



**CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY**

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Project Title The Degradation of Ascorbic Acid: Effects of Electromagnetic Radiation, Convection, and Time	
Abstract Objectives/Goals The objective of this project was to determine how Vitamin C in fruit juices is degraded in three conditions: exposure to open air (time), electromagnetic radiation (microwaving), and convection current (stovetop boiling). Methods/Materials Four different fruit juices (orange, lemon, lime, and grapefruit) were tested for Vitamin C content using dichloro-indophenol titration methodology. Using a Luer-lock syringe, juice samples across the three conditions were dropped into a .025% indophenol solution (indicator solution), 1/10th of a milliliter at a time, until the color change reached an endpoint. The number of milliliters required to change the solution were determined five times at each level of each condition; averages across the trials were recorded. Conditions included baseline measures, plus daily measures of juice left in open air condition for five days (time); baseline, plus measures after one to five minutes of exposure to microwave radiation (microwave); and one to five minutes of boiling (convection). Comparison to a standard Vitamin C solution was used to calculate milligrams/milliliter of Vitamin C. These data were transformed to milligrams of Vitamin C in an 8-ounce serving for a practical reference. Results While the basic hypotheses that time and heat are destructive forces to Vitamin C levels were supported, the magnitude of destruction was about the same for both of the heating conditions. Microwave trials showed slightly more degradation as averaged over juices and conditions. There were differential results among juices with respect to microwave and boiling conditions. Time (open air exposure) proved to be most destructive to Vitamin C content. Conclusions/Discussion The implications for these findings suggest that food storage may be a more important consideration for Vitamin C retention than food preparation. Juices should still be kept away from direct heat sources (refrigeration) and definitely sealed in an airtight container to preserve nutrients.	
Summary Statement Heat is less of a destructive force to Vitamin C than time and exposure, with only minor differences in Vitamin loss between radiation and convection currents.	
Help Received Dr. Norwan Moaleji answered questions regarding concentrations and chemical solutions.	