Skin Carotenoid Levels Over Time and Differences by Age, Sex, and Race Among Head Start Children (3-5 years) Living in Eastern North Carolina

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INTRODUCTION

- Low intake of fruits/vegetables (FV) among preschoolers is well documented, establishing a need for interventions that can improve intake.
- However, in order to determine effectiveness of interventions, valid and objective methods are needed.
- A promising non-invasive tool for objectively measuring FV consumption is the Veggie Meter® (VM), which uses reflection spectroscopy to assess skin carotenoids.
- While the tool has been used and validated in adults, limited research exists to describe its use in children.

PURPOSE

The purpose of this study was to investigate skin carotenoid levels in 3-5-year-old children enrolled in Head Start (HS) centers in North Carolina by using an objective measure of FV intake to assess changes over time and differences between sex, race, and age.

STUDY DESIGN

- Three HS (federally funded preschool)1 centers located in Eastern North Carolina participated in this prospective cohort study.
- East Carolina University IRB approved study methods and protocols (UMCIRB 19-01553).

DATA COLLECTION TOOLS

- Survey data was collected from families including demographic information and strong food likes/dislikes.
- Participating children’s height, weight, and skin carotenoids using the Veggie Meter® (VM®) were measured as shown in Table 1.
- Height and weight were measured using adapted NHANES procedures for collecting anthropometry measurements from children.
- The VM® was used to measure skin carotenoids reflective of a diet high in carotenoids such as FV (Figure 4).10,11

METHODS

- Four Research assistants attended a 2-hour training on research ethics, protocols, and procedures. Research assistants also completed mock data collection sessions in a local non-HS preschool site prior to collecting data.
- Parent-reported data was collected at Time 1.
- Height, weight, and skin carotenoids (VM®) were measured at Times 1-3.
- The child’s finger was inserted into the VM® and the multiple measurement mode was utilized to derive a single carotenoid score on a spectral range of 350-850 nanometers.11

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DATA ANALYSIS

- Over the 2018-2019 school year, Site 1 was participating in a nutrition education intervention focused on improving FV consumption which resulted in significant differences between the two groups (F(2,76)= 3.98, p=.02, η²=.10).10,11
- Site 1 (n=67) was excluded from the repeated measures ANOVA analyses since these children had significantly higher SCL at Time 3 compared to children attending Sites 2 and 3 (t(38)=2.54, p<.05).14

RESULTS

- The final sample consisted of 112 HS children.
- Participants were 57% male, an average age of 4.1 (SD=0.5) years, and predominantly Black/AA (81.3%) followed by Hispanic (6.3%).
- 8.9% of children had parent-reported food allergies.
- Mean skin carotenoid levels were 266 (SD 82.9) (n=112).
- Skin carotenoid levels over time had significant differences (F(1,58)=17.66) from Time 1 to Time 3 (p<.001) and from Time 2 to Time 3 (p=.001).
- No significant differences from Time 1 to Time 3 (p=.496) (Figure 1).

- Significant differences were seen between males (282, SE 9.3) and females (245, SE 12.8) (F(1,153)=1.45, p=.03) with 265 (SE 19.7), followed by white at 281 (SE 35.8), AA at 297 (SE 19.7), females at 297 (SE 35.8), and “other races” at 234 (SE 35.8).2
- Age (F(1,153)=1.45, p=.01) was significant with higher skin carotenoid levels found in 5-year-olds (Figure 3).

- Mean skin carotenoid levels changed significantly over time and were significantly different between sex and age groups. No significant differences were observed between race.


- Although not significant, variations were observed between race and skin carotenoid levels possibly due to the cultural food differences seen among different race groups.

- Prior research is inconclusive as to whether males or females have higher FV intake. However, this study found that males had higher skin carotenoid levels compared to females, suggesting that males had higher intake of FV.

- Findings also suggest preschooler’s age group is a significant predictor FV intake assessed by skin carotenoids. This finding is supported by existing literature describing neophoria emerging around the second year of life, peaking in preschool years and then slowly declining.17

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- Skin carotenoid levels over time changed significantly.

- Significant differences were seen between males (282, SE 9.3) and females (245, SE 12.8) (F(1,153)<1.45, p=.01) at Time 1 (Figure 2).
- Although the test was not significant, there were slight variations on skin carotenoid levels and race (F(1,153)=76.76, p<.001).
- Mean skin carotenoid levels were 266 (SD 82.9) (n=112).
- Skin carotenoid levels over time had significant differences (F(1,58)=17.66) from Time 1 to Time 3 (p<.001) and from Time 2 to Time 3 (p=.001).

- Mean Skin Carotenoid Levels Between Age for Head Start Children (N=45)

- Mean Skin Carotenoid Levels Over Time for Head Start Children (N=45)

- Figure 2. Mean Skin Carotenoid Levels Between Sex for Head Start Children (n=112)

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- The VM® is a useful tool for objectively measuring FV intake in preschool-aged children. However, the tool should be validated using blood plasma and traditional subjective measures of intake.

- More research is also needed to explore the impact of skin carotenoid levels in evenly distributed sex, race, age groups in a larger sample while also utilizing subjective methods of dietary intake.

ACKNOWLEDGEMENTS

FUTURE RESEARCH

- The VM® is a useful tool for objectively measuring FV intake in preschool-aged children; however, the tool should be validated using blood plasma and traditional subjective measures of intake.

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REFERENCES