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Original Article

A Comparison of the Antioxidants and Carbohydrates in Common Wines and Grape Juices

Connor M. Callaghan, Robert E. Leggett and Robert M. Levin

Stratton VA Medical Center, Albany College of Pharmacy and Health Sciences, UNITED STATES.

ABSTRACT

Objective: The positive benefits of drinking wine and grape juices for their antioxidant properties have been well documented. Comparing the antioxidants between wine and grape juice as well as different types of each should lead to a better understanding of these benefits. **Method:** Three wines: Concord grape, Pinot noir, and Pinot grigio, as well as three types of grape juice: homemade purple grape juice, Concord grape, and white were compared. The cupric reducing antioxidant capacity (CUPRAC) biochemical test for total antioxidant activity and a carbohydrate biochemical test were used. **Result:** The Pinot noir had more antioxidants than the Concord grape wine and the Pinot grigio. The purple and Concord grape juices had similar antioxidants and both had significantly higher antioxidants than any of the wines. The white grape juice had low antioxidant levels. All three grape juices had high and similar carbohydrate levels, while the Pinot noir and Pinot grigio were extremely low and the Concord grape wine fell in the middle. **Conclusion:** This study confirms that purple grapes and red wine have significantly more antioxidants than do green grapes or white wine. **Conclusion:** This study supports the drinking of both purple grape juice and red wine for their antioxidant activity.

Key words: Antioxidants, Carbohydrates, Grape Juice, Oxidative Stress, Wine.

Correspondence :

Robert M. Levin PhD,
Senior Research Career Scientist, Stratton VA Medical Center,
113 Holland Ave. Albany, NY 12208, 518-626-5662, UNITED STATES.
Phone no: 518-626-5662

E-mail: Robert.levin2@va.gov
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INTRODUCTION

The healthy benefits of drinking wine have been well publicized in both the popular culture and the medical literature.[1,2] Phenomena such as the "French Paradox" and the small incidences of cardiac disease and cancer in certain European countries have been attributed primarily to the potent antioxidant benefits from drinking wine in moderation.[3,4] Just because wine's antioxidant benefits have been well documented does not mean that they cannot be better understood.[5,6] Different factors such as the type of grape and how it is produced can cause differences in the total antioxidant capacities and beneficial effects of wine.[7,8] In addition, specific components of wine such as flavonoids and tannins in other natural products also have demonstrated antioxidant and analgesic properties as does wine.[9]

It is almost universally accepted that red wine contains more antioxidants than white wine, but a further understanding of the magnitude of this disparity as well as several possible causes are still worth investigating.[10,11] Three different wines used for comparison are a common red wine, pinot noir; a common white wine, pinot grigio; as well as Concord grape wine. These three wines will also be compared to three different grape juices: homemade purple grape juice as well as store-bought organic varieties of Concord grape juice and white grape juice.

Wine has been much more heavily advocated for health benefits than grape juice for a few reasons.[11,12] For one, people always love having a nice excuse to drink alcohol and it is drunk in greater quantities than grape juice. Secondly, people might lump grape juice and grapes into one broad category while considering wine a separate entity. Comparing the total antioxidant capacities of three varieties of wines and grape juices through the Cuprac assay will not only help show which options are the healthiest but also how big the differences are. This comparison can also hint at whether the types of grapes used or the differences in how wines and grape juices are produced is the bigger determinant in terms of total antioxidants.

Health conscious people who plan on basing their drinking choices on antioxidants are probably also interested in the carbohydrate content of the different wines and grape juices. The carbohydrates of each will be analyzed primarily from a health perspective (especially for weight-conscious individuals). Secondarily, this analysis can also hint at why there are fewer carbohydrates in either wines or grape juices.[13] In theory, wines should have significantly fewer carbohydrates which are because carbohydrates turn into alcohol during the fermentation process.[14]

METHODS

The methods used in this study were approved by the Research and Development Committee of the Stratton Veteran's Administration Medical Center. Three winesand grape juices were acquired for analysis by the Cuprac assay,[15,16] for total antioxidants as well as a Carbohydrate analysis.[17,18] The three wine varieties were Concord grape wine, Pinot noir, and Pinot grigio. The three grape juices used were a purple homemade grape juice, and organic varieties of Concord grape juice and white grape juice purchased from the store. All juices were 100% juice with no antioxidant or other supplements added. Each experiment utilized 4 individual samples of each wine and juice.

The Cuprac biochemical assay was conducted by diluting each sample to four different concentrations on ice in a 0.05M Tris buffer (pH 7.6), composed of 7.45 grams of Trizma preset crystals in 1 L of water. Each dilution was then pipetted in the amount of 150 µl into duplicate test tubes. 150 ml each of 1M ammonium acetate, 7.5 mM neocuproine, and 10 mM copper (II) chloride dehydrate was added to each test tube. The ammonium acetate was prepared by mixing 7.708 grams in 100 mL of water. The neocuproine was prepared by dissolving 156.20 mgs in 100 mL of 96% ethanol, and the copper (II) chloride consisted of 170.48 mgs of the compound in 100 mL of water.

Table 1: Antioxidants and Carbohydrates

Name of Sample	Antioxidant Activity (mg Ascorbic Acid/ ml)	Carbohydrates (mg glucose/ ml)
1 Concord grape wine	1469 +/- 112	44.415 +/- 5.1
2 Pinot noir (red wine)	2752 +/- 183	1.250 +/- .073
3 Pinot grigio (white wine)	180 +/- 2.4	1.674 +/- .017
4 Homemade purple grape juice	4520 +/- 283	75.760 +/- 7.8
5 Concord grape juice	4781 +/- 893	87.083 +/- 6.6
6 White grape juice	36 +/- 0.91	91.968 +/- 9.4

Each data point is the mean +/- SEM of 4 individual assays.

Table 2: Statistics for antioxidant activity

	Concord Grape Wine	Pinot noir	Pinot grigio	Purple grape juice	Concord Grape Juice	White Grape Juice
Concord Grape Wine	-	-	-	-	-	-
Pinot noir	*	-	-	-	-	-
Pinot grigio	*	*	-	-	-	-
Purple grape juice	*	*	*	-	-	-
Concord Grape Juice	*	*	*	-	-	-
White Grape Juice	*	*	*	*	*	-

*=significantly different, $p<0.05$.

Table 3: Statistics for carbohydrates

	Concord Grape Wine	Pinot noir	Pinot grigio	Purple grape juice	Concord Grape Juice	White Grape Juice
Concord Grape Wine	-	-	-	-	-	-
Pinot noir	*	-	-	-	-	-
Pinot grigio	*	-	-	-	-	-
Purple grape juice	*	*	*	-	-	-
Concord Grape Juice	*	*	*	-	-	-
White Grape Juice	*	*	*	-	-	-

*=significantly different, $p<0.05$.

A standard curve was prepared daily at room temperature from a solution of 1 mM L-ascorbic acid which was made by mixing 19.81 mgs in 100 mL of water. Dilutions for the standard curve were made in the Tris buffer with concentrations of 1000, 500, 250, 125, 62.5, and 31.25, as well as a blank (Tris buffer). Once all of the samples or standards and the three solutions were added to the test tubes, they were then incubated at room temperature for thirty minutes. All of the test tubes were then analyzed in a Hitachi U-2001 Spectrophotometer.

In order to analyze the carbohydrates of the samples, the samples and standards were prepared in a similar fashion to the Cuprac assay. This time, 20 μL of each sample or standard was added to each test tube. Pipetted into each test tube was 1 mL of an anthrone solution, prepared daily, at a ratio of 1 mg of anthrone per 1 mL of 2.3:1 sulfuric acid in water. The standard curve was created using six glucose standards diluted in water with concentrations of 5, 2.5, 1.25, 0.6, 0.3, and 0.15 mgs/mL; the seventh standard was a blank (water). This glucose solution was prepared daily. The samples were incubated in a water bath at a temperature of 90°C for two minutes and then cooled in cold water for five minutes. They were then removed from water in order to stabilize to room temperature for five more minutes. All standards and samples were then read in the Hitachi U-2001 Spectrophotometer.

Statistics

Statistical analyses utilized one way ANOVA followed by the TUKEY test for individual differences. A $p<0.05$ was required for statistical significance.

RESULTS

A comparison of the antioxidants and carbohydrates of the six different samples can be found in Table 1. The drinks with the highest antioxidants were the two purple grape juices which were not significantly different from one another. The white grape juicehad the lowest antioxidant activity of any sample. Of the wines, the Pinot noir contained the highest antioxidant activity which was significantly higher than the Concord wine or the Pinot grigio. The wine with the lowest antioxidants was the Pinot grigio.

When comparing the carbohydrates, the three grape juices were much higher than the wines and not statistically different from one another. Of the three wines, the Concord wine was roughly in the middle of the other two wines and the three grape juices. The Pinot noir and Pinot grigio had extremely low carbohydrates.

The statistical comparisons for the antioxidant activities are given in Table 2 and the statistical comparisons for carbohydrates are given in Table 3.

DISCUSSION

The data demonstrated that purple and Concordgrape juices had significantly higher antioxidant content than any of the wines. The purple grape juices were not significantly different from one another. The white grape juice contained extremely low antioxidants which was less than a hundredth of the purple grape juice. A plausible explanation is that since the antioxidants are different in purple grapes and green grapes, the antioxidants from the green grapes were less soluble than those in the purple grapes.[19]

The Pinot grigio was also much higher in antioxidants than the white grape juice. This could have been caused, in part, because different grapes were used to make the white wine and the white grape juice. Either the grapes used to make the Pinot grigio may have had more antioxidants or slightly different antioxidants which affected how well they made it from the grapes into the final product. Another explanationis that the processing of wine compared to grape juice is different in such a way that it allowed more antioxidants to make it through the production of the wine than of the grape juice.

When analyzing the antioxidants in the wines, the Pinot noir was significantly higher in antioxidants than the Concord grape wine and the Pinot grigio. Once again, whether different grapes have higher antioxidants or just more soluble antioxidants remain a difficult issue to resolve.[20]

The most direct comparison between grape juice and wine is from the study betweenthe Concord grape wine and the Concord grape juice. Since the same grapes were used, the huge difference in antioxidants is most likely a result of how wine is produced versus how grape juice is produced. The grape juice had roughly three times the antioxidants as the wine, supporting the idea that grape juice has more antioxidants than comparable wine. This is most likely because the skin and other particulate matter is removed sooner in the process of wine making, thereby not allowing as many antioxidants to solubilize into the final product. Due to how much higher the antioxidants in Pinot noir are compared to Concord grape wine, it would be worthwhile to investigate whether grape juice made from Pinot noir grapes would be significantly higher than Pinot noir wine. In studies of other plants and vegetables, the processing methods have been shown to have direct effects on the antioxidant properties.[21]

The carbohydrates for the three grape juices are all fairly similar. The wines however were significantly different in terms of carbohydrates. The Pinot noir and Pinot grigio both had very low carbohydrate content. This can be supported by the fact that the fermentation process turns carbohydrates into alcohol. However, the Concord grape wine was much sweeter and had much more carbohydrates.

When taking both antioxidants and carbohydrates into account, there is a strong argument to be made that red wine is the best grape product to drink (in moderation).[6,20] Purple grape juices seem to have more antioxidants than their comparable wines, but this is at the expense of significantly more carbohydrates.

CONCLUSION

Grape Juice has higher carbohydrates and antioxidants than the same colored wine. Purple grapes and red wine appear to be the best choices for their antioxidant properties.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

ABBREVIATIONS USED

CUPRAC: The cupric reducing antioxidant capacity.

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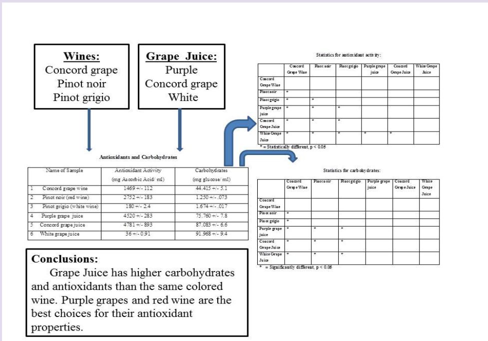
PICTORIAL ABSTRACT



SUMMARY

- The positive benefits of drinking wine and grape juices for their antioxidant properties have been well documented.
- Comparing the antioxidants between wine and grape juice as well as different types of each should lead to a better understanding of these benefits.
- Our results demonstrated that Pinot noir had more antioxidants than Concord grape and Pinot grigio.
- Our study confirms that purple grapes and red wine have significantly more antioxidants than do green grapes or white wine.
- This study supports the drinking of both purple grape juice and red wine for their antioxidant activity.

ABOUT AUTHORS

Connor M. Callaghan, Robert E. Leggett and Robert M. Levin PhD

Connor M Callaghan: Is currently a senior pharmacy student at the Albany College of Pharmacy and Health Sciences. Robert E Leggett is currently a Research Associate working with Dr. Levin within the Stratton VA Medical Center, Albany, NY. Robert M Levin is currently a Senior Career Research Scientist within the Stratton VA Medical Center and an Emeritus Professor within the Albany College of Pharmacy and Health Sciences.