatile compounds. Respectable claims have been published which state that diluting alcoholic beverages may have the paradoxical effect of accentuating rather than diminishing the aroma (McGee, 2010). The principle is that many of the volatile odor compounds are held in the solution by the alcohol and dilution frees them up. This trick is usually performed with spirits and the degree to which the drink is diluted is substantial. I can't see that changing the alcohol content of wine by 0.1% could possibly produce any such effect.

Wine can only be brought into the province of Ontario, Canada by the Liquor Control Board of Ontario. Each wine is tested for various characteristics including alcohol content. Alston *et al.* used the LCBO figures covering the years 1992–2009 to analyze trends in the changes in alcohol content in wines from around the world (Alston *et al.*, 2011). Unsurprisingly, red wines are more alcoholic than white, New World wines more so than Old World wines and hot climate wines more than cool climate ones. Overall, the alcohol in wines has gone up an average of 0.23% a year, so a wine of 13% alcohol 20 years ago will have become 13.5% today, but this can vary between 0.2 and 2% depending on the region.

Alston's group was also interested in looking at the actual alcohol content of wines compared to what was printed on the label. The misrepresentation of alcohol content was systematically skewed towards what producers felt would be the levels the public would find desirable. Thus, high alcohol wines were reported as lower than they actually were while low alcohol wines were reported as higher. Since there were more of the former than the latter, the overall trend was to underreport the alcohol content by 0.13%. This varied significantly by region. The biggest fibbers were from Argentina, Spain and the United States.

Alcohol is the reason we enjoy the flavor of wine. Very few people like the taste of wine at their first sip. If its flavors were not reinforced by the mood-altering effect of alcohol, we would not find them pleasant. Certain basic tastes have a built in affective component. Sweet is good; bitter is bad. This is not true of the olfactory components of taste, which we learn to consider pleasant or unpleasant depending on the conditions under which we first encounter them¹ (Herz, 2007). Learning to appreciate flavors occurs as early as in the womb and with breast-feeding and possesses a large degree of cultural specificity. Japanese eat stuff for breakfast that would turn our stomachs while, on the other hand, they cannot understand how we enjoy something as disgusting as cheese. Let us not forget that alcohol is why we

¹The one clear exception is cilantro where whether you like it or hate it seems to be genetically determined. If one identical twin likes or dislikes cilantro, most likely the other will feel the same way. This is much less so of fraternal twins.

have wine. No one would bother to ferment grapes if alcohol didn't have a pleasurable psychological effect. Let's be grateful that it does.

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