



## Systematic Review of Anthocyanins and Markers of CVD

Taylor C. Wallace, PhD, CFS, FACN  
Margaret Slavin, PhD, RD  
Cara L. Frankenfeld, PhD

## Disclosures

- Employment
  - Think Healthy Group, LLC
  - George Mason University
- Dr. Taylor Wallace – Food & Nutrition Blog

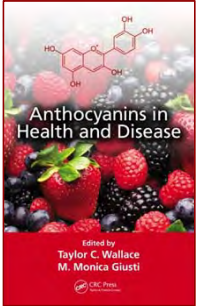




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## Anthocyanins in Health & Disease









## Presentation Outline

- What are anthocyanins?
- Bioavailability issues
- Estimated population intakes
- Anthocyanins and markers of CVD – A systematic review
- Conclusions
- Future work



## What are Anthocyanins?

- The orange-red to blue-violet pigments in many plants (anthos = flower; kyanos = blue).

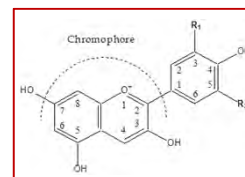
## What are Anthocyanins?

- Secondary plant metabolites produced via the phenylpropanoid pathway as a response to the environment.
  - UV light
  - Frost
  - Soil acidity
  - Pollination attractants
  - Deter insects (e.g. purple potatoes)



## What are Anthocyanins?

- Members of the flavonoid family
  - (C6-C3-C6) skeleton
- Their **positive charge** allows them to absorb light in the visible region.



## What are Anthocyanins?

- > 700 anthocyanins identified
  - 96% are glycosylated
  - Approximately 50% are acylated
- 27 anthocyanidins (aglycons)
  - 6 are predominant in nature and make up 90% of those identified to date.



Adv Nutr. 2015; 6:620.

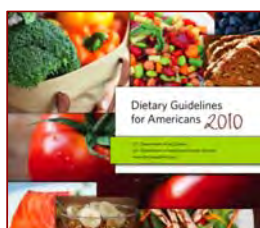
## Bioavailability Issues

- It has been previously thought that only about **>0.1%** of anthocyanins cross the basolateral membrane and enter circulation.
  - Non-acylated anthocyanins shown to be more bioavailable than the larger more complex molecules.
- A recent <sup>13</sup>C-tracer study indicates that cy-3-glu has a minimal relative bioavailability of **12.38%**.

AJCN. 2013; 97:995.

## Estimated Population Intakes

- Anthocyanin intake would be **~34.4 to 36.0 mg/d** if fruit and vegetable recommendations set by the 2010 Dietary Guidelines were met.



J Acad Nutr Diet. 2012; 112(2):222.


## Anthocyanins and CVD

- Observational studies have consistently suggested a preventive effect on CVD.
  - Cassidy et al., 2015
  - Jennings et al., 2012
  - McCullough et al., 2012
  - Cassidy et al., 2011
  - Mink et al., 2007
- Animal studies also support plausible biological mechanism(s).



### Objective(s)

- Systematically review randomized controlled trials (RCTs) testing effects of purified anthocyanins and/or anthocyanin-rich extracts on markers of CVD.
  - Triglycerides
  - Total cholesterol
  - HDL
  - LDL
  - Blood pressure

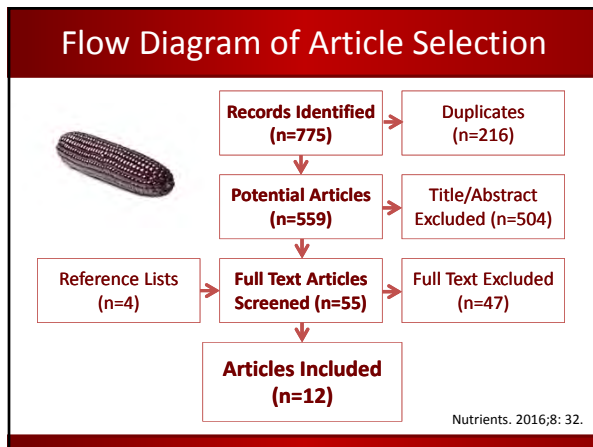


Nutrients. 2016;8: 32.

### Inclusion Criteria

- RCTs of purified anthocyanins or anthocyanin-rich extracts.
- Participants ≥ 18 y.
- Measured an effect on markers of CVD
- Treatment groups reported a quantitative or quantifiable anthocyanin content.
- Published in English language.

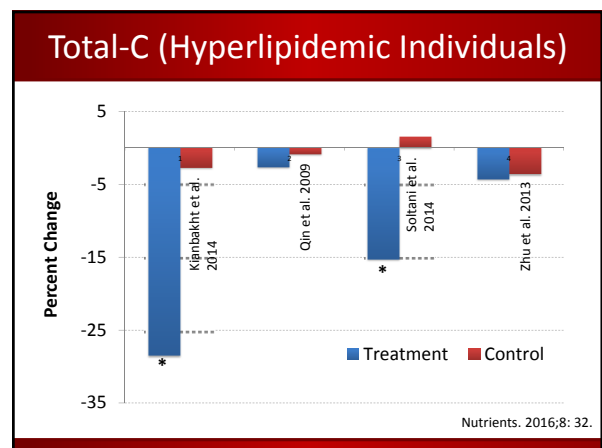
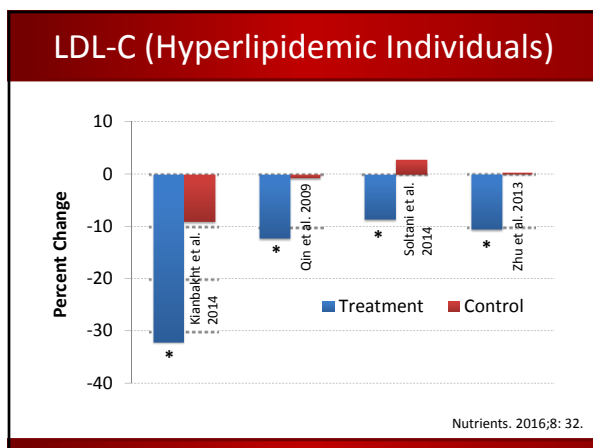
Nutrients. 2016;8: 32.

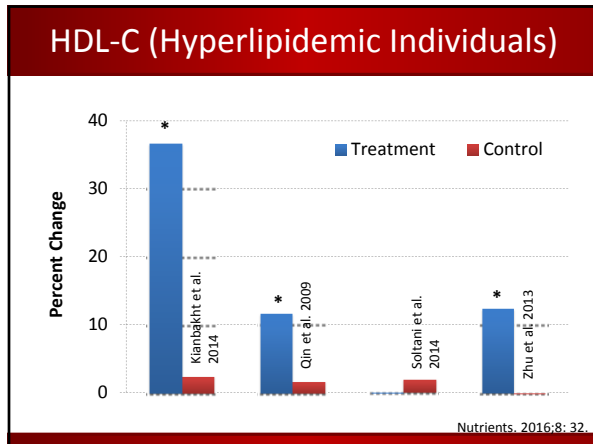


### Results

	Healthy	Diseased
Triglycerides	♥	♥
Total Cholesterol	♥	♥
LDL Cholesterol	♥	♥ ♥
HDL Cholesterol	♥	♥
Blood Pressure		


Nutrients. 2016;8: 32.





### Conclusions

- Anthocyanins consistently lowered LDL-C across studies of hyperlipidemic individuals.
- These data support their therapeutic use.



Nutrients. 2016;8: 32.


### Conclusions

- Trends for improvement in lipid profiles and triglycerides were suggested in both healthy and hyperlipidemic individuals. Studies were inconsistent and many were not statistically significant.
- No trends were found for blood pressure in either healthy or hyperlipidemic individuals.

Nutrients. 2016;8: 32.

### Future Work

- Assess the effect of anthocyanin intake on endpoints and markers of obesity, type-2 diabetes and CVD in the U.S. using NHANES and the USDA Flavonoid Database.



### Thank You!

**Collaborators:**  
**Margaret Slavin, PhD, RD**  
**Cara L. Frankenfeld, PhD**




### Questions?

**Taylor C. Wallace, PhD, CFS, FACN**  
**Phone:** 270-839-1776  
**Email:** twallac9@gmu.edu  
**Website:** www.thinkhealthygroup.com  
**Blog:** www.drtylorwallace.com

