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U.S. Wine consumer interest in wine ingredient and nutritional information

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Abstract. In the United States, labelling for wine containing at least 7% alcohol by volume is regulated by the Tax and Trade Bureau, which does not require wine labels to include ingredient or nutrition labelling, except for added sulfites. With the European Union moving toward mandatory disclosure of nutrition and ingredient information for wine, one may expect the level of debate in the U.S. to increase. We conducted an online survey of consumers in the U.S. who are at least 21 years old (legal drinking age in the U.S.) and consume wine at least once every two or three months to determine their interest in wineries disclosing ingredient and nutrition information for wine. We asked about the importance of ingredient information when deciding which wine to purchase and when determining willingness to pay, and we asked about the importance of nutrition information when deciding which wine to purchase. We separately regressed three dependent variables against Wine Consumption (frequency), Price, Physical Activity, Diet, Wine Knowledge, Age, Income, and Education. Overall, respondents indicated that having ingredient and nutrition information was only somewhat important, with mean responses 3.04 on a 5-point scale (1 = Not Important, 5 = Very Important) for ingredient information when choosing a wine, 3.01 for ingredient information when determining willingness to pay, and 2.48 for nutrition information when choosing a wine. The factor with the greatest impact on interest in ingredient information was Price, with consumers who buy a higher-end wine at least monthly having a higher level of interest, followed by Diet, with consumers with a healthy diet having a higher interest in ingredient information, and Age, with older consumers having less interest in ingredient information. Price, Diet, and Age also had the greatest impact regarding interest in nutrition information, following the same direction but with Age being the most significant.

Keywords: ingredient and nutrition information, U.S. wine consumers.

1. INTRODUCTION

In the United States (U.S.), the labelling requirements for prepared or processed food products are regulated by the Food and Drug Administration (FDA). The FDA generally requires food manufacturers to list all ingredients of a food product on the label and requires most foods to bear nutrition

labelling. However, labelling for wine containing at least 7% alcohol by volume is not covered by FDA regulations and is instead regulated by the Tax and Trade Bureau (TTB). The TTB does not require wine to bear nutrition labelling, and the only ingredient requiring listing is added sulfites. Alcohol by volume must be listed, but alcohol is neither an added ingredient nor a nutrition category.

In Europe, the European Commission has rejected self-regulation proposals from the beverage alcohol industry, and the European Union (EU) is moving forward with a proposal for mandatory ingredients and nutrition labelling on alcoholic beverages. The European Commission's proposal is part of the "Europe's Beating Cancer Plan" adopted on February 3, 2021, with a 2021 – 2025 timeframe for the alcohol-related initiative. The debate on the issue in the U.S. has been building over the past few years, but as of now the TTB has not indicated interest in expanding wine labelling requirements for ingredients or nutrition information.

Public opinion on the topic in the U.S. is unclear. Forbes [1] quotes John Gillespie of the market research company Wine Opinions as saying, "I can say from a number of consumer research projects in the past, 'involved wine drinkers'—those who account for the greatest percentage of wine purchases—are usually interested in having more information and detail, especially as concerns health or wellbeing issues. I do think that would have an impact on how wineries respond to the possibility of mandatory ingredient labeling."

However, in a survey conducted by the Wine Market Council (WMC) in May 2020 [2], 41% of regular wine drinkers said they rarely want to know nutritional information or the ingredient list, and only 21% said they always want to know. When asked to choose the top five categories of information they wanted to see on a wine label, only 4% put nutritional information and ingredient list as most important, and 81% did not include it in the top five. Interest in ingredients and nutrition information was positively correlated with level of education and negatively correlated with age. Core wine drinkers expressed more interest than Marginal wine drinkers in this information, but they expressed more interest in most forms of information, and nutrition information and ingredient list were not highly ranked in the list of types of information they want. Moreover, Core wine drinkers valued having additional information for the sake of knowing more about the wine and did not place much value on having information as an aid in making wine purchasing decisions.

With the EU moving toward mandatory disclosure of nutrition and ingredient information for wine, one

may expect the level of debate in the U.S. to increase, as illustrated by a pair of posts on the wine-searcher.com website in which wine writer W. Blake Gray argued that the U.S. should follow the EU on this issue [3] while wine maker Adam Lee responded with a list of challenges such regulation would create and reasons why the labels could potentially cause consumer confusion [4]. This study seeks to contribute additional information to the debate in the U.S. on adding the ingredient list and nutrition information to required disclosure for wine and to add insight into the value of such disclosure from a policy perspective.

2. LITERATURE REVIEW

Much of the academic literature related to nutrition information and ingredient list disclosure for wine has centered on Europe, which is not surprising since the EU is closest to making such disclosure mandatory. Bazzani, et al., [5] conducted an online survey of Italian red wine drinkers that included questions on consumer attitudes toward wine and health-related aspects and a choice experiment using attributes that are often associated with more natural and healthier foods. They found that health consciousness is an important driver in the use of wine labels, but they did not specifically include nutrition information or an ingredient list on the label.

Multiple studies show that the usefulness and value of nutrition and ingredient information vary across countries. Employing a discreet choice experiment with representative samples of wine consumers from Germany, Italy, and Australia, Pabst, et al., [6] found that consumers across all three countries had a significant positive utility for detailed nutrition information. Ingredient information, on the other hand, received a positive utility only in Italy, and a short ingredient list was preferred to a long ingredient list. Grunert, et al., [7] utilized an online survey in Denmark, Germany, Netherlands, Poland, Spain, and UK to examine consumer wants and use of ingredient and nutrition information from a range of non-label sources. Information wants and use varied between the countries, was highest in Spain, and was lowest in Denmark. Product involvement was a stronger predictor of information wants than health interest. The effect of product knowledge was lower still and decreased with more product knowledge. Previous ingredient knowledge led to lower ingredient information wants, while previous nutrition information knowledge led to higher nutrition information wants. The strongest predictor of information use was information wants.

Annunziata, et al., [8] conducted a survey in France, Spain, Italy, and the U.S. and found that interest in receiving additional information on wine labels (e.g., about ingredients or nutrition information) differed significantly between consumer groups based on the consumer's country. Among respondents in the U.S. panel, 40% said they seldom change a habit because of the nutritional label, and the mean response for the question "I find it difficult to understand nutritional labels" was 3.1 on a 5-point scale (5 = strongly agree). Only 25% said they always read the front label on a bottle of wine, and only 18% said they always read the back label. Still, the mean interest in having nutritional information was 3.6, and the part-wise utility value for nutritional information was higher than for price, health warnings, or units in bottle and units not to exceed.

Another consistent result in research studies is that the usefulness and value of nutrition and ingredient information are not identical across consumer segments. Escandon-Barbosa and Rialp-Criado [9] used eye tracking to study a sample of 114 individuals in a simulated supermarket with more than 100 wines at a university in Columbia, focusing on purchase intention, related to wine label information on denomination of origin, nutritional information, and health warnings. Expert wine consumers used all three pieces of information to make a purchase decision. Non-expert wine consumers, by contrast, made much less use of this information to make a purchase decision and tended to focus on the origin information and health warnings and not make use of nutritional information. The intent to purchase wine increased with the use of all three pieces of information for both men and women. However, the effect was stronger for men. Women and men processed the information differently, and the mean time to make a purchase decision was less than half as much for men as it was for women.

Annunziata, et al., [8] found that interest in receiving additional information on wine labels differed significantly between consumer groups based on the consumer's socio-demographic variables, wine consumption habits, attitudes towards nutritional information in general, and the degree of involvement with wine. In a survey of Italian wine consumers, Annunziata, et al., [10] found that consumers who already have better knowledge of wine nutritional properties and a greater awareness of the links between wine and health preferred a more detailed nutritional label than other consumers. Those who generally find it more difficult to understand nutritional labels either show higher interest in health warnings or prefer the specification of the number of glasses not to exceed and did not value more detailed

information. Pabst, et al., [11] assessed consumers' reactions to new back-label information on ingredient and nutrition labelling in three focus groups with a total of twenty-one wine-involved participants in three different cities in Germany. Of those participants who looked at the back label (81%), almost two-thirds said they did not detect the nutrition or ingredient listing.

Pabst, et al., [12] conducted an online survey of German wine producers to examine producers' expectations about consumer reactions to new label information, the consequences of mandatory labelling on production processes, and relative competitive advantages for different producer sizes. They found that producers expect the labelling regulations to create consumer confusion and uncertainty; weaken wine's image as a natural product; and increase costs due to changes in oenological practices, the increased need for laboratory analyses, and more challenging labelling processes. Producers believe the regulations will create opportunities for wineries to focus on clean labelling strategies by completely avoiding additives that require labelling and that large wineries will be better able to react to the regulations.

Producers' concern for how consumers will react to the new labelling requirements is not unfounded. Pabst, et al., [9] found that focus group participants who recognized the nutrition labelling and ingredient list initially reacted to this information with insecurity, confusion, and incomprehension. Pabst, et al., [6] found that presenting negative media information resulted in subjects in all three countries surveyed significantly increasing their rating of importance of ingredients while also increasing their preference for clean labelled products without ingredients. Further, a significantly higher share of consumers in Germany and Italy prefer not to buy any wine. The effect of reading positive media information on consumers' wine choice is significantly lower than that of reading negative information.

Hayward, et al., [13] studied the influence an ingredient list had on the sensory perception of red wines from Nova Scotia. In this study, participants used attributes associated with liking the wine more often when the ingredient list was shorter and familiar. Hayward and McSweeney [14] studied the influence calorie information had on the sensory perception of rosé wines from Nova Scotia and found that the calorie information did not influence consumers' sensory perception.

One factor that is still undecided in the E.U. is the format of the disclosure, with producers generally hoping that technology-enabled disclosure will be allowed in lieu of labelling on the bottle. Vecchio, et al., [15] conducted an incentive compatible artefactual field experiment that indicated that Italian wine consumers most

prefer to have nutritional information presented in a panel and least prefer having only a link to a website that contains the information. Grunert, et al., [7] found that the level of both information wants (for ingredient and nutrition information) and information use was higher for websites (product, public, and health) than for advertising, apps, or in-store sources.

Robinson, et al., [16] conducted a rapid systematic review and meta-analysis of eighteen studies to assess consumer knowledge of energy content (calories) of alcoholic drinks, public support for energy labeling, and effect of such labeling on consumer behavior. They found consistent evidence that consumers tend to overestimate the number of calories in an alcoholic drink and that people are more likely to support than oppose energy labeling of alcoholic drinks, but there was a high degree of heterogeneity. (Two thirds of the studies used for this analysis examined nutrition information that included calories, and one third looked specifically at calorie information disclosure.) The authors concluded that the studies they included suggest that energy labeling did not affect consumer behavior but that the overall quality of the evidence supporting that conclusion was very low. Generally, the authors found that the use of self-reported information and lack of real-world settings resulted in most (72%) of the studies they reviewed provided low evidential value with high levels of uncertainty.

Overall, the body of work shows there is inconsistency across consumers in the importance of both nutrition and ingredient labeling. This includes how they might use it and how much content on the labels they would find important. Additionally, much of the research had been conducted in Europe. The current project seeks to continue to fill the gap in how important information is to consumers, targeting a U.S. sample.

3. MATERIAL AND METHODS

We conducted an online survey of consumers in the U.S. who are at least 21 years old (legal drinking age in the U.S.) and either consume or purchase wine at least once every two or three months. A professional panel recruitment agency recruited respondents across the U.S. using its internal recruiting platform. Respondents who did not finish the questionnaire, including respondents who failed a quality control check embedded in the survey, were eliminated. We received 331 completed surveys. Thirteen respondents were rejected based on a speed test (completing the survey in less than half the median time in a soft launch of the survey), and we

obtained 318 useable responses, with an average completion time of 10 minutes, 38 seconds. See Table 1 for demographic information on our sample.

To verify that our respondent set is representative of regular wine drinkers in the U.S., we compared it to the Wine Market Council's (WMC) U.S. Wine Consumer Segmentation study, one of the most thorough such studies in the industry. Comparing our respondent set to wine drinkers in the 2019¹ U.S. Wine Consumer Segmentation study [17], our set skews older. Our respondents have an average age of 53.8 compared to 48.2 for the WMC study, and we have a lower percentage of respondents in each 10-year age group (21-29, 30-39, etc.) below 60. Females are overrepresented in our respondent set, 66% compared to 54% in the WMC study². In terms of educational attainment, our respondent set is highly comparable to the WMC study, with the same proportion of respondents who did not earn any degree beyond high school (44%) and the same proportion with postgraduate work or degree (20%). We have slightly more respondents with a technical or two-year degree (13 v. 11%) and slightly less with a four-year degree (23% v. 25%). Respondents who identified as non-Hispanic Caucasian are overrepresented (79% v. 67%). Blacks and African Americans are almost equally represented in our study (10% v. 11%), but we have proportionately about half as many Hispanics (7% v. 14%), Asians (2% v. 4%), and respondents identifying with another designation (2% v. 5%).

Geographically, the northeast U.S. is slightly underrepresented compared to the WMC study (17% v. 20%), with the difference divided nearly equally as overrepresentation of the mid-west, south, and west regions. However, our sample set closely mirrors the distribution of the entire U.S. population, with less than one percentage point difference in any region (Table 2).

Table 3 reports the frequency of wine consumption for our sample. The 318 useable responses include six whom the Wine Market Council would not consider a wine drinker, since four drink wine less than every 2-3 months and two never drink wine. We initially included these in the respondent set because they purchase wine regularly, at least once every 2-3 months. Because the number of respondents in this category was too small to analyze as a sub-group, we excluded them from further analysis. None of the six purchased wine at a high level of frequency, five only once every 2-3 months and one 2-3 times per month.

The WMC defines Core wine drinkers as those who report drinking wine at least once per week and Margin-

¹ The most recent study available as of this writing

² None of the 318 respondents either identified as non-binary or preferred not to indicate a gender.

Table 1. Demographic Characteristics of the Sample.

		Frequency	Percent
Gender	Female	208	65.409
	Male	110	34.591
Race	Caucasian/Non-Hispanic	252	79.245
	Hispanic or Latino	21	6.604
	Black or African American	31	9.748
	Asian	7	2.201
	Mixed Race	4	1.258
	Other	3	0.943
Marital Status	Married, in an official civil union, or in a registered domestic partnership	148	46.541
	Living with a partner	31	9.748
	Single, never married	64	20.126
	Separated or divorced	51	16.038
	Widowed	24	7.547
Income	< \$35,000	106	33.333
	\$35,000 – \$49,999	56	17.610
	\$50,000 – \$74,999	48	15.094
	\$75,000 – \$99,999	44	13.836
	\$100,000 – \$149,999	37	11.635
	\$150,000 or above	21	6.604
	Prefer not to state	6	1.887
Education	High school graduate or less	68	21.384
	Some college	71	22.327
	Completed technical/2-year degree	42	13.208
	Completed 4-year degree	74	23.270
	Some graduate school	11	3.459
	Completed graduate Degree (e.g., MA, MS)	43	13.522
	Completed terminal degree (e.g., PhD, MD, JD)	9	2.830

N = 318.

Note: percentages may not add to 100% due to rounding.

al wine drinkers as those who drink wine less often (but at least once every 2-3 months) and say that they like wine. The WMC definition of Total Wine Drinkers also includes those who report drinking wine at least once every 2-3 months but say that they do not like wine. Of the 312 respondents in our sample whom the WMC would classify as Total Wine Drinkers, 184 (59%) are Core wine drinkers, 113 (36%) are Marginal, and 15 (5%) did not report liking wine³. We conducted a Pearson's chi-squared test to compare our respondent set with the

³ One respondent reported being too new to wine to have a decided yet whether he or she would claim to like wine. We included that respondent in the third group for the Chi-square analysis.

Table 2. Sample and U.S. Population Distribution by Region.

	Sample		U.S.	
	Frequency	Percent	Frequency	Percent
Midwest	66	20.755	68,329,004	20.817
Northeast	53	16.667	55,982,803	17.055
South	120	37.736	125,580,448	38.259
West	79	24.843	78,347,268	23.869

N = 318.

Note: percentages may not add to 100% due to rounding.

Table 3. Wine Consumption Frequency.

	Frequency	Percent
Every day	36	11.321
Not every day but more often than once a week	79	24.843
Once a week	69	21.698
2-3 times a month	74	23.270
Once every 2-3 months	54	16.981
Less than once every 2-3 months	4*	1.258
Never	2*	0.629

N = 318 (* excluded from further analysis).

WMC 2019 segmentation study regarding the proportion of Core wine drinkers, Marginal wine drinkers, and others in the Total Wine Drinker category. Base on $X^2(2) = 4.655$ we rejected the null hypothesis that the two groups are different at $p = 0.098$. For the remainder of our analysis, we define Core and Marginal wine drinkers based only on the frequency of wine consumption and disregard whether they report liking wine.

To determine the importance of having information about a wine's ingredients, we asked respondents to indicate the level of importance of knowing the wine's ingredients when purchasing wine for each of five different occasions: giving wine as a gift; bringing wine to a large gathering; bringing wine to a small dinner with friends; buying wine for a special occasion at home; and buying wine simply to drink at home. Using a 5-point Likert scale, respondents indicated whether, for each occasion, knowing a wine's ingredients is (1) Not Important, (2) Slightly Important, (3) Somewhat Important, (4) Important, or (5) Very Important.

We first asked about the importance of having information about a wine's ingredients when deciding which wine to purchase. Then we asked about the importance of having information about a wine's ingredients when deciding how much the respondent would be willing to pay for the wine. We calculated the mean response for

each respondent across all five occasions for each question as the dependent variables Ing-Choice and Ing-Pay, respectively.

To measure the importance of having nutritional information about a wine, we asked respondents to indicate the level of importance on the same 5-point Likert scale of thirteen nutrition elements⁴ when deciding which wine to purchase, and we calculated the mean response for each respondent as the dependent variable Nutrition.

For each dependent variable we ran a separate regression using the following independent variables that had some significance during preliminary bivariate analysis:

- Wine Consumption: We divided respondents into (1) Core or (2) Marginal wine drinker as defined earlier.
- Price: We categorized respondents based on the highest price level at which they purchase wine at least monthly: (1) Do not purchase wine at least once a month, (2) Purchase wine at least once a month costing under \$15 per 750 ml bottle, (3) Purchase wine at least once a month costing \$15 – \$24.99 per 750 ml bottle, (4) Purchase wine at least once a month costing \$25 or more per 750 ml bottle.
- Physical Activity: We asked respondents whether they regard themselves as (1) Much less active, (2) Less active, (3) About the same, (4) More active, or (5) Much more active compared to others their age. This was dummy coded into healthy (4 or 5 = 1) and all others (0) to compare those who were intentionally engaging in a healthy lifestyle to everyone else.
- Diet: We asked respondents whether they would describe their diet as (1) Very unhealthy, (2) Unhealthy, (3) Neutral, (4) Healthy, or (5) Very healthy. This was dummy coded into a healthy diet (4 or 5 = 1) and all others (0) to compare those who were intentionally engaging in a healthy lifestyle to everyone else.
- Wine Knowledge: We asked respondents to describe their level of wine knowledge and familiarity as (1) Almost none at all, (2) Low, (3) Average, (4) Connoisseur, or (5) Expert.
- Age: We asked respondents for their year of birth and calculated their age as of their birthday in 2021. All respondents had to be the legal drinking age in the U.S. (minimum 21) at the time of the survey.
- Income: We asked respondents to report their annual household income as (1) under \$35,000, (2)

\$35,000 - \$49,999, (3) \$50,000 - \$74,999, (4) \$75,000 - \$99,999, (5) \$100,000 - \$149,000, or (6) \$150,000 or more.

- Education: We asked respondents to report their highest level of completed education as (1) High school graduate or less, (2) Some college, (3) Completed technical/2-year degree, (4) Completed 4-year degree, (5) Some graduate school, (6) Completed graduate degree, or (7) Completed terminal degree.

Six respondents chose “Prefer not to answer” for Income and four others were missing another data point and were not included in the regression analysis. We tested the assumptions of regression and there were no issues across the three regressions. We found that collinearity between the independent variables was not an issue, as variance inflation factors (VIF) ranged from 1.097 to 1.366.

4. RESULTS

The respondents did not have a strong interest in ingredient and nutritional label information in general. Less than half of the sample said that they read label information Often or Very Often, whether it was ingredients (Often: 31.4%; Very Often: 17.9%) or nutritional information (Often: 31.1%; Very Often: 18.6%). When it comes to using nutritional information to decide which alcoholic beverage to consume, or whether to consume one, barely a quarter (25.3%) said that it was Important or Very Important. The lack of a strong interest in general ingredient and nutritional information carries over to wine even though, overall, the respondents think that wine is associated with good health. When asked which alcoholic beverages, if any, are associated with a healthy lifestyle or diet, almost 75% selected wine. When asked if they would agree that moderate wine consumption is good for health, the mean response was 3.958 on a 5-point scale.

4.1 Ingredient information when choosing a wine

Overall, respondents think that knowing the ingredients when deciding which wine to purchase is somewhat important, with a mean response of 3.037. Table 4 presents the regression results for the question “For each of the wine purchase occasions listed, indicate how important it would be to you to know what the ingredients are in deciding which wine to buy” (Ing-Choice).

The model was a significant predictor of Ing-Choice ($F(8, 293) = 10.652, p < 0.001$), accounting for 20.4% of the variance in the model. Price, Age, Physical Activity,

⁴ The thirteen nutrition elements were Calories, Total Fat, Cholesterol, Sodium, Potassium, Total Carbohydrates, Sugar, Protein, Calcium, Iron, Vitamin B-6, Magnesium, and Phosphorus.

Table 4. Regression results for dependent variable Ing-Choice.

	B	SE	t	Sig.
Wine Consumption	0.223	0.126	1.772	*
Price	0.264	0.069	3.840	***
Physical Activity	0.308	0.131	2.356	**
Diet	0.314	0.127	2.483	**
Wine Knowledge	0.167	0.185	0.898	
Age	-0.010	0.003	-2.933	***
Income	0.052	0.039	1.328	
Education	-0.070	0.037	-1.905	*
Constant	2.830	0.284	9.974	***
F (8, 293)			10.652	***

Note: *, **, and *** indicate significance levels (two tailed) of 0.10, 0.05, and 0.01. N = 302. Adjusted R² = 0.204.

Diet, Education, and Wine Consumption were all significant predictors of wanting to know ingredients when deciding which wine to purchase.

The higher the price category the respondent reported purchasing at least monthly, the more the importance of knowing the ingredients increased ($p < 0.001$). Those who were more active ($p = 0.019$) or had a healthy diet ($p = 0.014$) were more likely to want to know the ingredients in deciding which wine to purchase, and Core wine consumers wanted to know the ingredients more than Marginal wine consumers ($p = 0.077$). On the other hand, wanting to know the ingredients decreased with age ($p = 0.004$) and education ($p = 0.058$).

4.2 Ingredient information when determining willingness to pay

On average, respondents think that knowing the ingredients when deciding how much to pay for a wine is slightly less important than when deciding which wine to purchase. The mean response for this variable was 3.014. Table 5 presents the regression results for the question “For each of the following wine purchase occasions listed, indicate how important it would be to you to know what ingredients are in a bottle of wine in deciding how much you are willing to pay for the wine” (Ing-Pay).

The model was a significant predictor of importance of knowing ingredients for willingness to pay ($F(8, 293) = 8.046, p < 0.001$) and accounted for 15.8% of the variance in the model. Similar to the importance of knowing ingredients when deciding which wine to purchase, Price ($p = 0.001$), Diet ($p = 0.008$), and Age ($p = 0.017$), are significant predictors of wanting to know ingredients

Table 5. Regression results for dependent variable Ing-Pay.

	B	SE	t	Sig.
Wine Consumption	0.117	0.136	0.864	
Price	0.248	0.074	3.351	***
Physical Activity	0.226	0.140	1.607	
Diet	0.362	0.136	2.654	***
Wine Knowledge	0.435	0.199	2.179	**
Age	-0.009	0.004	-2.398	**
Income	0.015	0.042	0.347	
Education	-0.051	0.039	-1.289	
Constant	2.943	0.305	9.644	***
F (8, 293)			8.046	***

Note: *, **, and *** indicate significance levels (two tailed) of 0.10, 0.05, and 0.01. N = 302. Adjusted R² = 0.158.

Table 6. Regression results for dependent variable Nutrition.

	B	SE	t	Sig.
Wine Consumption	0.136	0.134	1.019	
Price	0.237	0.073	3.257	***
Physical Activity	0.236	0.138	1.712	*
Diet	0.359	0.134	2.682	***
Wine Knowledge	0.355	0.196	1.808	*
Age	-0.016	0.004	-4.401	***
Income	-0.011	0.041	-0.261	
Education	-0.050	0.039	-1.298	
(Constant)	2.839	0.300	9.452	***
F (8, 293)			10.175	***

Note: *, **, and *** indicate significance levels (two tailed) of 0.10, 0.05, and 0.01. N = 302. Adjusted R² = 0.196.

when deciding how much to pay for a wine, with the importance of knowing the ingredients increasing with the level for each variable except Age. When deciding how much to pay, Wine Knowledge is also a significant ($p = 0.030$) positive indicator of wanting to know the wine’s ingredients.

4.3 Nutrition information when choosing a wine

Collectively, respondents were less interested in knowing nutrition information than in knowing a wine’s ingredients. The mean response for the Nutrition variable was 2.481. The regression results for the importance of nutrition information for wine are reported in Table 6, which looks at the questions related to “For each of the following nutritional items, indicate how important

you think that item is when considering which wine to purchase.” The model was a significant predictor of the importance of nutrition information ($F(8, 293) = 10.175$, $p < 0.001$) accounting for 19.6% of the variance in nutrition information. Price ($p = 0.001$), Physical Activity ($p = 0.088$), Diet ($p = 0.008$), and Wine Knowledge ($p = 0.072$) were positive predictors while as Age increases the desire for nutrition information decreased ($p < 0.001$).

5. DISCUSSION AND CONCLUSIONS

5.1 Overall summary of results and implications

Price is the only variable that was highly significant ($p \leq 0.01$) across all three regression models. Consumers who purchased a higher-priced wine at least once a month were more interested in having wine ingredient and nutrition information. This result is consistent with the WMC Communications Study [2] that indicated that high-end wine buyers tend to want more information about wine in general and are more likely to agree that the information found on wine labels rarely helps them choose a wine. This group represents a small portion of wine consumers. In our survey, less than 30% of respondents said they purchase a bottle of wine at least monthly at a price of \$15 or more per bottle, and almost half of those did not purchase a bottle priced at \$25 or more at least once a month. The U.S. Wine Consumer Segmentation study [17] also found that almost half of regular wine consumers say they never buy a bottle of wine in the \$25.00 - \$29.99 range and almost three-quarters never pay more than \$50.00 a bottle.

Age was highly significant in two of the regression models (Ing-Choice and Nutrition) and significant ($p \leq 0.05$) in the third (Ing-Pay). It is the most significant factor when considering nutrition information. Younger consumers had more interest in ingredient and nutrition information than older consumers. Younger consumers were also more likely to accept getting this information through technology than the labels on a wine bottle. When presented with the statement in our survey, “including the website (URL) or a QR code that links to that information would be a good alternative to listing the ingredient or nutrition information directly on the bottle,” almost 70% of respondents age 40 or younger chose either Agree or Strongly Agree, a significantly higher rate than respondents between 41 and 64 (55%) and 65 and older (41%) [$\chi^2(8) = 23.336$, $p = 0.003$].

Diet is highly significant for Ing-Pay and Nutrition and significant for Ing-Choice. Respondents who indicated having a healthy diet were more interested in

ingredient and nutrition information than those who do not. Similarly, respondents who say that they were more physically active than their peers were more interested in ingredient and nutrition information, although that variable was only significant for Ing-Choice and marginally significant ($p \leq 0.10$) for Nutrition. This result is consistent with the finding of Bazzani, et al., [5] that health consciousness was positively related to the use of wine labels information and the finding of Grunert, et al., [7] that interest in health is a predictor, but not the strongest one, of information wants for nutrition and ingredients.

Similar to Annunziata, et al., [10] we found that better wine knowledge (as self-assessed by respondents) is positively related to wanting more information. However, the variable was only significant for Ing-Pay and marginally significant for Nutrition. It is worth noting that the WMC Communications Study [2] indicated that more knowledgeable wine consumers tend to want more information of all kinds about wine and were less likely to use that information in making a wine-buying decision.

Surprisingly, frequency of wine consumption was not an important factor. Core wine drinkers were more likely to want ingredient and nutrition information, but the variable only reached marginal significance and only in the Ing-Choice model. In contrast, Escandon-Barbosa and Rialp-Criado [9] found that expert wine consumers, defined by the amount and frequency of wine consumption, make more use of nutrition information than non-experts.

The education level of respondents was negatively related to the interest in ingredient and nutrition information but, like wine consumption, only reached marginal significance in the Ing-Choice model. Income was the only variable not to be at least marginally significant in at least one regression model.

5.2 Policy implications of results

While some wine industry professionals and wine writers advocate for ingredient and nutrition information disclosure (e.g., Pellechia [1] and Gray [3]), the primary push for government regulations has come from the public health sector. In 2007, the TTB issued “Labeling and Advertising of Wines, Distilled Spirits and Malt Beverages; Proposed Rule” [18] that, if enacted, would have required alcoholic beverages covered by the rule to disclose “on any label affixed to the container” the alcohol by volume and a statement of calories, carbohydrates, fat, and protein. The proposed rule notice noted that almost 4 ½ years earlier the TTB had received a petition calling for such disclosure, and more, from the Center for Science in the Public Interest, the National Consumer

League, 67 other organizations, and eight individuals (including four deans of schools of public health).

Government regulations should weigh the costs of the regulations against the expected benefits. Our study suggests the actual benefits of such regulation may be less than the intended benefits. Overall, the respondents think that wine is associated with good health. Still, respondents had only a marginal interest in having ingredient and nutrition information for wine. Our findings would suggest that the benefit of requiring ingredient and nutrition information on wine bottle labels seems small, especially given research that shows that people tend to use nutrition labels at lower rates than they claim and that having such information often does not change consumers' choices. For example, Grunert, et al. [19] demonstrated that self-reported use of nutritional labels may be overstated by 50% and that the lack of use is mostly not attributable to not understanding the information on the label. In addition, their results do not prove that the label information changed consumers' choices, compared to a situation where such information is not available or is not read by the consumer. Furthermore, Köster [20] showed that many food and beverage purchase and consumption decisions are based on routine, habit, or other subconscious factors.

The operational cost for wineries, on the other hand, would be significant given the additional testing and chemical analysis that would be required and the cost of having to create new labels and seek TTB (and in some cases state) label approval with each new vintage as nutritional properties change from year to year. One might expect that ingredient and nutrition labeling could lead to negative news stories based on ignorance and fear rather than science and fact, and these stories could result in costs of lost opportunities, especially considering the findings of Pabst, et al. [6], and current TTB regulations related to advertising health claims could make it difficult for wineries to respond to such stories.

As EU regulations come into effect, researchers will have opportunities to study the impact of the regulations in the real-world settings that Robinson, et al., [16] concluded would be necessary to produce studies with high evidential value. In the meantime, our study adds to the body of research that calls into question the efficacy of requiring wine ingredient and disclosure information to meet public health goals and suggests that the TTB could benefit from the opportunity to learn from the EU's experience before issuing its own regulations.

5.3 Limitations and Research Opportunities

This study was based on a survey that asked respondents about their interest in having ingredient and nutri-

tional information available. We did not attempt to measure the extent to which they truly would use ingredient and nutritional information in making wine purchase or consumption decisions or how having ingredient and nutritional information would change such decisions.

We approached our study from a public health perspective rather than a marketing perspective. We did not investigate whether consumers would be willing to pay more for wine that discloses ingredient or nutrition information. Likewise, we did not study consumers' preference for ingredient or nutrition information if having that information would require them to make a tradeoff between having access to this information or some other information, such as food pairings or a description of the wine, that they may use in making wine purchase and consumption decisions. These are all avenues for future research on this subject.

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