Novel Type 2 Diabetes Prevention Curriculum Resulted in Increased Skin Carotenoids and Lowered BMI Percentile in Adolescents

Nica Clark, PhD, RDN[2], Carmen Ramos, MS, RDN[3], Julie Metos, PhD, MPH, RDN[3]
[2]Department of Agriculture & Nutrition, Southern Utah University, Cedar City, UT
[3]Department of Nutrition & Integrative Physiology University of Utah, SLC, UT

Background

Adolescent type 2 diabetes (T2D) incidence increased 4.8% annually between 2002-2015[1] and currently accounts for 20% of adolescent diabetes diagnoses[1]. Obesity is strongly correlated with T2D among adolescents. Few previous interventions show efficacy at improving adolescent eating and exercise behaviors, which could decrease the proportion of overweight and obese adolescents and reduce risk for T2D.

Objective: To evaluate the efficacy of a novel T2D prevention curriculum on nutrition behaviors and anthropometrics in high-risk adolescents.

Methods

Quasi-experimental intervention versus control study with convenience sampling. Trained researchers taught curriculum to adolescents at three schools during mandatory health education classes, while students in three population-matched control schools received standard nutrition education in their health education classes. Six lessons incorporated elements of Social Cognitive Theory through technology, goal-setting, competition, incentives, and peer support to promote behaviors that reduce risk for type 2 diabetes. Outcome variables were assessed at baseline (T1); 1-day post curriculum delivery (T2); and 1-month follow-up (T3). Multi-level general linear mixed effects regression models, independent t-tests, and Pearson chi-square tests assessed differences in intervention effectiveness (Stata version 15).

Results

Table 1. Baseline participant demographics

	N	Intervention	Control
Number of participants (% female)	888	535 (52)	353 (51)
Age: x̄ (SD)	877	15.4 (0.71)	15.3 (0.78)
Race/ethnicity: n (%)	891		
American Indian/Alaska Native	7	7 (1.3)	0 (0)
Asian	13	8 (1.5)	5 (1.4)
Black/African American	9	5 (.93)	4 (1.1)
Native Hawaiian/Pacific Islander	13	13 (2.4)	0 (0)
White	594	348 (64.8)	246 (69.5)
Mixed Race, Not Hispanic	37	20 (3.7)	17 (4.8)
Hispanic/Latino, All Races	**167**	**125** (23.3)**	**42** (11.9)**
Unknown	51	11 (2.1)	40 (11.3)
BMI percentile: n (%)	865	516	350
< 5	19	12 (2.3)	7 (2.0)
5-84.9	509	299 (57.9)	211 (60.3)
85-94.9	162	92 (17.8)	70 (20.0)
≥ 95	175	113 (21.9)	62 (17.7)
Qualify for free/reduced lunch: n (%)	**832**	**191** (36.6)**	**76** (24.5)**
Family history of diabetes: n (%)	781	239 (48.8)	121 (41.6)

Note: Bold indicates statistical significance, ** $p < 0.001$.

Table 2. Intervention effect (Group x Time Interaction) for select anthropometric and dietary outcomes using multilevel mixed effects models

Outcome	Time	Group x Time Interaction b-coefficient	Group x Time Interaction 95% CI	Group x Time Interaction *p*-value
BMI Percentile	T2	-0.85	-1.71 – 0.01	0.054
	T3	**-1.13***	**-2.01 - -0.26**	**0.011**
Skin Carotenoid (cm^{-1})	**T2**	**1132****	**545 - 1719**	**< 0.001**
	T3	**1868****	**1286 - 2450**	**< 0.001**
Carrot consumption (0-7 days/week)	**T2**	**0.92****	**0.41 - 1.42**	**< 0.001**
	T3	**0.69***	**0.12 – 1.26**	**0.018**

Note: Bold indicates statistical significance, * $p < 0.05$, ** $p < 0.001$.

Results

The intervention **increased** skin carotenoids and lowered BMI percentile in adolescents. There was **no effect** on adolescent self-reported sugar consumption from soda, sports drinks, energy drinks, lemonade, sweetened tea, and fruit juice.

Conclusions

Novel intervention components may increase adolescent motivation and engagement, resulting in behavioral changes that reduce risk for type 2 diabetes. Future intervention designs should focus on strategies shown to motivate adolescent behavior change.

Key Limitations to this study include lack of follow-up on outcomes beyond 3 months and potential variation in instruction among control groups teachers.

References & Funding

[1]Divers, J., Mayer-Davis, E., Lawrence, J. M., Isom, S., Dabelea, D., Dolan, L., . . . Wagenknecht, L. E. (2020). Trends in Incidence of Type 1 and Type 2 Diabetes Among Youths — Selected Counties and Indian Reservations, United States 2002–2015. *MMWR Morb Mortal Wkly Rep, (69)*6, 161-165. doi: 10.15585/mmwr.mm6906a3

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