Mighty Fruits: Antioxidant Performance of Various Fruits

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Abstract: Antioxidants help fight free-radicals, which are produced by stress and later can induce many health problems. L-Ascorbic acid (Vitamin C) is a great antioxidant, and it can be found in a vast variety of fruits. Additionally, vitamin C is marketed as an over-the-counter remedy for the common cold. This motivates our desire to understand vitamin C's antioxidant properties. This investigation presents the antioxidant capacity of various fruits that are known to be sources of vitamin C, and their comparison to pure vitamin C using the Briggs-Rauscher (BR) oscillatory reaction. The antioxidant species scavenge free radicals formed in the BR reaction, lengthening the time intervals of the reaction's oscillations; the higher the antioxidant capacity, the longer the oscillation delays. The samples that were tested were: L-ascorbic acid, Sunny-D®, red grape juice, white grape juice, pineapple juice with pulp, pineapple juice without pulp, mango juice, and kiwi juice. Pure vitamin C could only be tested at low concentrations, as high concentrations completely interrupt the BR reaction. Kiwi exhibited the best antioxidant capacity of the tested samples, followed by mango juice. The antioxidant performance of orange juice resembled that of vitamin C the most. This result suggests that vitamin C is the main antioxidant present in orange juice. The other fruits exhibited antioxidant performances different to pure vitamin C. We ascribe these observations to the presence of other molecules, such as flavonoids and tannins, which also show antioxidant capacity.

Keywords: *antioxidants, oscillatory reaction, Briggs-Rauscher reaction, and vitamin C.*

Introduction

Vitamin C (L-Ascorbic acid) is a great antioxidant present in many fruits. Consuming vitamin C helps provide the needed antioxidant intake while also helping decrease the production of free radicals. Antioxidants are very important when it comes to free radicals. Antioxidants help control the production of free radicals. Free Radicals are blamed as the cause of many diseases, such as heart disease, cancer, and diabetes. Lacking antioxidants in the body can become very dangerous because the production of free radicals will increase and the chances of developing these diseases will also increase. Antioxidants can be found in many fruits such as the ones that were tested. Antioxidants in a daily diet may delay and even prevent cell damage that is caused by free radicals.

The Briggs-Rauscher (BR) reaction is an oscillating reaction that changes between two cycles back and forth until it reaches equilibrium. The two cycles the reaction oscillates between correspond to a radical state and a non-radical state. The BR reaction is mostly used as demonstration.[1] Recently, Cervellati reported its use as a method to assess antioxidant capacity.[2] In this method, the presence of an antioxidant increases the oscillation time in the BR reaction. In this short communication we report the antioxidant performance of pure vitamin C by using the BR oscillating reaction. Additionally, we determine the antioxidant performance of various fruit juices while also comparing the results to a standard (vitamin C).

Methods and Results

A typical preparation of the Briggs Rauscher reaction was utilized.[3] When all stock solutions were prepared the solvents were tested as follows. Take 5mL of the sodium iodate solution, 5mL of starch solution, and 10mL 3% hydrogen peroxide. Once a stir bar has been placed in a 100mL beaker, start to mix the sodium iodate solution and starch solution in the beaker over a stirring plate. Then add the peroxide; the solution turns amber yellow then dark blue. Start the timer when the first dark blue color appears until the next dark blue appears. This is the oscillation time (usually 13-18 seconds).

This is also the control time for each trial. Repeat the step above and when the second deep blue color appears, add 1mL of antioxidant solution. Measuring the time from the second blue to the third blue appearance determines the antioxidant performance.

Concentrations above 2% of vitamin C completely disrupted the BR reaction. The reason for this observation is that high vitamin C concentrations alter the BR mechanism, reacting with iodine. The average slope of the orange juice was the most comparable to that of L-ascorbic acid, suggesting that the main antioxidant species in orange juice is vitamin C (Figure 1). Sunny-D® seems to have a higher slope than regular orange juice. Sunny-D® contains thiamin hydrochloride (vitamin B), as well as other fruits. These factors contribute to why Sunny-D® has higher strength in antioxidant than orange juice. Red grape juice had a higher level of antioxidant strength than white grape juice (Figure 2). Red grapes contain flavonoids which give them a higher antioxidant level. Juices with pulp also contain flavonoids, which is why pineapple juice with pulp had higher antioxidant potency than pineapple juice with no pulp. Mango juice and Kiwi juice are the fruits that have the highest slope average. The reason being is both of these fruits contain beta carotene which causes them to have higher antioxidant strength.

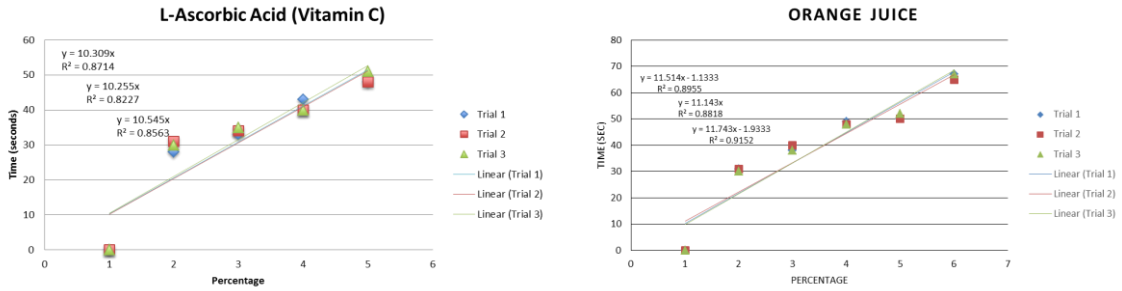

Fig. 1: (Left) Antioxidant performance of pure vitamin C. (Right) Antioxidant performance of orange juice.

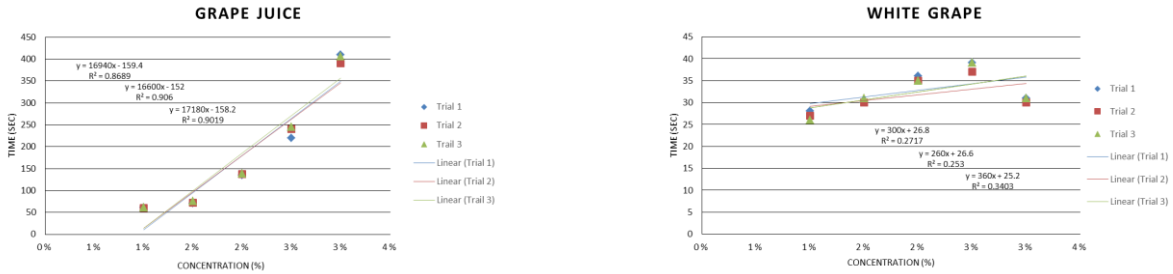

Fig. 2: (Left) Antioxidant performance of red grapes. (Right) Antioxidant performance of white grapes.

Conclusions

The Briggs-Rauscher oscillating reaction is effective assessing antioxidant performance. When the concentration of L-ascorbic acid is above 2%, it will completely stop the reaction. Kiwi had the highest antioxidant strength of the fruits, but it could be due to the various vitamins Kiwi contains of ethanol had no effect on the BR oscillations. In the future, we will test other fruits that are said to have a high level of antioxidant performance, and possibly isolate the active components of the fruits.

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgments

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