Chapter

Production and Marketing of Low-Alcohol Wine

Tamara Bucher, Kristine Deroover and Creina Stockley

Abstract

Moderate wine consumption may be associated with specific health benefits and a healthy lifestyle. However, increased amounts of ethanol are cytotoxic and associated with adverse health outcomes. Alcohol reduction in wine might be an avenue to reduce alcohol related harm without forcing consumers to compromise on lifestyle and benefit from positive aspects of moderate consumption. The aim of this review is to give an overview of viticultural and pre and post fermentation methods to produce low-alcohol wine, and to summarize the current evidence on the consumer acceptance and behaviour related to low-alcohol wine. Strategies for the labelling and marketing of wines with reduced alcohol content are discussed.

Keywords: reduced-alcohol wine, wine trends, alcohol content, consumer behavior, alcohol reduction technologies

1. Alcohol and health

Alcohol consumption is associated with several social and health risks and since 2010, the WHO conducts its global strategy to reduce the harmful use of alcohol [1–4]. In a recent review, alcohol was found to be the seventh leading risk factor for premature death in 2016, contributing to 2.8 million deaths worldwide, leading to the conclusion that no amount of alcohol is safe [5]. Other sources found that alcohol can have some beneficial health effects when consumed in low-risk drinking patterns [6–10]. Research shows that there may be a beneficial cardioprotective effect of these relatively low levels of drinking for ischaemic heart disease, ischaemic stroke and diabetes mellitus, as well as death from all causes [6–10]. Low-risk drinking is also called "drinking in moderation" and is usually defined using standard units. The WHO recommends consuming a maximum of two standard drinks per day, with at least two days a week without alcohol, and never more than four drinks per consumption episode [4]. In Australia, a standard drink contains 10 g of pure alcohol [11]. Ethanol is found to be associated with favourable changes in several cardiovascular biomarkers such as higher concentration of high-density lipoprotein cholesterol and adiponectin, and lower concentration of fibrinogen and other haemostatic factors [12].

1.1 History of wine as a health food

From earliest times wine has been used as a therapeutic agent, irrespective of a lack of clinical and scientific data for a variety of ailments [13]. It has been used

as a nourishment, for diuresis and hyperthermia and as an aperient, as well as an antibacterial agent for wounds. These therapies eventually became widely adopted throughout Medieval Europe until the puritanical religious movement accredited to Oliver Cromwell spread to the east coast of North America via the Pilgrim Fathers in 1620.

These puritan movements in England and the USA eventually led to the temperance movement of the nineteenth century, which condemned alcohol in all its forms. Wine only found favour again as a medicine in the last decades of the twentieth century.

1.2 Wine and health

Wine, with its grape-derived phenolic compounds, has been found to potentially have additional health benefits to other alcoholic beverages [14, 15]. Wine, when consumed in moderate amounts and when consumed together with a meal, mitigates oxidative stress and vascular endothelial damage induced by a high-fat meal [16]. Consequently, consuming red wine with meals, has been suggested to be cardioprotective and even protective against diabetes type 2 where consumers can experience better health whilst ageing as well as experience an increased lifespan [17]. This concept is now well known as the "French Paradox" and has been the subject of a considerable amount of research over the last 30 years [18]. Wine, in particular red wine, contains various phenolic compounds and their polymeric forms, which are antioxidant chemicals that interact with, and neutralize free radicals and thus prevent cell damage [19]. Phenolic compounds such as catechin, quercetin and resveratrol which are found in skins, seeds, and/or stems of the grapes are consequently in measurable concentrations in red wine have been shown individually and collectively to have antioxidant, anti-inflammatory, anti-proliferative and anti-angiogenic effects in in vitro, animal, ex vivo and limited human clinical studies, and have the potential to act as therapeutic agents in the prevention and treatment of certain chronic diseases [18]. The relative contribution of these phenolic compounds, and particularly resveratrol as a cardioprotective agent has been questioned [20], as it is yet unknown whether it is possible to absorb the necessary therapeutic amounts of resveratrol by drinking moderate amounts of wine [21]. While grape-derived resveratrol, for example, is marketed as functional ingredient and dietary supplement, it should be noted that definitive conclusions on its efficacy as a therapeutic agent are missing.

Some of the studies on the benefits of moderate wine consumption may have been limited by the possible presence of socio-economic, and other individual confounders [22]. Research on blue zones has suggested moderate wine consumption as one of the nine lifestyle behaviours found in populations worldwide that are known for their long lifespan and healthy ageing [23]. These findings suggest that moderate wine consumption may be associated with an increased longevity and a decreased risk for certain chronic diseases with for example an antioxidant, anti-inflammatory, anti-proliferative and/or anti-angiogenic basis. However, it would be incorrect to conclude that moderate wine consumption without the presence of the accompanying lifestyle behaviour determinants (such as not smoking, undertaking regular physical activity, eating a Mediterranean-style diet, not being overweight or obese, having a sense of purpose, and adequate stress management) could show the same associations. Despite these limitations and ongoing uncertainty, it may be cautiously concluded that moderate wine consumption, in addition to the positive

sensory effects experienced through its aroma and taste, may have some positive health effects as well. There are, however, some potential negative health effects associated with heavier wine consumption, whether regular heavy of "binge", which are well documented. Whether the potential positive effects consistently outweigh the potential negative effects is uncertain. Therefore, it may be beneficial for the wine consumer, to consider ways to avoid or reduce the potential negative effects of their consumption.

2. Less is more

The reduction of alcoholic strength in beverages has been proposed as one strategy to reduce the harmful use of alcohol. A report by the World Cancer Research Fund in 2007 stated that a decrease in alcohol content from 14.2 to 10% would reduce the risk of breast and bowel cancer by 7% [24]. This was followed by responses from other organisations, such as the Australian National Preventative Health Taskforce. In 2008, the latter recommended the production of low-alcohol products and suggested changes to the taxation regime to encourage a shift towards the supply of lower-risk products [25, 26]. Lately, low-alcohol beverages have increased in popularity and take up a growing portion of the market. Light beers, beer that is reduced in alcohol (ethanol) content or in carbohydrate content and hence calories, have known a great success on the market worldwide, with an increased global consumption by 47.2% in volume between 2006 and 2011 [27, 28]. A first explanation for this interest in low-alcohol products could be that consumers aim to reduce their alcohol consumption because, consumption, drunkenness and intoxication in particular, may be socially unacceptable, or because they still want to be able to drive [29]. In that way, low-alcohol beverages may be perceived as a response to the alcohol-related control policies that have been adopted in many countries worldwide [27, 30, 31].

An increased health consciousness among consumers may be a second explanation for the growing interest in low-alcohol beverages [24, 32]. As health promotion efforts continue to raise awareness about the increased prevalence of dietary-related diseases, consumers may perceive low-alcohol beverages as a healthier alternative to accompany their healthy diet and lifestyle [29, 33]. In line with this, Meillon et al. [34] and Thompson and Thompson [35] found that people were motivated to drink low-alcohol beverages for calorie and weight management and perceived low-alcohol beverages as an alternative to standard alcoholic beverages.

While not at the same pace as beer, wines with a reduced alcohol content have been growing on the marketplace as well. In the UK and Germany, major supermarket chains, such as Tesco and Aldi, sell several reduced and de-alcoholised wines [36]. Recently, also the Marks and Spencer Group UK launched a new South African 5.5% wine [37], and de-alcoholised wines produced by a winery in the Hunter Valley, Australia [38].

3. What is low-alcohol wine?

Wines with reduced alcohol content are generally classified as specified in **Figure 1**. It should be noted that this classification is not explicit and varies between countries and the applicable legislations [39, 40]. For example, Standard 2.7.1 of the Australian New Zealand Food Standards Code states that an

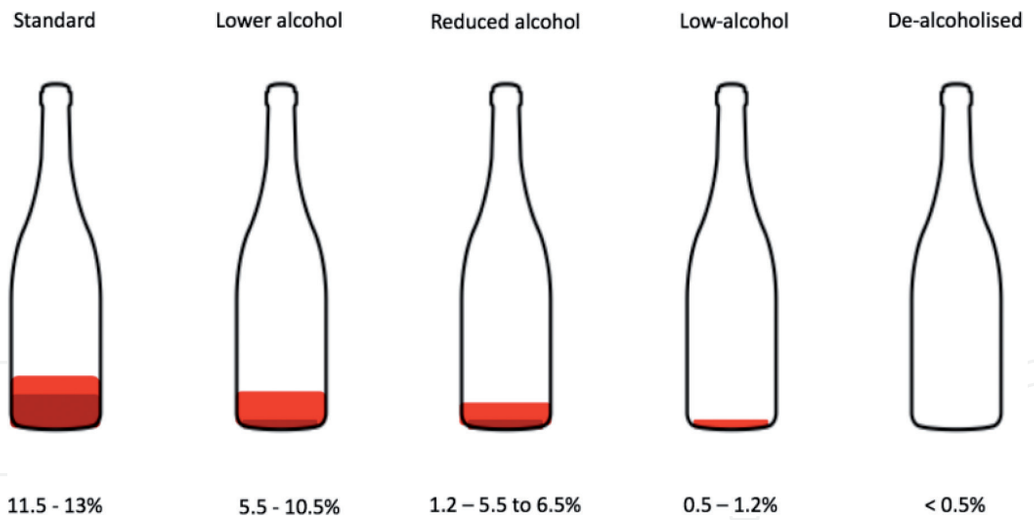

Figure 1.
Classification of wines with reduced alcohol content [39, 40].

alcoholic beverage which contains more than 1.15% alcohol by volume must not be represented as a low alcohol beverage, while as of December 2018, the United Kingdom's Department of Health and Social Care in its Low Alcohol Descriptors Guidance states that low alcohol drinks are those of 1.2% alcohol by volume or less [41]. Legislation around the taxation of wine products varies between countries as well. Whereas some countries apply a fixed duty fee, in other countries such as the UK, the amount of duty payable depends on the strength of the wine [42]. This can make low-alcohol wine products particularly attractive in the marketplace, as they would have an important financial benefit as compared to standard strength products.

4. Production methods

The amount of sugar determines the ethanol concentration of the initial wine, such that grape berries with a lower sugar concentration that produces a lower ethanol concentration initial wine. A reduction in grape berries sugar concentration can be achieved by various viticultural techniques such as reducing the leaf area of the grapevine. The ethanol concentration in wine can also be manipulated before, during and after fermentation by particular winemaking practices, such as blending of grape juices and musts, by choosing a low ethanol-producing yeast, or post-fermentation by blending with low strength juice and the physical removal of alcohol through distillation or membrane-based technologies. Winemaking practices are subject to legislations and local and destination market regulations need to be considered. For example, this latter practice is regulated by Commission Regulation 2009 ((EC) No. 606/2009), which states that the partial removal of alcohol is allowed using physical separation techniques up to a maximum of 2% relative to the original alcohol content.

The different viticultural and winemaking techniques to reduce the ethanol concentration of wine are summarized and shown in **Table 1** and additional information can be sourced from [26] "Controlling the highs and lows of alcohol in wine" [43], "Production technologies for reduced alcoholic wines" and [44] "Production of Low-Alcohol Beverages: Current Status and Perspectives", and [45] "Microbiological strategies to produce beer and wine with reduced ethanol concentration".

Viticultural practices	Winemaking practices	
	Pre-fermentation	**Post-fermentation**
Reducing leaf area—the rate of sugar accumulation in berries is primarily determined by the ratio of leaf area to fruit weight (LA/FW). A relatively high LA/FW may cause the sugar concentration to reach unacceptably high levels by the time that flavour or phenolic ripeness is judged to be optimal. Therefore, a reduction of leaf area after fruit set may lead to better synchronisation of sugar and flavour/phenolic ripening, and thus a lower alcohol concentration in the resultant wine	• **Blending** Grape musts with a high sugar concentration can be blended with low strength juice (LSJ) or condensate within the constraints of wine regulations • **Enzyme additions** The enzyme glucose oxidase (GOX) from the fungus *Aspergillus niger* catalyses the conversion of glucose into gluconic acid and hydrogen peroxide. The addition of commercial preparations of the enzyme to grape juice prior fermentation has been shown to decrease the ethanol concentration in the resultant wine by 0.7% v/v compared to untreated wines. • **Fermenter design** Aeration and higher fermentation temperatures may lower alcohol concentrations in wine. Consequently, open top fermentation has been shown to yield lower alcohol concentrations after fermentation. • **Wine yeast** Commercial wine yeasts generally do not show significant variation in the amount of ethanol yielded in wine following fermentation. The yeast strain AWRI 796 has been shown, however, in some laboratory-scale trials, to yield lower ethanol concentrations than certain other commercial wine strains. For example, compared to EC1118, AWRI 796 delivered a reduction of ethanol of approximately 0.4% v/v	• **Physical removal of grape sugar or wine alcohol** Engineering options for precisely reducing sugar content of juice and alcohol concentration in wine include membrane-based systems (such as reverse osmosis and evaporative perstraction), vacuum distillation and spinning cone distillation. • **Loss of alcohol by evaporation** During barrel maturation, both water and ethanol in the wine evaporate. The ethanol concentration slowly increases in dry cellars as water evaporates faster than ethanol in this environment. Conversely, in cellars with a relative humidity over 70%, the ethanol concentration slowly decreases over time. Alcohol concentration was reported to drop by 0.2% v/v when barrels were stored for 12 months at 15°C with relative humidity over 90%

Adapted from [26, 43–45].

Table 1.
A summary of the different viticultural and winemaking techniques to potentially reduce the ethanol concentration of the final wine.

5. The low alcohol wine consumer

5.1 Consumer interest

In 2000, a review by Pickering, concluded that dealcoholized, low- and reduced-alcohol wine (DLRAW) performed well below predictions in the marketplace [39].

Ongoing limitations in sensory quality, promotional issues, and a low level of awareness of the improvements in quality based on innovations in production methods, were suggested as potential barriers for market success [39]. Additionally, a 'snobbish' attitude within both wine consumers and producers, was suggested as a possible reason for the low acceptance of low alcohol wine. Therefore, Pickering [39] described the following strategies to grow consumer interest: efforts to increase awareness of and familiarity with the products, advocacy by industry opinion leaders to improve perceived credibility and consumer acceptance, and sustained promotion and advertising campaigns to promote DLRAW. Since then, varying findings on consumer interest have been reported. An Australian survey conducted in 2010 showed 6–8% consumer interest [46] whereas another Australian survey in 2013, found an acceptance of low alcohol wine of 16% [40]. This study by Saliba et al. [40], found that consumer acceptance increases to 40% if taste were to be the same as for standard wine products. According to a study on consumer metrics in the UK, a practical desire to keep buying cheap wines, health consciousness, taste and staying in control, were the main purchase decisions for wines with a strength lower than 11% [29]. Non-availability of the products, lower quality perceptions, taste issues, lack of awareness, lack of alcohol's feel effect and absence of a lower alcohol drinking occasion, were described as the main barriers to buying reduced alcohol wine (<11%) [29].

A study by Stockley et al. [32], showed that changes in wine consumption behaviour are most influenced by health. Wine Australia stated in 2017 in 'Global Drinking Trends' [47] that an increased consciousness about the risks of excessive alcohol consumption in combination with the general wellness trend among consumers, makes them choose beverages that are perceived to be healthier alternatives, such as wine, and leads to a preference to drink less but better. Current consumer groups choose high-quality, unique, and authentic brands and flavours, and this "premiumisation" trend is also seen in the global alcoholic drinks market [47]. A non-peer-reviewed report by a marketing company from 2016 suggests increasing consumer demand for low-alcohol wine and mentions high acceptance in Germany and big growth potentials in the US and Canada [48].

5.2 Consumer profile

Research has shown that the more knowledge consumers have and the more frequently they consume wine, the less likely they are to appreciate the sensory properties of alcohol-reduced wine [34, 49]. Meillon et al. [34] found that wine professionals did not like the sensory properties of reduced alcohol wines, whereas consumer likings were less clear and masked a strong segmentation [34]. Meillon et al. [34] suggested that these findings can be explained by the theory of mere exposure [50], stating that familiarity with a product makes a consumer more likely to develop specific preferences concerning that product. Consequently, frequent wine consumers may be more likely to miss the higher alcohol level simply because that is what they are most acquainted with. Meillon et al. [49] concluded that the fewer bottles owned in the cellar, the more likely the consumers were to like the sensory properties of the reduced alcohol wine [51].

Mainly women and the younger generation (age 18–39) show interest in lower alcohol wines, according to research by Prowein which was conducted in 2012 across the US, China, Germany and the UK [52]. Similarly, an Australian study showed that females and those who drink wine with food were the consumer groups that were most likely to purchase low-alcohol wine [53]. The buyers profile in the UK was described by Bruwer et al. [29] as females, Millennials and Baby Boomers,

mid to low income, who drink wine about once a week and have a medium to low level of involvement with wine [29].

5.3 Acceptability of low-alcohol wine

5.3.1 Taste

Taste is one of the most important factors in wine consumption decision making [53]. A lack of or an unfamiliar taste may be important drawbacks for low-alcohol beverages [27]. However, interestingly, experimental research has shown that, when unaware of the alcohol percentage, lay consumers were unable to discriminate between alcohol-free and alcohol-containing beer or between regular-strength and lower-strength beer [54, 55]. This is in line with research by Masson et al. [56] who found similar taste ratings for low-alcohol wine versus standard wine, however, before tasting, the subjects expected lower quality for the reduced alcohol wine. Studies have shown that low alcohol wine seems to be associated with a lower expected quality [49, 56]. Meillon et al. [49] found that a priori having tasted partially alcohol reduced wine expectations were negative, based on reasons such as; loss of tradition and authenticity of wine, worry about the quality of the wine and wine preservation, and a feeling of tempering with wine. Experimental studies with blind tasting, however, showed similar liking rates for standard wines and wines with reduced alcohol content [51, 56, 57]. It is therefore interesting to investigate the extent to which the lower expected quality based on the label or information cue affects taste ratings, i.e., are the taste ratings different when participants are aware of the reduced alcohol content versus when they are unaware of the alcohol strength. The study by Masson et al. [56], found that the expected quality for low-alcohol labelled wine was significantly lower as compared to a standard wine, however, in that same study, taste ratings of low-alcohol wines (9% alcohol) did not differ from ratings of standard wines (13% alcohol), neither under blind condition nor if participants were aware they were consuming low-alcohol wine [56]. In a recent wine study by Bucher et al., participants were randomly assigned to one of three conditions; a low-alcohol (8%) condition, a blinded low-alcohol (8%) condition, or a standard condition Sauvignon Blanc (12.5%). Participants in all three conditions reported similar results for liking of the wine and pleasantness to drink [57]. It should be noted that a further reduction in strength, i.e., <8% may have different results. A study by Meillon et al. [51], found that a reduction below or equal to −4% (resulting in a wine of 9.5%) had no significant impact on wine liking, however when the alcohol reduction reached the value of −5.5% (resulting in a wine of 7.9%), it was significantly disliked by consumers [51].

5.3.2 Price

Next to taste, price is another main determinant in wine purchase decision-making. Willingness to pay for non-standard wines with health benefits varied in previous literature. Some studies found that consumers are willing to pay more for wine made with grapes enriched in resveratrol [58]. However, others found that consumers expect lower alcohol wines to be cheaper compared to standard wine [29, 57]. As price has been described as an indicator of quality, a perceived lower quality associated with alcohol reduced wines could be a possible explanation for these findings [59]. Another explanation could be that consumers may not be aware of the additional steps, and therefore additional costs, involved in the production of low alcohol wine. Adequate information for the consumers about the process and

technology involved in the production of low alcohol wines may help to establish the market potential for these wines.

5.3.3 Cultural differences in acceptance

Perception willingness-to-pay, and overall acceptance of low-alcohol wines may, however, differ between countries. A study by d'Hauteville [60] showed higher acceptance rates for the UK (27%) and Germany (20%) than for France (12% acceptance, 61% rejection). An explanation for these findings could be that the rich culture and tradition, and level of involvement with wine in France, is associated with a lower acceptance or openness towards changes in the production methods and taste of wine [48]. Another possible explanation could be that the great success of low alcohol beer in countries like the UK, made the consumers in those countries more accepting of low alcohol beverages in general, and as such, has paved the way for wine [61]. Furthermore, it has been suggested that consumers in Germany might be more willing to accept low-alcohol wine because many traditional German wine styles are naturally low in alcohol [48]. Chan et al. [62] investigated consumer preferences and perceptions on dealcoholized wine in Malaysia and found that 20% of the respondents knew about the product but only 9% consumed it. The study aimed to analyse the Malaysian consumer's attitude and how the religious regulation status affect's this. The low (9%) consumption level was explained by the finding that most respondents (90%) perceived dealcoholized wine as not halal [62]. Additionally, a study by Yoo et al. [63] showed that Koreans were more likely to choose wine based on health enhancement properties compared with Australians. Further research on the differences between countries and cultures for acceptability of wines with reduced alcohol content is needed.

6. Does low alcohol wine reduce alcohol consumption?

Offering lower alcohol wine could result in a significant decrease in total alcohol consumption. However, low alcohol labelling may not only influence product selection but also consumed amounts. Previous studies in the area of food research showed that labels on food products, such as "light" or "low-fat" could trigger an increase in consumption [64, 65]. A study by Provencher et al. [64] found that people consume more of a product when they perceived the product as healthy. Similarly, there might be a risk that people overcompensate, if they consume low alcohol wine. The evidence on this is mixed. An experimental study by Vasiljevic et al. found that the total amount of drink consumed increased as the alcohol strength on the label decreased [66]. However, two other studies showed that low alcohol labelling did not increase consumption or intended consumption. In a study by Bucher et al. [57], participants consumed equal amounts of wine, whether that be standard wine (12.5% Sauvignon Blanc) or wine with reduced alcohol content (8% Sauvignon Blanc) [57]. These results are in line with the findings of another recent experimental study that concluded that reducing wine alcohol content had neither physiological nor cognitive influence on the quantities consumed [67]. A study with 1050 wine consumers, which investigated the perceived healthiness of wine on wine consumption patterns, was in line with these findings. Saliba et al. [68] found that those perceiving wine as healthy had a higher frequency but not volume of consumption.

When a beverage with reduced alcohol content is consumed in the same quantity as a standard beverage, the total alcohol consumption is significantly lower. In the study by Bucher et al., those who drank the low-alcohol wine consumed

approximately 30% less alcohol as compared to those who drank the standard wine [57]. These findings have important practical implications and suggest that reduced alcohol wine can be an effective strategy to reduce alcohol consumption and therefore decrease alcohol related risks. However, more experimental research in more natural settings is needed to investigate total alcohol consumption if consumers have the choice between a variety of different strength alcoholic wines.

7. Why marketing and labelling are important?

First, as previously mentioned by Pickering [39], and described again by Bruwer et al. [29], lack of product awareness is still an important barrier for uptake of low-alcohol wine consumption and needs to be addressed by adequate promotional activities. Second, research on the low-alcohol wine consumer in the UK found that lower alcohol on its own is not seen as a benefit [29]. Consequently, marketing strategies may need to focus on the benefits of the product rather than the literal credentials [29]. Research on consumer behaviour does suggest that consumers value the link between beverage intake and health status, and health claims may influence beverage choice [32, 69, 70]. However, even though the interest in alcohol-reduced beverages has increased, producers and marketers should carefully consider marketing strategies around alcohol-reduced wine. Experimental studies have shown that reduced alcohol claims can reduce product appeal [71] and may negatively impact expected quality [56]. A study by Masson et al. with French consumers found that the expected quality for "low-alcohol" labelled wine was significantly lower as compared to a standard wine [56]. However, in their tasting test, ratings of low-alcohol wines (9% alcohol) did not differ from ratings of standard wines (13% alcohol), neither under blind condition nor if participants were aware, they were consuming low-alcohol wine [56]. In agreement with this, the results of a recent tasting experiment with Australian consumers suggest that participants were willing to pay less for low alcohol wine [57], although quality and taste ratings were equal between the 'low alcohol wine' and the standard wine, which was labelled as 'new wine'. Therefore, a third marketing strategy may be to inform the consumers about the recent improvements in production methods and sensory properties of low-alcohol wine innovations. Furthermore, informing the consumer about the additional steps and costs involved in the production process of low-alcohol wine may have a positive effect on consumer's willingness to pay, and could be a fourth marketing strategy to consider.

A fifth marketing strategy relates to the descriptor or terminology used on the label. Terminologies for low-alcohol wine and related beverages may be tightly regulated by country specific food standards, however it might be critical to carefully consider the wording around low-alcohol wine on labels and its impact on consumer behaviour. Altered wording used on the label, e.g., light, de-alcoholised, reduced alcohol or low alcohol might evoke different consumer perceptions and reactions [71]. Vasiljevic et al. found that the terminology also has an effect on perceived strength [72]. More insight on these influences as well as on country specific differences is needed. Finally, it may be opportune to consider the way low alcohol beverages are promoted as a new product or product category. Reducing ethanol content in beverages can be an effective strategy to reduce the harmful use of alcohol [73]. However, the way the product is promoted may impact its potential positive effects. Rehm et al. described different potential mechanisms for how reduction of alcoholic strength could affect harmful use of alcohol; by replacing standard alcoholic beverages without increasing the quantity of liquid consumed; by current drinkers choosing no alcohol alternatives for part of the time and in that

way reducing the average amount of alcohol consumed; or by initiating alcohol use in current abstainers [73]. Vasiljevic et al. investigated the marketing messages accompanying online selling of low/er and regular strength wine and beer products in the UK and concluded that low/er strength beverages appear to be marketed not as substitutes for higher strength products but as ones that can be consumed on additional occasions with an added implication of healthiness [74]. For reduced alcohol beverages to reduce the harmful effects of alcohol consumption, it may thus be essential to carefully consider marketing messages and product promotion.

8. Conclusions

Reduced alcohol wine may be a strategy to reduce total alcohol consumption and alcohol related harm. However, recent literature suggests that, despite good quality ratings when tasting the wines, people may still tend to perceive wines with reduced alcohol content as a lower quality product and may therefore wish to pay less for them. Consumers might falsely assume that wines with lower strength would be cheaper to produce or benefit from tax incentives (which is the case in some countries). To circumvent negative consequences of low alcohol labelling on perception, a few strategies have been suggested in the literature. These include increasing consumer knowledge related to alcohol reduction processes and increasing consumer awareness about high quality low-alcohol wines with appealing sensory properties. Media campaigns and specific awards or recognitions for lower strength wines might be helpful to promote consumer awareness of high quality low-alcohol wine products. However, research on this is warranted.

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Conflict of interest

The authors declare no conflict of interest.

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