# Optimization of Extraction and Quantification of Antioxidants from Whole Foods Using Simple UV-Visible Assay

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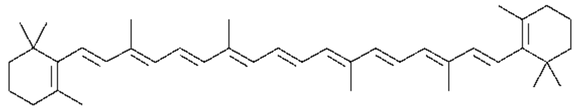
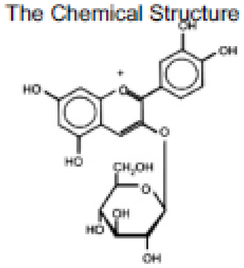
## Introduction

- Antioxidants scavenge unstable oxygen molecule free radicals to prevent cellular damage caused by oxidative stress.
- β-Carotene is an antioxidant found in bright orange- and yellow-colored foods, such as sweet potatoes and pumpkin. The anthocyanin, Cyanidin-3-Glucoside, is found in bright purple, pink, and blue colored foods, such as berries and eggplant.
- These studies were carried out to determine the most effective methods of extraction and quantification of these antioxidants in whole foods.



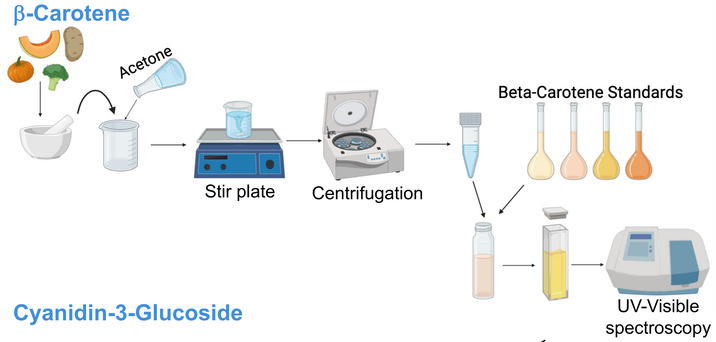
The Chemical Structure of β-Carotene[1]



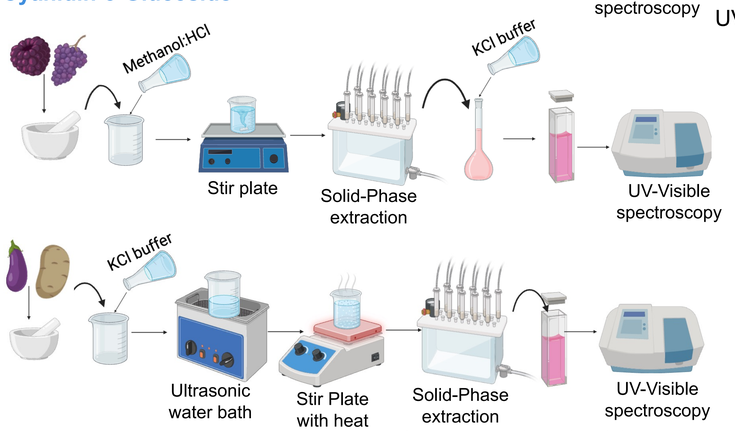
The Chemical Structure of Cyanidin-3-Glucoside[2]

## Extraction and Quantification

### β-Carotene

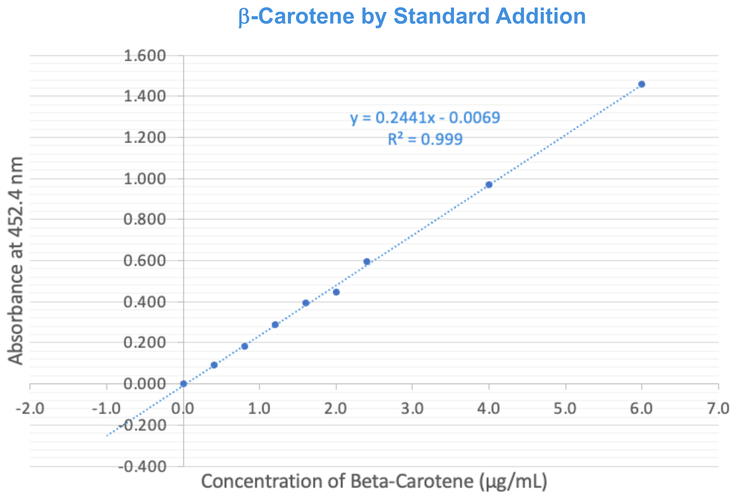



### Cyanidin-3-Glucoside

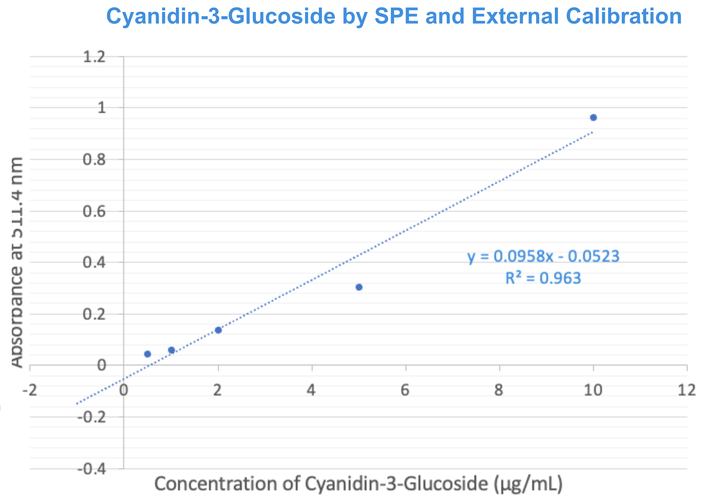



Images made using Biorender.com

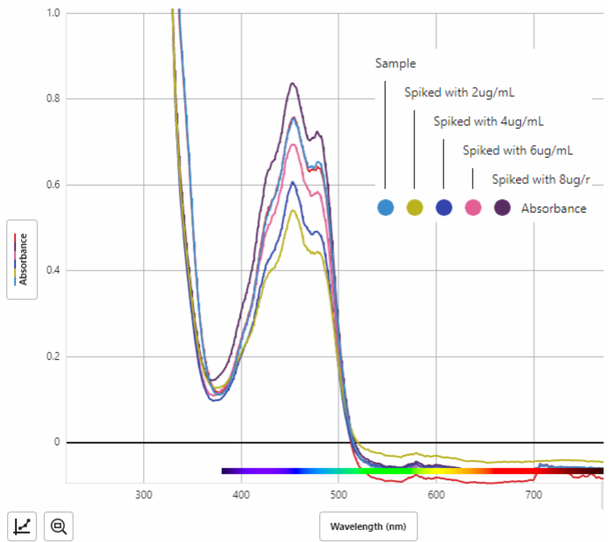
## Results



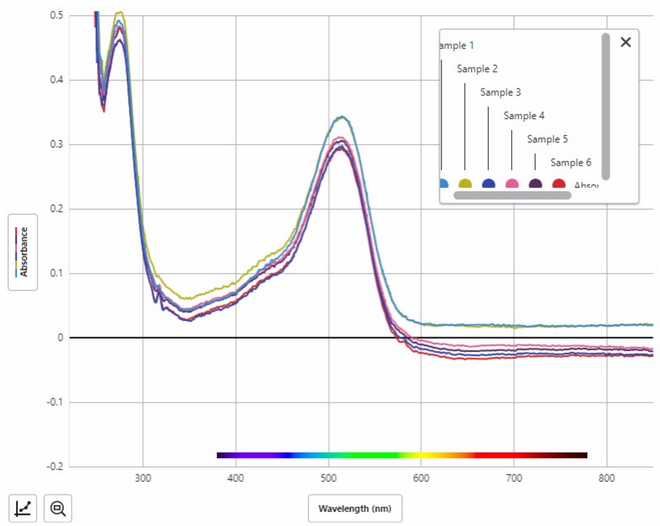

Absorbance Versus Concentration of Standards of β-carotene




Absorbance Versus Concentration of Standards of Cyanidin-3-Glucosisde




UV-Visible Spectrum of Sweet Potato Sample




UV-Visible Spectra of Blackberry Samples

Quantification of β-Carotene in Whole Foods

| Sample | Average Concentration of β-Carotene (µg/g) | Standard Deviation (µg/g) |
|---|---|---|
| Cantaloupe | 9.54 | 0.12 |
| Pumpkin Flesh | 0.27 | 0.02 |
| Sweet Potato | 41.56 | 2.45 |
| Broccoli | 11.63 | 1.59 |

Quantification of Cyanidin-3-Glucoside in Whole Foods

| Sample | Average Concentration of Cyanidin-3-Glucoside (µg/g) | Standard Deviation (µg/g) |
|---|---|---|
| Blackberries | 1074.90 | 70.55 |
| Purple Grapes | 58.41 | 10.21 |
| Purple Potatoes | 4.12 | 0.50 |
| Eggplant Peel | 7.19 | 0.55 |

## Conclusions

- Stirring in acetone and quantifying via standard addition were most precise for β-Carotene.
- Cyanidin-3-Glucoside was best extracted from fruits by stirring in methanol:HCl solution, but for vegetables, time in the ultrasonic water bath with a pH 2.1 KCl buffer was most precise. Both sample populations were quantified using external calibration, following SPE.
- Using simple UV-Visible assay allowed for the precise extraction of antioxidants from whole foods.

## Future Directions

- Perform the extraction of β-Carotene and Cyandin-3-Glucoside from other whole foods.
- Optimize the extraction of natural pigments from processed foods, using extraction methods from this study.
- Extract other antioxidants from whole foods.

## References

(1) Hagos, M., Redi-Abshiro, M., Chandravanshi, B. S., & Yaya, E. E. (2022). Development of Analytical Methods for Determination of *β*-Carotene in Pumpkin (*Cucurbita maxima*) Flesh, Peel, and Seed Powder Samples. *International journal of analytical chemistry*, *2022*, 9363692. https://doi.org/10.1155/2022/9363692

(2) VERGARA, C, et al. “Anthocyanins that confer characteristic color to red copihue flowers (lapageria rosea).” *Journal of the Chilean Chemical Society*, vol. 54, no. 2, June 2009, https://doi.org/10.4067/s0717-97072009000200023.

## Acknowledgements

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