



Skin carotenoid measures and self-reported fruit and vegetable intake in young adults

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Introduction

Carotenoids are a phytochemical present in a variety of red, orange, yellow, and green fruits and vegetables.¹ When absorbed, they are stored in fat deposits in the skin to later be converted to vitamin A.² Skin carotenoids (SC) have been shown to predict serum carotenoids and increasingly have been incorporated into the research setting as an objective measure of fruit and vegetable (FV) intake.^{3,4} To date, existing data using SC across different populations are limited. Further, the relationship of SC to self-reported FV intake has not been well documented.

Objective

To examine SC measures in comparison to self-reported FV intake among male and female young adults attending a public, northeast university.

Methodology

- Data were collected between 2018 and 2023 from the College Health and Nutrition Assessment Survey (CHANAS).
- CHANAS is an ongoing cross-sectional study at a public, northeast land-grant university.⁵ Participants for CHANAS are recruited from a general education, nutrition course and represented all majors and class standings at the university.
- Participants included young adults ages 18-24 years old who consented to participating in CHANAS. (UNH IRB #5524)
- Participants were excluded if they were missing any dietary intake or SC data.
- Skin carotenoid scores were measured using the VEGGIE METER® (Longevity Link). Measures were conducted in triplicate and averaged.
- Self-reported FV intake (average cups/day) were assessed from 3-day food diaries recorded on non-consecutive days, including one weekend day, then analyzed by online nutrient analysis software (Diet and Wellness+).
- Differences in SC scores between groups of FV intake (<1, 1-1.99, 2-2.99, 3-3.99, 4-4.99, and ≥ 5 cups/day) were analyzed using ANCOVA, using % body fat and gender as covariates, as well as post-hoc pairwise comparisons.
- Data were analyzed using SPSS (version 27).

Veggie Meter®

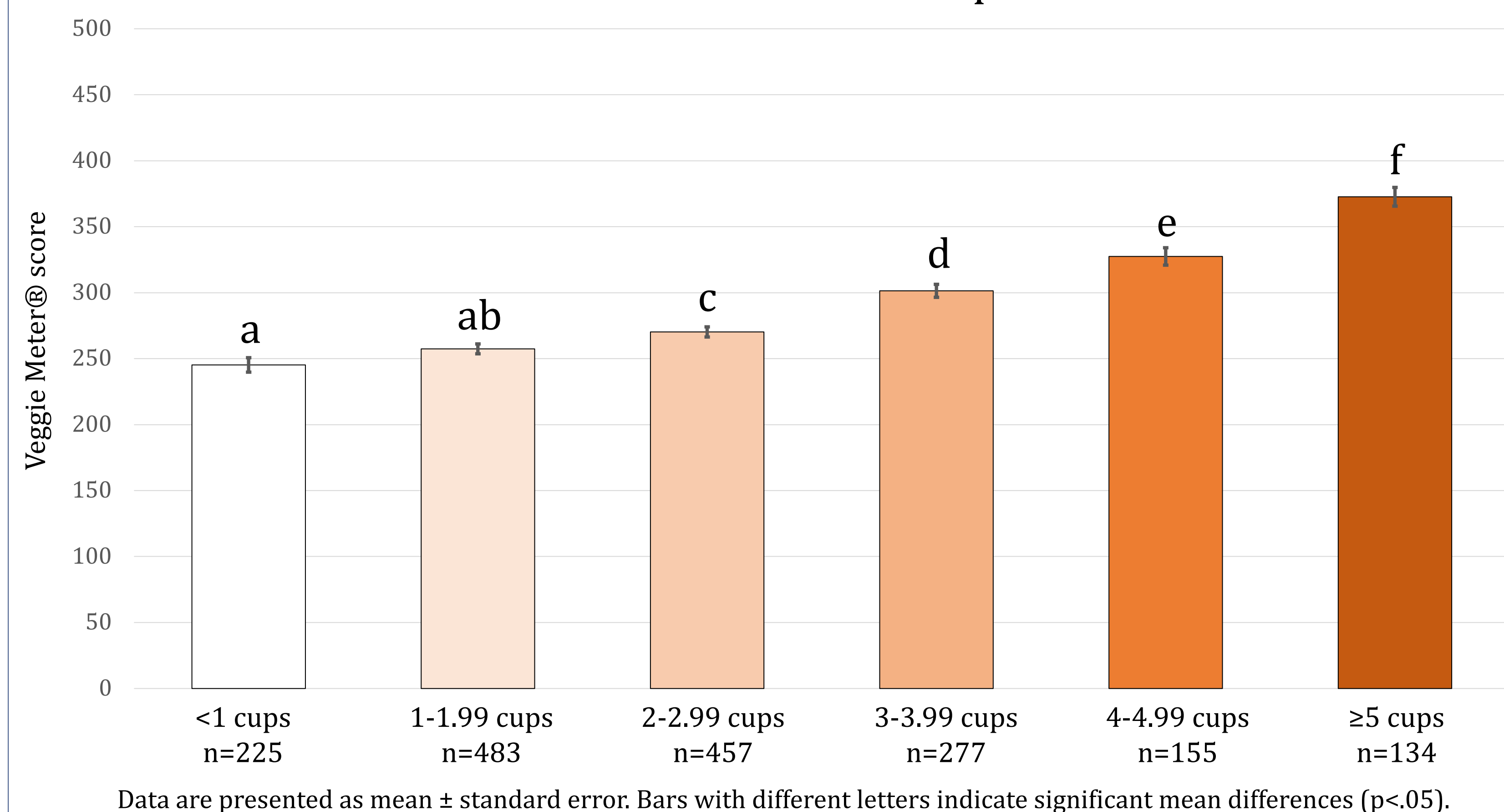
- The Veggie Meter® uses pressure-mediated reflection spectroscopy to measure the skin carotenoid content in the tip of the finger.²
- Participants place their finger into the finger hold, where 3 measurements are taken in approximately 90 seconds.
- Measurements are generated on a laptop interface as a score ranging from 0-800
- Skin carotenoid scores measured by the Veggie Meter® have been shown to be highly correlated with serum carotenoids.⁶

Subject Characteristics

Subject Characteristic	Males n=637-663	Females n=1094-1128	Total n=1731-1791
Age (years)*	19.1±0.05	18.8±0.03	18.9±0.02
Race (%)			
White*	91.3	95.1	93.7
Asian*	4.3	2.4	3.1
Other races/ Multiracial	4.4	2.5	3.2
Major (%)*			
Nutrition	2.1	8.2	5.9
Allied-health	11.3	19.1	16.2
Other	86.6	72.7	77.8
BMI (kg/m ²)*	24.1±0.15	23.1±0.12	23.5±0.09
% Body fat*	16.3±0.25	27.4±0.22	23.3±0.21
Fruit intake (cups/day)	0.9±0.04	0.9±0.03	0.9±0.02
Vegetable intake (cups/day)*	1.8±0.05	1.6±0.03	1.7±0.03
Total FV intake (cups/day)	2.6±0.07	2.6±0.05	2.6±0.04
Skin carotenoid score*	289.7±3.1	274.7±2.8	280.2±2.1

Categorical data (race and major) are presented as frequencies (%); all other characteristics presented as mean ± SE; * Significant difference between genders (p<.05)

Skin Carotenoid Scores and Self Reported FV Intake

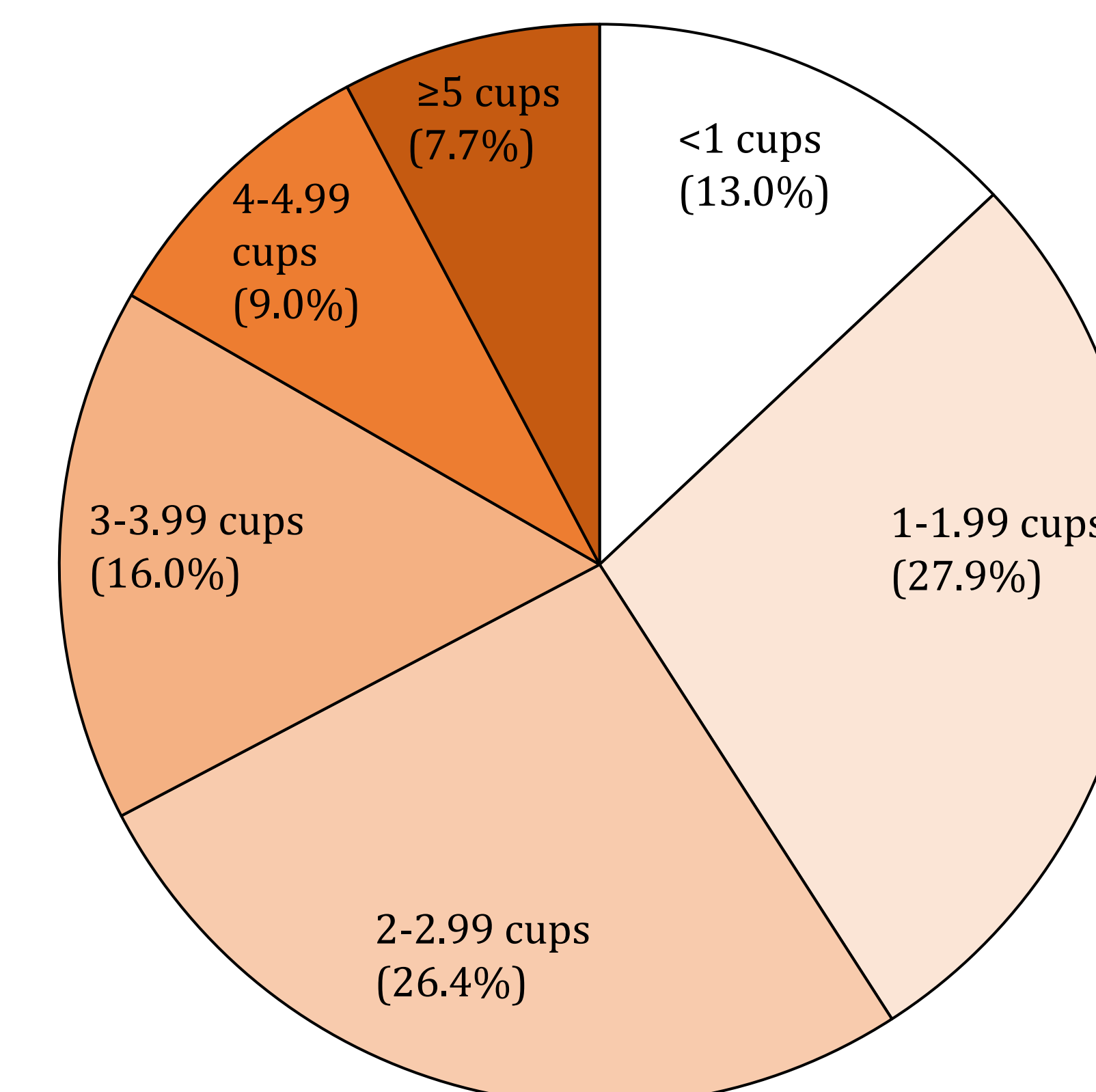


Veggie Meter instrument and laptop interface



Veggie Meter example output and comparison to reference population

Proportion of Fruit and Vegetable Intake



Results

- The final sample (n=1791) was predominantly white (93.1%), female (61.7%), and first year students (45.4%).
- Skin carotenoid scores positively increased with each FV group (adjusted R² = 0.18, p<0.01).
- Skin carotenoid scores were significantly different for all FV intake groups except between those who consumed <1 vs. 1-1.99 cups of FV (p=.067).

Conclusions

- Data supports a positive and linear relationship between SC scores and self-reported FV intake in a sample of college students.
- Given the ease of use and low subject burden, SC scores are a promising tool for objective assessment of FV intake and a useful addition to intervention studies, as well as in community and clinical settings.
- Future research could aim to compare SC scores to diet quality.

Acknowledgements

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