

Introduction

- 15.5 percent of NC adolescents are overweight and 15.4% are obese (1).
- 20% and 33% of Eastern NC middle schoolers are overweight or obese respectively (7).
- Association of obesity with morbidity and mortality in the US (2). Efforts have focused primarily on diet, exercise and behavioral modification with limited long-term success. (3, 4).
- Adverse childhood experiences (ACE's) shown to correlate with obesity as well as many of the leading causes of adult morbidity and mortality in the U.S (5,6).
- Food insecurity (an ACE) as a surrogate for ACE exposure within the context of the Pediatric Healthy Weight Clinic at East Carolina University.

The purpose of this study is to determine the associations of ACE exposure in the form of food insecurity with initial BMI-Z score, BMI-Z Score at first follow up and baseline sugar sweetened beverage consumption.

References

- Centers for Disease Control and Prevention.
- US Department of Health and Human Services
- Mol Psychiatry*
- Am J Clin Nutr*.
- Am J Prev Med*. 1998;14(4):245.
- Obesity (Silver Spring)*. 2017;25(5):820-832. doi: 10.1002/oby.21797 [doi].
- Child Obes*. 2016;12(2):103-112. doi:10.1089/chi.2015.0073
- J Acad Nutr Diet*. 2019;119(10):1695-1702. doi:10.1016/j.jand.2019.03.004
- Child Obes*. 2015;11(2):148-155. doi:10.1089/chi.2014.0105
- J Acad Nutr Diet*. 2012;112(12):1949-1958. doi:10.1016/j.jand.2012.08.031
- J Acad Nutr Diet*. 2012;112(6):840-849. doi:10.1016/j.jand.2012.01.023
- Pediatrics*. 2010;126(1):e26-e32. doi:10.1542/peds.2009-3146
- Nutr Today*. 2015;50(1):28-39. doi:10.1097/NT.0000000000000072.

Materials & Methods

- Study design: retrospective chart review using sequential convenience sampling from electronic health record data.
- Participants: 193 patients seen at the East Carolina Healthy Weight Clinic in 2018-2019.

Figure 1: BEVG-15P data set

Type of Beverage	Average cal/fl oz	How Often per Day	How much (fl oz)	Average Daily fl oz	Average Daily calories
Water	0	3	16	48	0
100% Fruit Juice	17.67	0.357	12	4	76
Sweetened Fruit Drink*	14.3	0.357	12	4	61
Whole Milk	18.75	0.357	12	4	80
Reduced Fat Milk (2%)	15	0	0	0	0
Low Fat/Fat Free Milk	11.25	0	0	0	0
Flavoring in milk*	6	0	0	0	0
Soda, regular*	13.3	0.142	12	2	23
Diet soda	0.3	0	0	0	0
Artificially sweetened drink	0.3	0	0	0	0
Sweetened tea*	9.37	0	0	0	0
Tea or coffee, with cream and/or sugar*	10	1	8	8	80
Sports/energy drinks*	6.5	0	0	0	0
Total Avg Daily Beverage calories					320
Total Avg Daily SUGAR-sweetened bev. calories					164
values in BOLD are calories from added sugar (+juice) TOTAL =					240

- Data drawn from intake form that included age, gender, race, initial BMI Z-score, verified food insecurity questions (Figure 2) and modified BEVQ-15 (Figure 1): a verified drink survey used to assess for kilocalories acquired from beverages. Follow-up BMI Z-score taken from nutritionist follow-up note (11, 12, 13)

Figure 2: Food insecurity questions

- Within the past 12 months we worried whether our food would run out before we got money to buy more.
- Within the past 12 months the food we bought just didn't last and we didn't have money to get more.

Results

Table 1: Demographic Data and sugar sweetened beverage (SSB) intake

Patients	N	Gender	Baseline SSB Intake (kcal)	Initial BMI Z-score
All-comers	193	Female: 116	382	2.511
		Male: 78		
Black	118 (61.1%)	Female: 70	455	2.583
		Male: 48		
Hispanic or Latino	44 (22.8%)	Female: 23	249	2.386
		Male: 21		
White	29 (15%)	Female: 21	273	2.410
		Male: 8		
Other	2 (1%)	Female: 1	386	2.45
		Male: 1		

Table 2: Food Insecurity Associated With Higher Sugar Sweetened Beverage Intake and Elevated BMI

Patient	N	Baseline SSB Consumption (kcal)	Initial BMI-Z Score
All-Comers Food Secure	135/185 (73%)	352	2.493
All-Comers Food Insecure	50/185 (27%)	470	2.554
Black Food Secure	78/114 (68.4%)	359	2.583
Black Food Insecure	36/114 (31.6%)	363	2.562
Hispanic Food Secure	33/41 (80.5%)	193	2.378
Hispanic Food Insecure	8/41 (19.5%)	501	2.461
White Food Secure	23/28 (82.1%)	228	2.351
White Food Insecure	5/28 (17.9%)	480	2.680
Others Food Secure	1/2 (50%)	336	2.500
Others Food Insecure	1/2 (50%)	436	2.400

Table 3: Food Insecurity Associated With Decreased Weight Loss in Whites and Hispanics

Patient	Follow Up	Initial BMI Z-Score	Follow Up BMI Z-Score	Difference
All-Comers	88 (45.6%)	2.488	2.465	- 0.023
All-Comers Food Secure	65/88 (73.9%)	2.467	2.450	- .017
All Comers Food Insecure	23/88 (26.1%)	2.544	2.527	- .017
Black Food Secure	33/50 (66%)	2.506	2.507	.001
Black Food Insecure	17/50 (34 %)	2.559	2.505	-.054
Hispanic Food Secure	19/24 (79.2%)	2.418	2.367	-.051
Hispanic Food Insecure	5/24 (20.8%)	2.524	2.566	.042
White Food Secure	12/12 (100%)	2.435	2.433	-.002
White Food Insecure	0/12 (0%)	N/A	N/A	N/A
Others Food Secure	1/2 (50%)	2.500	2.410	-.09
Others Food Insecure	1/2 (50%)	2.400	2.400	0

Results Continued

- Significant differences in baseline SSB intake across races with black individuals showing significantly higher SSB intake compared with other races
- Differences across races in obesity at baseline
- Significantly more black individuals self-identified as food insecure
- Overall higher SSB intake if food insecure, but not across all races; food insecurity associated with excessive SSB consumption in whites and Hispanics, but not blacks; similar trend seen regarding BMI and food insecurity
- Food security associated with increased weight loss at first follow-up amongst whites and Hispanics; the inverse was seen in the black subgroup.

Discussion

- Previous studies have considered the association between food insecurity and obesity, but with mixed results (9, 10).
- Previous studies shown higher amounts of sugar sweetened beverage consumption in food insecure households (8).
- Studies considering all three factors in this study: sugar sweetened beverage intake, obesity and food insecurity, are lacking.
- Our study showed food insecurity correlated with overall higher amounts of sugar sweetened beverage consumption, but with variations across races.
- Food insecure households showing overall higher initial BMI-Z scores and less weight loss at first follow up; the opposite trend was seen in black individuals.
- This study better allows for a more patient centered approach to caring for patients regarding healthy eating habits and maintaining a healthy weight.

1. Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity, and Obesity. Data, Trend and Maps [online]. [accessed Mar 30, 2020]. URL: <https://www.cdc.gov/nccdphp/dnpao/data-trends-maps/index.html>.
2. US Department of Health and Human Services. National Institutes of Health. Managing Overweight and Obesity in Adults: Systematic Evidence Review from the Obesity Expert Panel, 2013
3. Danese A, Tan M. Childhood maltreatment and obesity: Systematic review and meta-analysis. *Mol Psychiatry*. 2014;19(5):544.
4. Johansson K, Neovius M, Hemmingsson E. Effects of anti-obesity drugs, diet, and exercise on weight-loss maintenance after a very-low-calorie diet or low-calorie diet: A systematic review and meta-analysis of randomized controlled trials. *Am J Clin Nutr*. 2014;99(1):14-23. doi: 10.3945/ajcn.113.070052 [doi].
5. Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. the adverse childhood experiences (ACE) study. *Am J Prev Med*. 1998;14(4):245.
6. Elsenburg LK, van Wijk, K J E, Liefbroer AC, Smidt N. Accumulation of adverse childhood events and overweight in children: A systematic review and meta-analysis. *Obesity (Silver Spring)*. 2017;25(5):820-832. doi: 10.1002/oby.21797 [doi].
7. Lazorick S, Fang X, Crawford Y. The MATCH Program: Long-Term Obesity Prevention Through a Middle School Based Intervention. *Child Obes*. 2016;12(2):103-112. doi:10.1089/chi.2015.0073
8. Lee J, Kubik MY, Fulkerson JA. Diet Quality and Fruit, Vegetable, and Sugar-Sweetened Beverage Consumption by Household Food Insecurity among 8- to 12-Year-Old Children during Summer Months. *J Acad Nutr Diet*. 2019;119(10):1695-1702. doi:10.1016/j.jand.2019.03.004
9. Trapp CM, Burke G, Gorin AA, et al. The relationship between dietary patterns, body mass index percentile, and household food security in young urban children. *Child Obes*. 2015;11(2):148-155. doi:10.1089/chi.2014.0105
10. Metallinos-Katsaras E, Must A, Gorman K. A longitudinal study of food insecurity on obesity in preschool children. *J Acad Nutr Diet*. 2012;112(12):1949-1958. doi:10.1016/j.jand.2012.08.031
11. Hedrick VE, Savla J, Comber DL, et al. Development of a brief questionnaire to assess habitual beverage intake (BEVQ-15): sugar-sweetened beverages and total beverage energy intake. *J Acad Nutr Diet*. 2012;112(6):840-849. doi:10.1016/j.jand.2012.01.023
12. Hager ER, Quigg AM, Black MM, et al. Development and validity of a 2-item screen to identify families at risk for food insecurity. *Pediatrics*. 2010;126(1):e26-e32. doi:10.1542/peds.2009-3146
13. Taft, Natalie, MS, RDN, Collier, David, et al. How Sweet It Is: Traditional Sweet Iced Tea and the Diabetes Epidemic. *Nutr Today*. 2015;50(1):28-39. doi:10.1097/NT.0000000000000072.