Kid’s Juice: The effects of consumption of high carotenoid juice and change in skin carotenoid levels among school-age children

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Abstract

Objective: To determine the effect and dose response of a known dose of carotenoid consumption on change in skin carotenoid concentrations among children.

Rationale: No published study has looked at this correlation in children.

Study Design, Intervention: Participants were children age 5-17 from Cache County, UT (n=60). Children were randomly assigned to one of three groups: high dose (AH) of carotenoid juice (2.75 mg carotenoids/28ml juice), low dose (AL) of carotenoid juice, placebo juice (no detectable carotenoids). Children were asked to drink the assigned dose of the juice (14 ounces/day), which was based on the weight of the child, every day for four weeks. Skin carotenoids were assessed at baseline and week four by a BioPhotonic Scanner™.

Outcome Measures and Analysis: A one-way ANOVA was used to assess the mean differences in change in skin carotenoid levels by group: AH (n=18), AL (n=20), P (n=23).

Results: The AH group had a mean difference increase in scanner score of 6,779 compared to the P group (p<.001). There was no significant difference between change in skin carotenoids between the AH and AL groups.

Conclusions and Implications: Consumption of 1.4 ounces/day of a high carotenoid juice significantly increased scanner scores over a four week period among children aged 5-17.

Introduction

Reactive oxygen species (ROS) are chemically reactive molecules that contain oxygen, cause damage to cells, and are created during times of physiological stress. Antioxidants, including carotenoids, are substances that protect cells from the damage caused by ROS. Highly pigmented fruits and vegetables are good sources of carotenoids as well as other antioxidants. Numerous studies have demonstrated that fruits and vegetables can be protective against oxidative damage (1) and people who eat high amounts of fruits and vegetables have lower risk for mortality and many chronic disease (2).

Carotenoid status may be a marker of antioxidant status and fruit and vegetable intake. Carotenoids are fat soluble pigments and when eaten are transported in the blood in lipoproteins and may be deposited in the skin and fat cells of humans. Carotenoid status may be assessed by measuring the concentration of carotenoids in blood or in the skin. Previous studies in adults have identified strong correlations between the amount of carotenoids measured in the blood using high-performance liquid chromatography and the amount measured in the skin, using Raman spectroscopy (ref). BioPhotonic Scanner™ is a portable Raman spectroscopy device that may be used to measure the concentration of carotenoids in the skin. The device uses an infrared light to detect carotenoids, is non-invasive and painless, and takes about 90 seconds to complete. In addition, skin carotenoids may reflect long-term carotenoid status (3) as compared to blood carotenoids.

The purpose of this study was to examine changes in skin carotenoid concentrations in children, measured by the BioPhotonic Scanner™ over a four week period of time when a known dose of carotenoids were consumed. This research was designed to answer the following questions: If we increase carotenoid intake, do skin carotenoid concentrations increase?

Methods

Study Population: 61 healthy children age 5-17 participated in the study. Qualifying children had a BioPhotonic Scanner™ score between 10,000 and 31,000 Raman Intensity counts. They were also non-smokers, lived in homes without smoke exposure, and free of chronic disease, which are factors known to reduce carotenoid concentration in the human body. They were asked to refrain from taking carotenoid supplements, avoid tanning bed use or excessive exposure to sunlight without sunscreen use. Participants were chosen to represent the demographic of students in cache valley schools.

Participant Randomization: Participants were randomly assigned to one of the three treatment groups: AH (n=18), AL (n=20), or P (n=23). Supplementation was 15-60 ml twice daily for four weeks. Individuals involved in assessment of study endpoints were blinded with respect to treatment assignment.

Supplementation: Participants were divided into a supplement or control group, and received either a high dose (30 ml if under 99 lbs, 60 ml if 100 lbs or more) or a low dose (15 ml if 99 lbs or under, 30 ml if 100 lbs or more) of juice. The active juice (Juice A) is commercially available and has 2.75 mg carotenoids per ounce. Measuring devices were used for proper dosing when juice was administered. During weekly clinic visits, bottles were weighed to check compliance.

Dietary instructions during study: The participants were encouraged to maintain their normal diet throughout the duration of the study and this was assessed using repeated 24 hour recall and food frequency questionnaires. In addition, participants reported changes in sun exposure, physical activity, supplement use and new illness during their weekly clinic.

Scanning: Participants were scanned using resonance Raman spectroscopy with the BioPhotonic Scanner™ at baseline and again at week 4. Participants were blinded to their scanner scores.

Statistics: The mean difference in baseline to week 4 scanner scores were calculated. Pair-samples t-tests were calculated to assess the change in scanner scores. Changes in scanner score over time in response to the juice consumption were analyzed by one-way ANOVA using the SPSS System. A Levine’s statistic was calculated to test homogeneity of variance and a Scheffe test was used for the Post Hoc test statistics.

Results

The average increase in scanner scores for AH was 6,390 (p<.001), for AL was 2740 (p=.046), and for P was -388 (p=.726). The AH group had a mean difference of 6,779 compared to the P group (p<.001). There was no significant difference between change in skin carotenoids between the AH and AL groups, or AL and P.

Conclusions

Consumption of a known dose of carotenoids from a high carotenoid containing juice significantly increased scanner scores over a four week period among children age 5-17. These results indicate that skin carotenoid levels, as measured by the BioPhotonic Scanner™, are sensitive to change in carotenoid intake among children. Thus, skin carotenoid levels may be used as a biomarker of change in carotenoid intake in children.

References / Acknowledgements

References:


Thanks to Pharmanex, LLC for the use of the BioPhotonic Scanner™.