



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

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Project Title
Mighty Microgreens? Investigating the Effect of the Maturity of Plant Greens on Their Nutrient Contents Using HPLC

Abstract

Objectives/Goals
The benefits of plant nutrients are studied extensively for cancer prevention, blood sugar, and cardiovascular diseases. Greens provide an abundance of vitamins for human health. Microgreens are immature, vibrant, and flavorful greens harvested at the cotyledon stage that have become a popular culinary trend. Scientific data on the nutrient content of microgreens is very limited, so this project investigated how the maturity of plant greens affects their nutrient contents. Based on research, it was hypothesized that the nutrient content will decrease as the maturity of the plant increases.

Methods/Materials
6 microgreens chosen: kale, chard, cilantro, mustard, arugula, and red cabbage; 4 vitamins tested for: B9, C, E, and K. Independent variable: maturity of the greens. Dependent variable: nutrient content of the greens. Controls: vitamin standards. Sample preparation involved juicing, high speed centrifugation, and filtration (0.45 µm nylon filter), followed by addition of water:methanol:acetonitrile (60:30:10 v/v). Vitamin content of the microgreens was determined by reverse-phase HPLC with a mobile phase of water:methanol:acetonitrile (60:30:10 v/v) . Chromatogram was used for qualitative and quantitative analysis of the data. Tests were in triplicates to ensure consistent results. Vitamin concentrations of microgreens and mature greens (USDA national nutrient database) were compared.

Results
Rainbow chard had the highest vitamin C content (27 times greater than mature chard); cilantro had the least. Vitamin B9 was highest in kale (26 times greater than mature kale); lowest was in red cabbage. All microgreens tested had higher vitamin C and B9 contents compared to their mature counterparts. Data for vitamin E and K was not interpretable after trials.

Conclusions/Discussion
Since microgreens are harvested right after germination, all the nutrients they need to grow are present. Therefore, nutritional compounds in the microgreens are highly concentrated. Hypothesis was supported. Simultaneous analysis of water and fat soluble vitamins is a difficult task due to the range of chemical structures involved - the reason for uninterpretable data for vitamins E and K. My experiment may be used as a reference for health agencies' recommendations, consumers' choice of vegetables, and as part of school lunches. Microgreens may help eliminate the practice of replacing whole food nutrition with vitamin supplements.

Summary Statement
This novel project investigates the nutrient contents of microgreens compared to mature greens; it introduces microgreens as a convenient, concentrated, and flavorful means for a daily shot of vitamins, leading to a healthy life.

Help Received
I acknowledge my family and teacher for their support; Dr. Terrill from SJSU for guidance with the HPLC.