Food Environment Measurements

ProToolBox:

ProColor, ProDes, ProPhen

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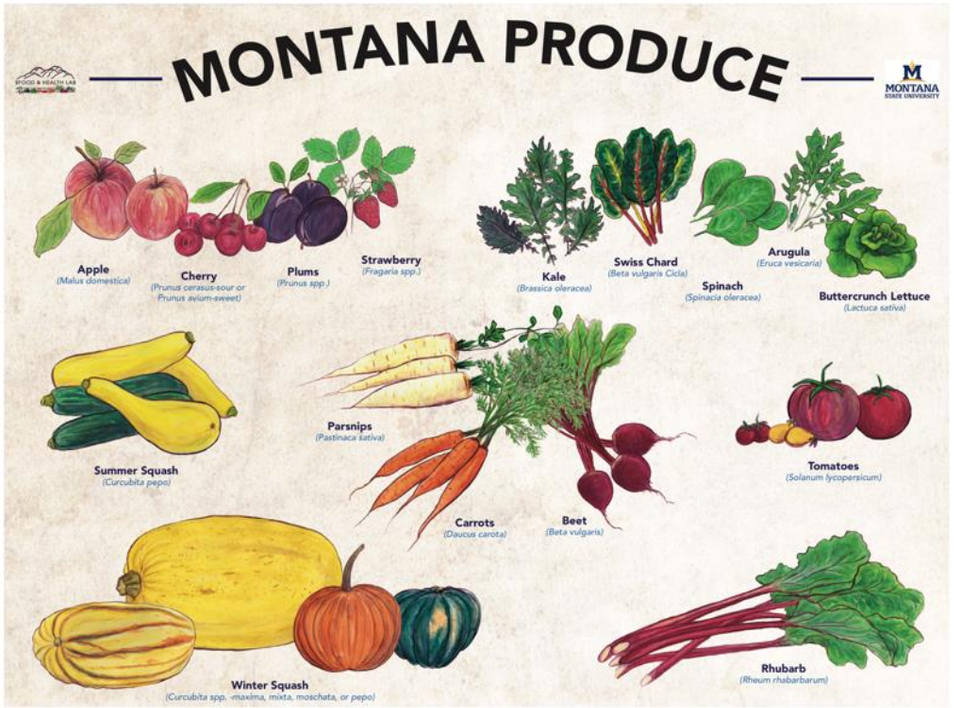
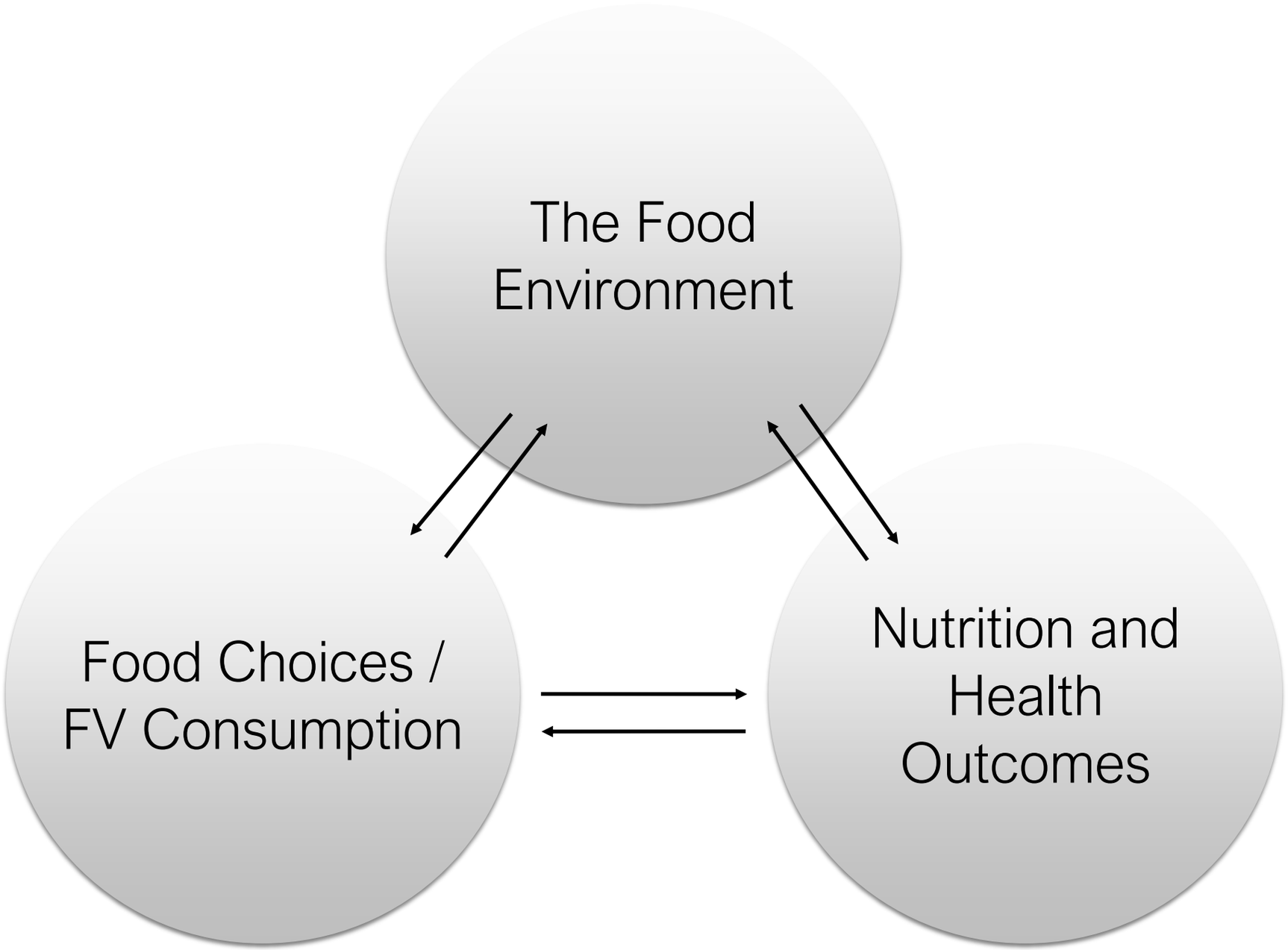
Natural Food Environments in Yunnan



Natural and Built Food Environments in Montana

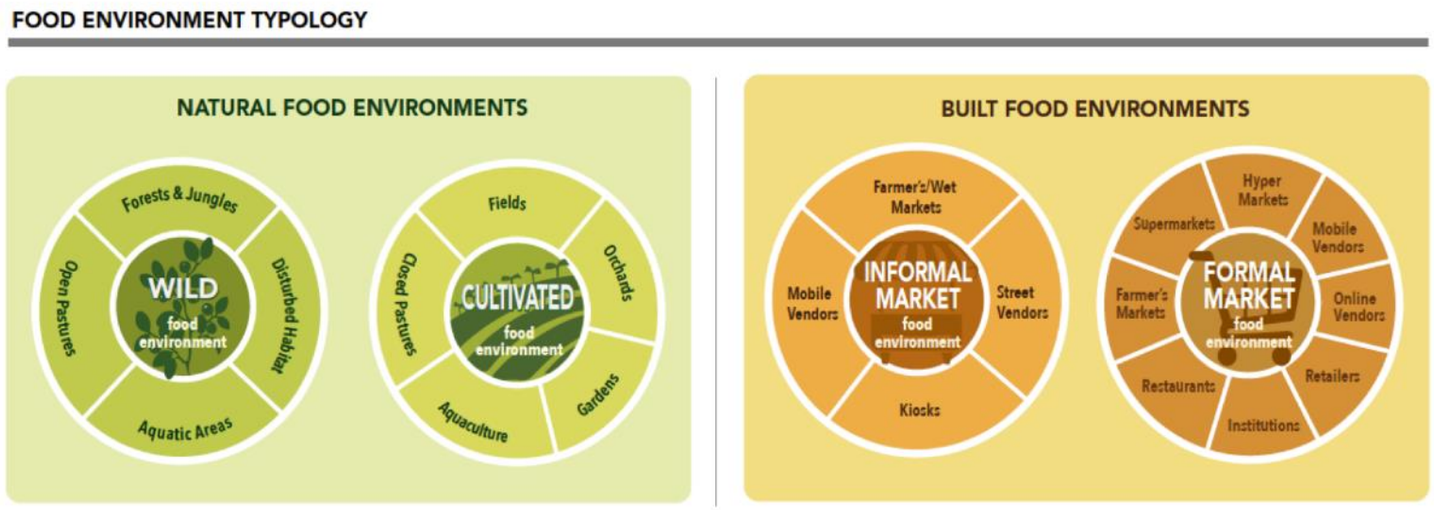
Gaps in Rapid Food Environment Metrics for the Parameter of Quality



Need metrics to address: How does the food environment influence food choices and ultimately, nutrition and health outcomes?

Types of Needed Metrics

- <u>Complementary tools to</u> capture the multifaceted aspects of food environments
- Objective measures
- Built and natural food environments
- Simple, cost-effective, and rapid tools
- Measures with commo
- Scalable



(Downs, Ahmed & Herforth, forthcoming)

ProToolBox for Food Environment Rapid Metrics for Fruit and Vegetable Quality

ProPhen
(Produce Phenolic Content)

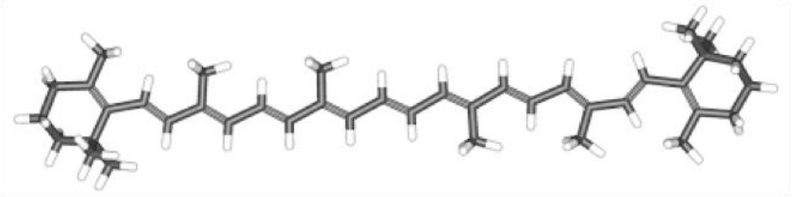
ProDes
(Produce Desirability)

ProColor
(Produce Color Diversity)

ProPhen
(Produce Phenolic Content)

The quality of fruits and vegetables is determined by phytonutrients and secondary metabolites that vary based on agricultural practices

A systematic review and meta-analysis based on 343 peer-reviewed publications indicate that organic crops and foods have statistically higher concentrations of antioxidants previously linked to crop quality and reduced risk of chronic diseases (Baranski et al. 2014)



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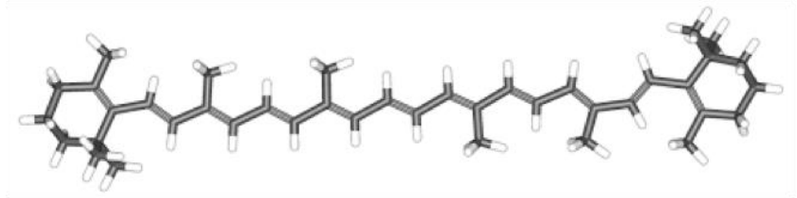


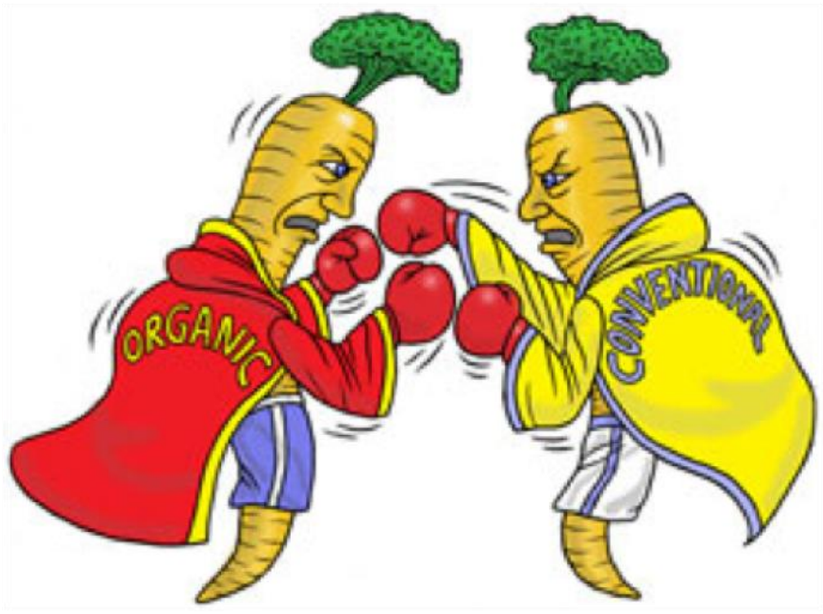


Image source: Creative Commons

- The antioxidant phenolic class of phytochemicals has been identified to play an important role in fruit and vegetable (FV) **quality** through an influence on flavor, appearance, health-promoting attributes, and stability

ProPhen
(Produce Phenolic Content)

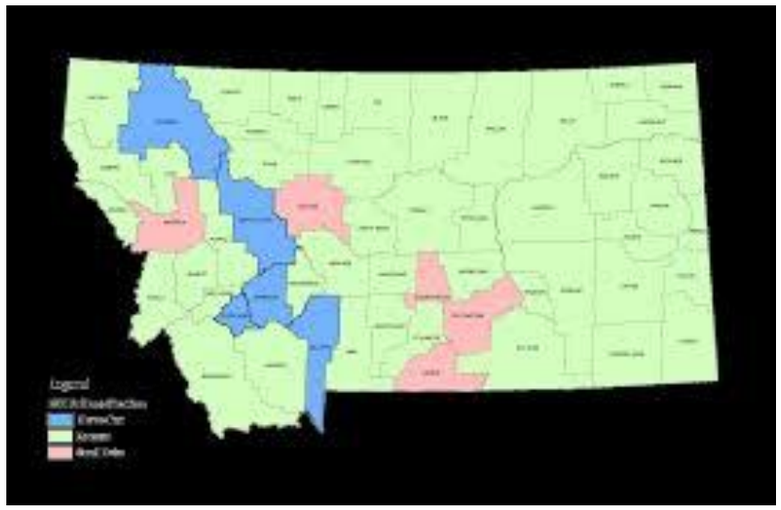
- Create a **market basket** of produce to analyze
  - Examples
    - First 5 fruit and first 5 vegetables listed on the Nutrition Environment Measurement Survey for Stores (NEMS-S)
    - Five most prevalent FVs from community free listing

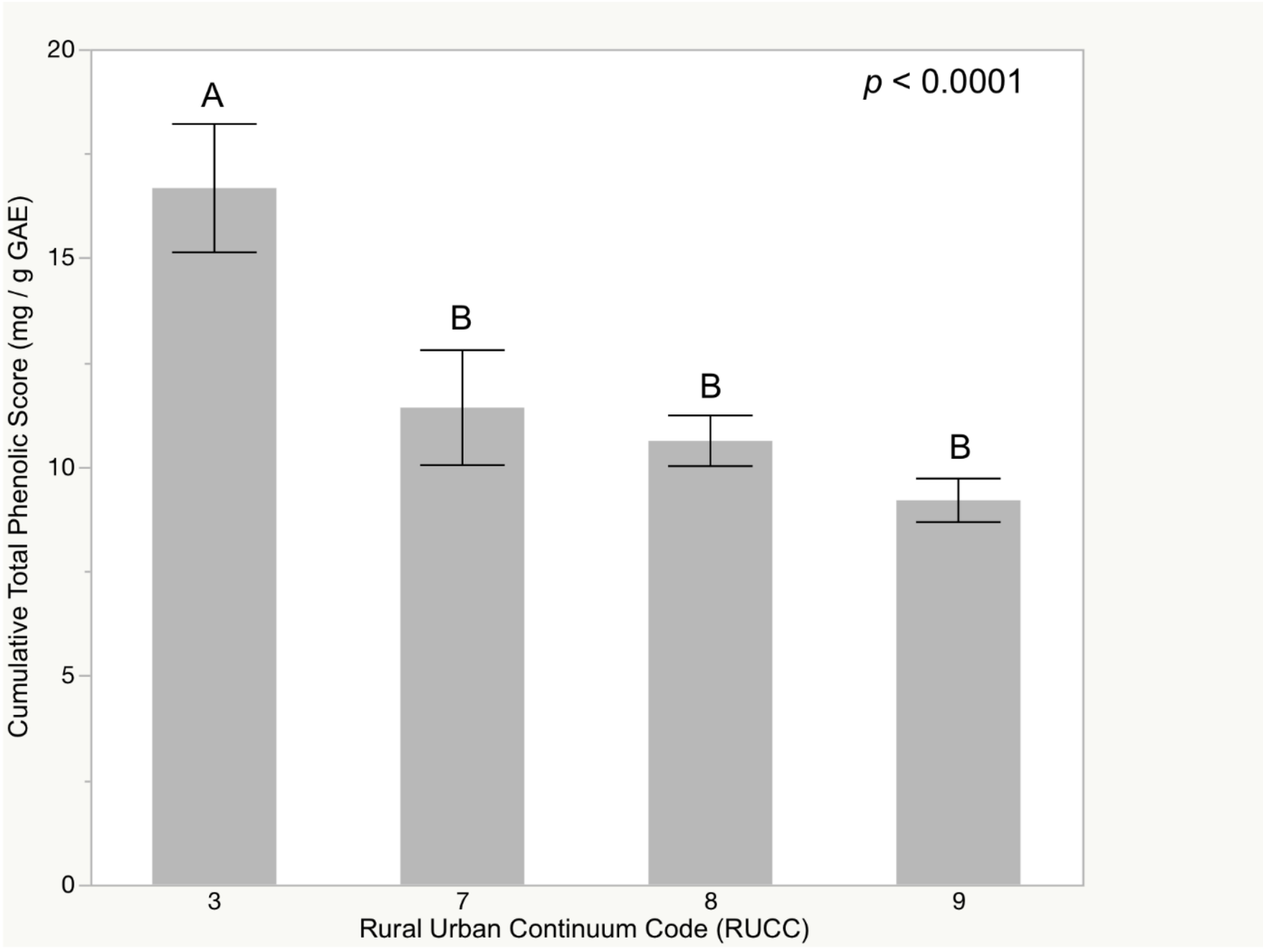
ProPhen
(Produce Phenolic Content)

- Total phenolic (TP) concentration analyzed using the spectrophotometric Folin–Ciocalteau reagent method

- Calculate Cumulative TP scores based on LS-Means of TP concentrations of all analyzed FVs.

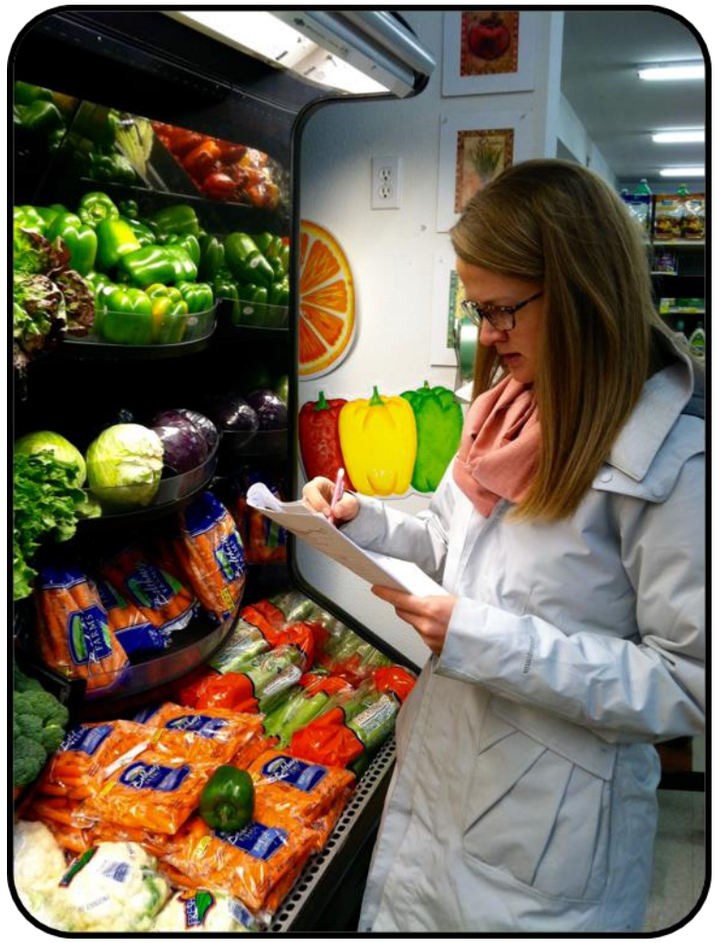
- Fruit TP scores and vegetable TP scores were calculated as the LS-Means of TP concentrations of analyzed FVs accordingly.





Ahmed et al. 2017

ProDes
(Produce Desirability)



- Sensory attributes are related to phenolic concentrations.

- The ProDes survey tool takes the **objective perspective** of produce sensory attributes / desirability in a food environment.

- Based on findings on the importance of **sensory attributes** as determinants of food choice and fruit and vegetable consumption

ProDes
(Produce Desirability)

- Paper and pencil or web-based consumer survey that records sensory aspects of produce in food outlets

- Create a **market basket** of produce to analyze
  - Examples
  - First 5 fruit and first 5 vegetables listed on the Nutrition Environment Measurement Survey for Stores (NEMS-S)
  - Five most prevalent FVs from community free listing

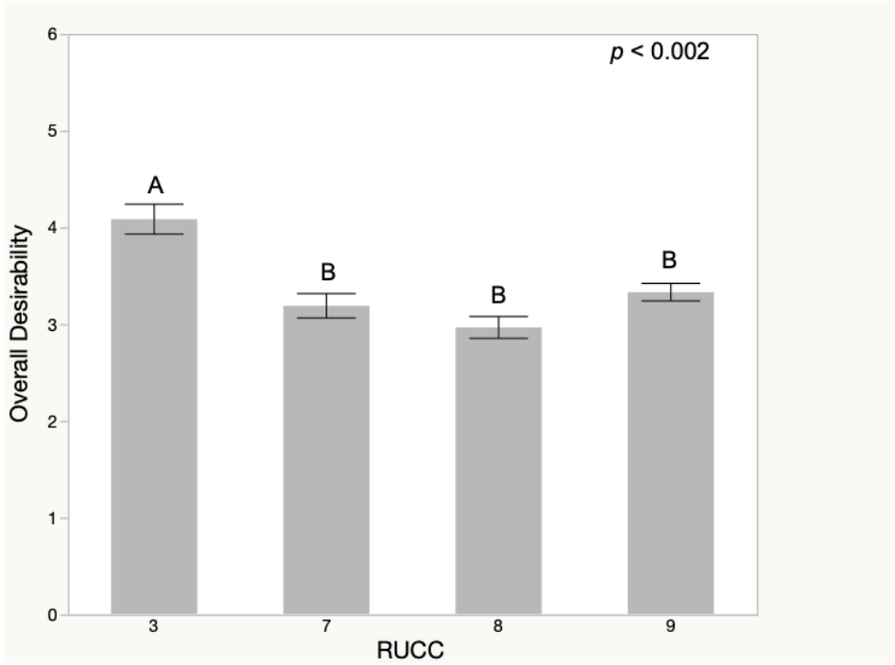
ProDes
(Produce Desirability)

- Five observational sensory characteristics were identified to be prevalent and generalizable for FVs including:
  - **overall desirability**
  - **visual appeal**
  - **touch and firmness**
  - **aroma**
  - **size**

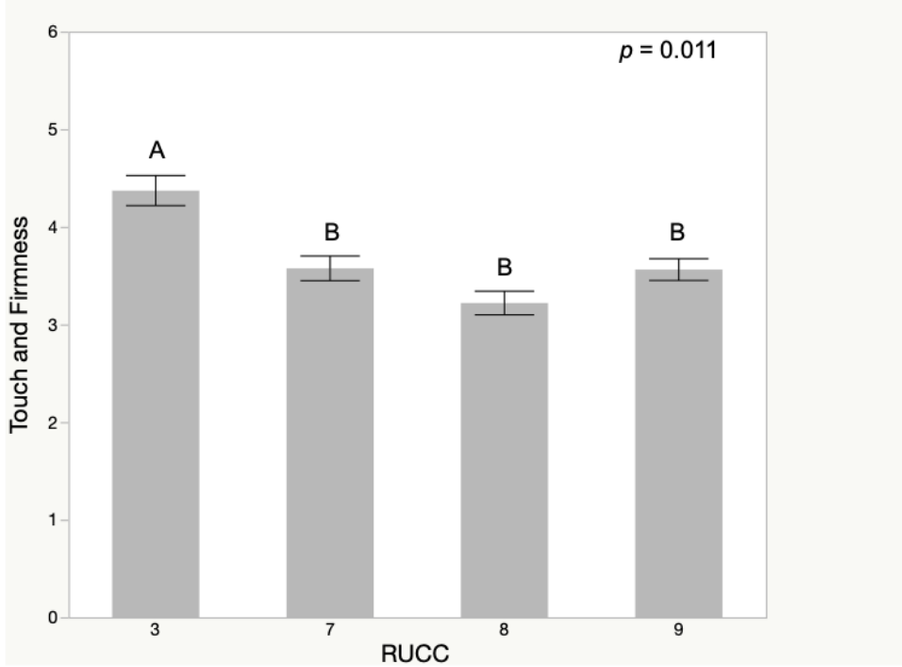
- The ProDes is based on a 7-point Likert rating scale with 0 as the lowest score and 6 as the highest score. Rating is based on rater perceptions of high quality produce and not personal pref

ProDes
(Produce Desirability)

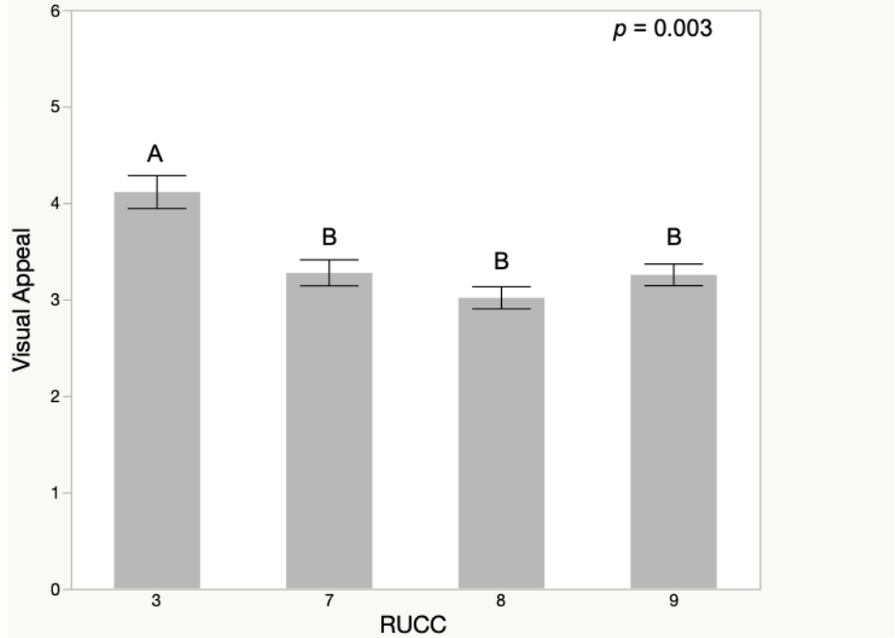
- Validation of the ProDes Tool via Standard Deviation and Internal Consistency.
- High inter-rater reliability despite personal preferences.



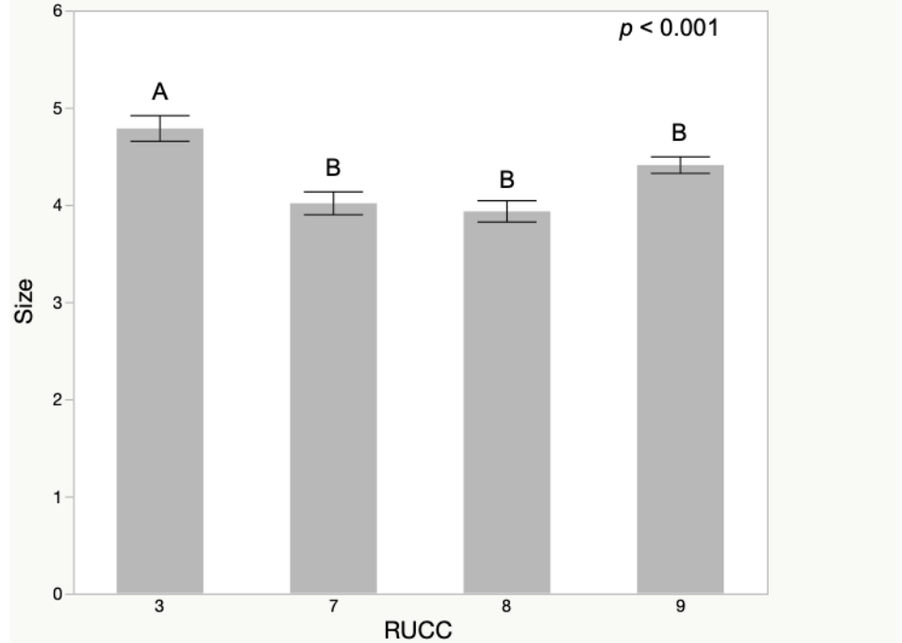
(a)



(b)

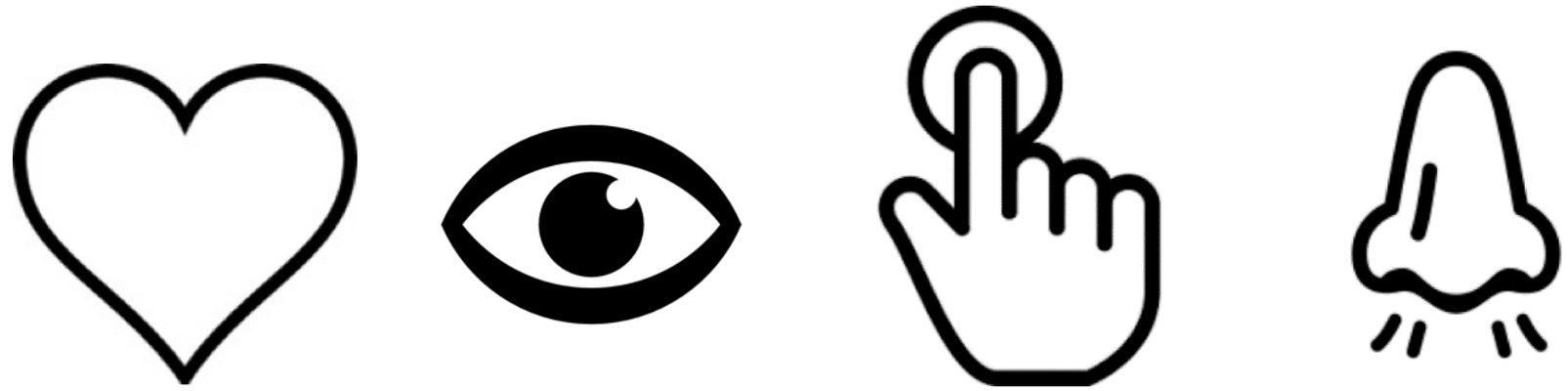


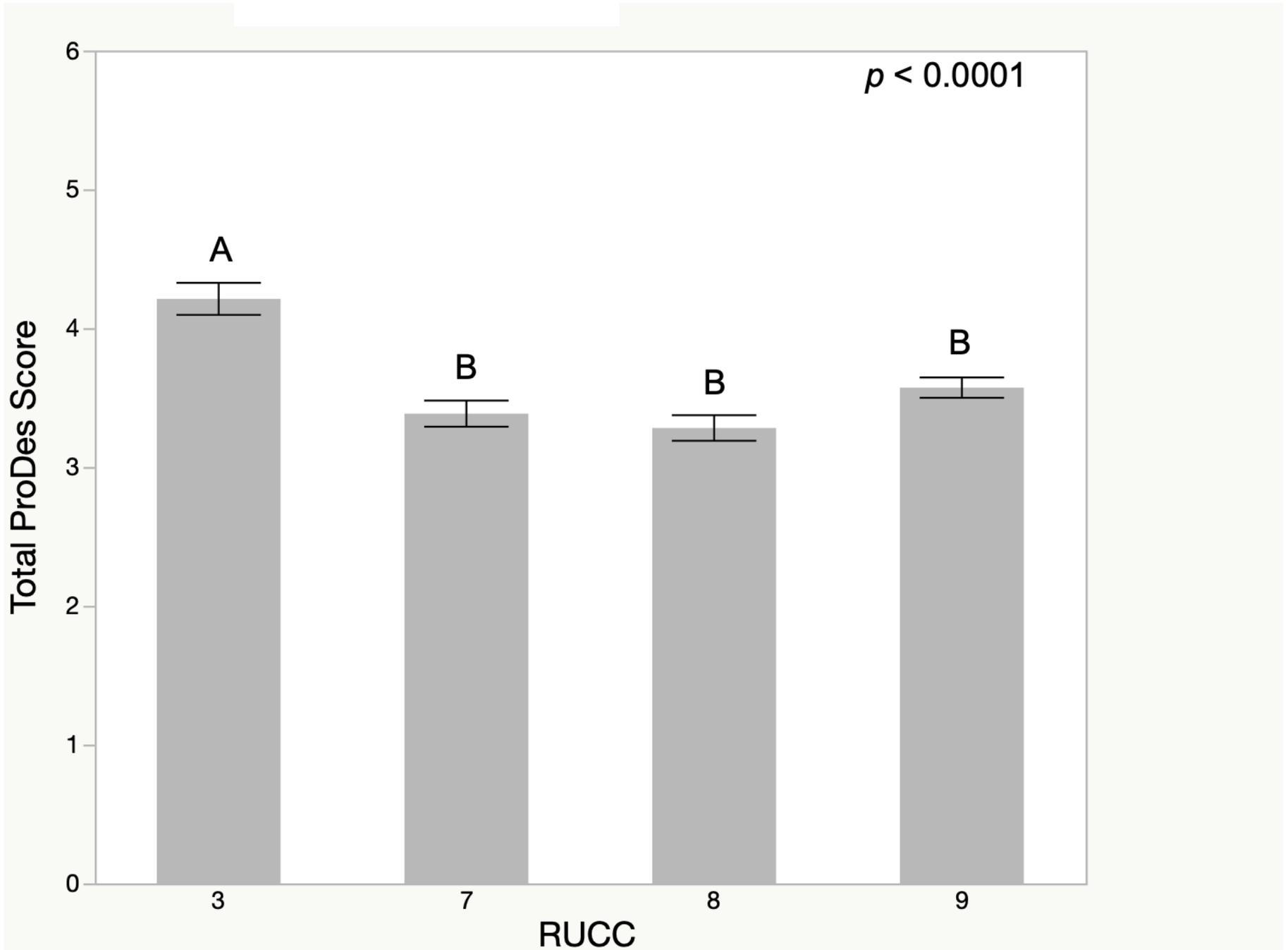
(c)



(d)

Ahmed et al. 2018 *Food Security*

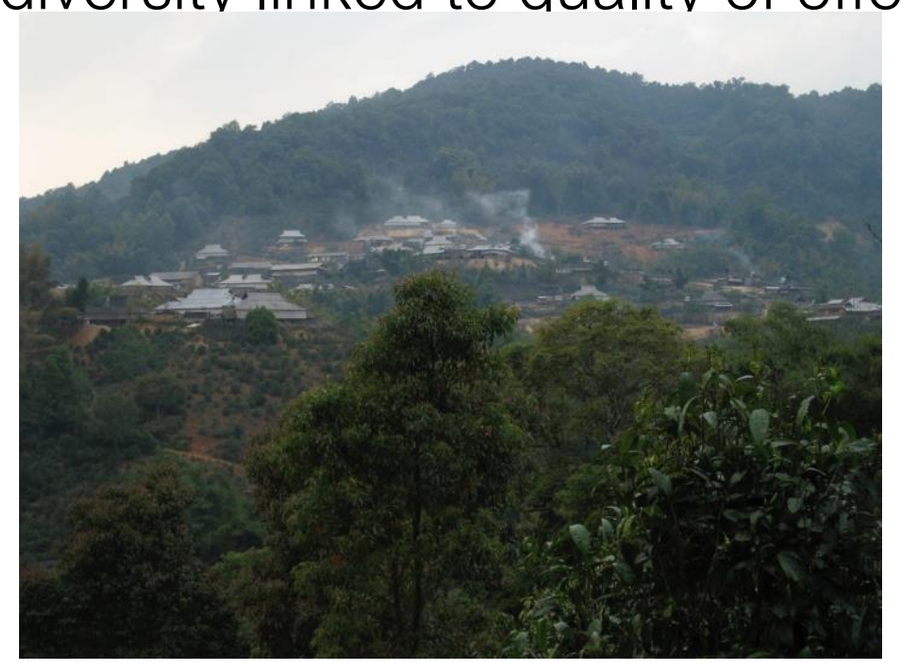


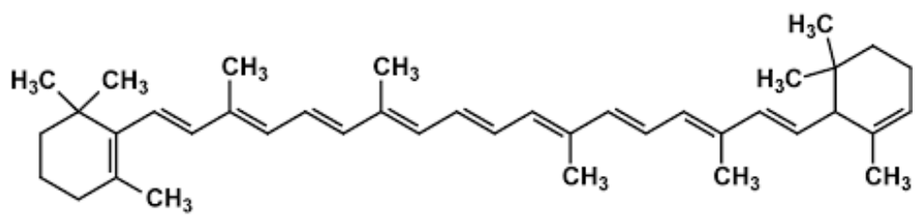


Ahmed et al. 2018 *Food Security*

ProColor
(Produce Color Diversity)

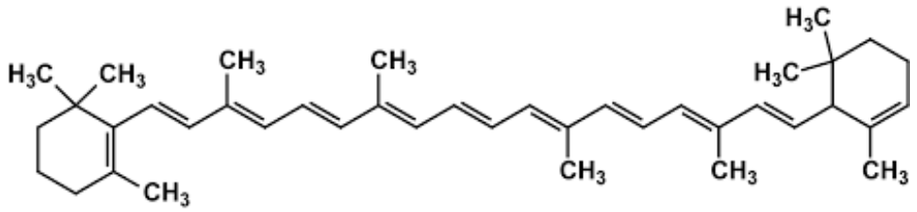
- The **color of FVs** is one way to measure diversity and detect the **presence of phytochemicals** as these compounds may also be pigments that impart color to produce.
- Dietary diversity is part of dietary quality. ProColor is a way to assess diversity linked to quality of offerings in the food environment.



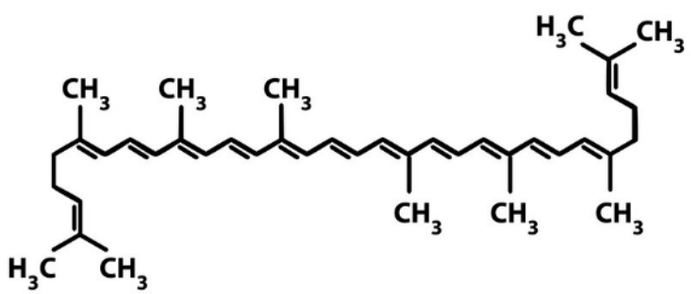


Fruit and Vegetable Color	Dietary Phytochemical	Health claims of the dietary phytochemical	Citation	Specific fruits and vegetables observed in the study (if applicable)
Green	Beta carotene	Antioxidant	Milani et al. 2016	
			Rao and Rao, 2007	
			Upadhyaya et al., 2007	
			Patricia et al., 2013	Broccoli
			Sikora & Bodziarczyk, 2012	Kale
		Anticancer	Milani et al. 2016	
			Guo et al., 2015	
			Zang et al., 2016	
			Zhu et al., 2016	
			Husein et al., 2014	Roman nettle
		Antitumor	Milani et al. 2016	
			Chen et al., 2013	
			Zhang et al., 2016	
			Zhu et al., 2016	
			Husein et al., 2014	Roman nettle
		Induction of apoptosis	Jang et al., 2009	
			Upadhyaya et al., 2007	
			Palozza et al., 2001	
			Olmos et al., 2015	
			Zhu et al., 2016	
	Lutein	Antioxidant	Kamoshita et al., 2016	
			Serpeloni et al., 2010	

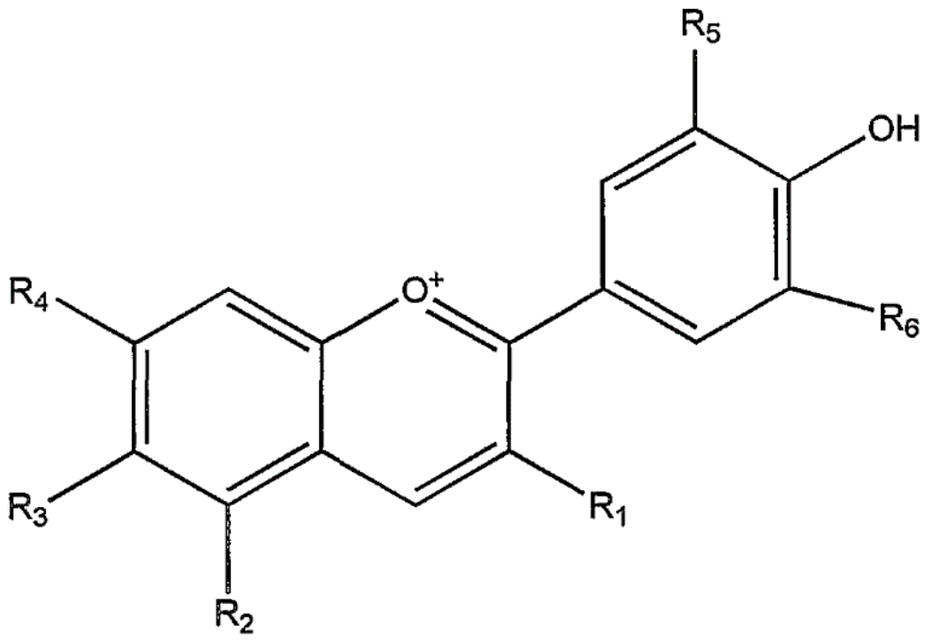
Orange	Beta carotene	Pro vitamin A antioxidant	Englberger et al., 2002	Pacific pandanus fruit
			Englberger et al., 2007	Pandanus fruit



Lycopene

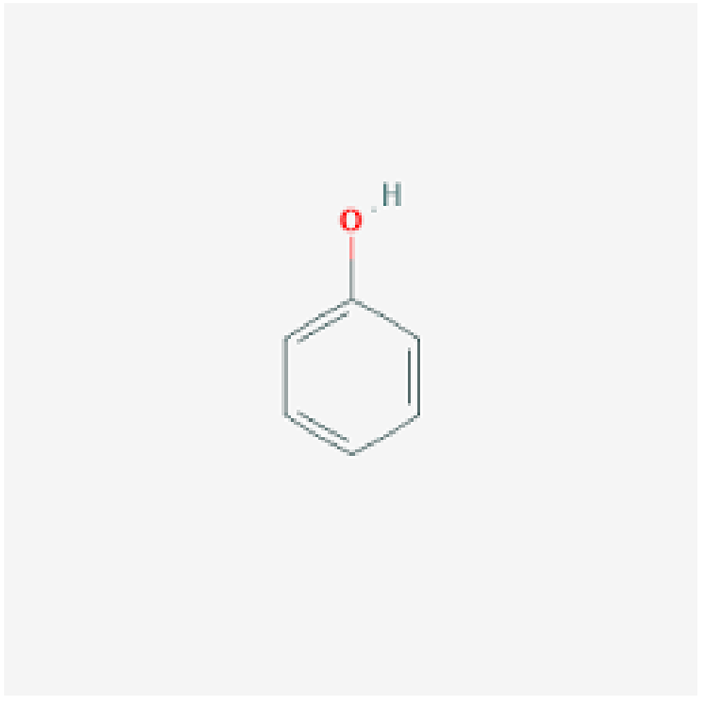


Red	Lycopene	Antioxidant	Kaulmann et al., 2014	
			Porcu & Rodriguez-Amaya, 2008	Pitanga fruit
			Bose & Agrawal, 2007	Tomatoes
			Cefali, 2015	Tomatoes
			Toor et al., 2005	Tomatoes
		Antitumor	Tang et al., 2005	
			Sahin et al., 2011	
			Palozza et al., 2007	Tomatoes
			Canene-Adams et al., 2007	Tomatoes
			Mossine et al., 2008	Tomatoes
		Apoptosis	Liu et al., 2003	
			Palozza et al., 2007	Tomatoes
			Canene-Adams et al., 2007	Tomatoes
			Bowen et al., 2002	Tomatoes
			Salman et al., 2007	



Purple and blue	Anthocyanins	Antioxidant	Kalt et al., 2001	bluberries
			Sugata et al., 2015	purple-fleshed sweet potatoes
			Sashwati et al., 2002	Blueberry, bilberry, elderberry, raspberry, strawberry
			Neto 2007	Cranberry and blueberry
			Garzon 2016	Columbian acai
		Anti-inflammatory	Sugata et al., 2015	purple-fleshed sweet potatoes
			Xu et al., 2016	bluberry
			Nile SH, & Park SE, 2014	Edible berries

White	Colorless phenolics	Antioxidant	Kim et al., 2015	
			Matias et al., 2016	Saco cherry
			Zhen et al., 2016	Hibiscus
			Zhao et al., 2015	Peach
			Saldilova et al., 2007	Elderberry and strawberry



ProColor
(Produce Color Diversity)

- ProColor is a paper and pencil or web-based food environment survey that records the type and number of fresh FVs in vendors based on color category.

- **Vegetables**: 1) dark green, (2) other green, (3) red, (4) orange and yellow, (5) purple and blue and, (6) white.

- **Fruit**: (1) green, (2) red, (3) orange and yellow, (4) purple and blue and, (5) white.

ProColor
(Produce Color Diversity)

- For FVs where the **flesh is a different color than the skin** (e.g., eggplant or apple), the produce is categorized on the basis of the color of the flesh.
- For vegetables that have **multiple consumable parts** that are different colors (e.g., purple beets and beet greens), the produce parts are placed in multiple categories if both are consumed by the local culture where the food environment measurement occurs.
- If both produce parts are not commonly consumed by the local culture, then only list the consumed part of vegetable under corresponding color.
- If **multiple varieties** exist of a specific produce type, each variety with a distinct color is to be included (e.g., green peppers and red peppers are counted as separate items

ProColor
(Produce Color Diversity)

- Total ProColor Abundance Scores
- Total ProColor Category Scores
- Total ProColor Relative Frequency Scores
- Total ProColor Richness Scores based on ecological metrics.

- Tool was validated for inter-rater reliability and internal consistency.

Links of Food Environment Assessments with Dietary Quality

ProColor of
Food Environment

ProColor of Diets

Thank you

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