

Dietary Intake Changes in Response to a Sugar-Sweetened Beverage Reduction Trial for
Various Supplemental Nutrition Assistance Program (SNAP) Eligibility Groups

Molly Catherine Bremer

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Valisa E. Hedrick, Committee Chair
Sarah A. Misyak
Wen You
Jamie M. Zoellner

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It is unknown if participation in the Supplemental Nutrition Assistance Program (SNAP) influences the magnitude of improvement in dietary intake in response to dietary interventions. Adults with low socioeconomic status (SES) tend to have lower overall dietary quality as compared to those with higher SES. However, low SES adults are more likely to receive benefits from SNAP, which gives nutrition assistance to millions of eligible Americans. The objective of this investigation is to examine differences in dietary intake between 1) SNAP participants, 2) those eligible for SNAP but not receiving (nonparticipants), and 3) those ineligible for SNAP, in response to an intervention targeting a reduction in sugar-sweetened beverage (SSB) consumption. Adult participants (n=146) from Southwest Virginia were enrolled in a 6-month, community-based trial, *SIPsmartER*. Participants provided SNAP enrollment status and 3 24-hour dietary recalls at baseline and 6-months. Dietary variables (SSB, macronutrients, etc.) and dietary quality data (Healthy Eating Index [HEI-2010]) were derived from nutritional analysis software (NDS-R 2011). Statistical analyses included descriptives and repeated-measures ANOVA. Although SNAP participation and eligibility status did not impact the overall effectiveness of this dietary intervention, the within group data suggests that those eligible for SNAP but not participating (n=30) may be at a disadvantage to improving their dietary intake as compared to those at a similar household income who receive SNAP benefits (n=56) or ineligible individuals at a higher income level (n=60). Future research is needed to explore if participant's ability to maintain long-term adherence to the dietary changes differs between groups.

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General Audience ABSTRACT

It is unknown if participation in the Supplemental Nutrition Assistance Program (SNAP) effects the magnitude of improvement in dietary intake in response to dietary interventions. Adults with lower income and educational attainment tend to have lower overall dietary quality as compared to those with higher income and education levels. However, lower income adults are more likely to receive benefits from SNAP, which is a program that gives nutrition assistance to millions of eligible Americans. The objective of this study is to investigate potential differences in dietary intake between 1) SNAP participants, 2) those eligible for SNAP, but not receiving (nonparticipants), and 3) those ineligible for SNAP, in response to an intervention targeting a reduction in sugar-sweetened beverage (SSB) consumption. Adult participants (n=146) from Southwest Virginia were enrolled in a 6-month, community-based trial, *SIPsmartER*. Participants provided SNAP enrollment status and 3 24-hour dietary food recalls at baseline and again at 6-months. Dietary variables (SSB, protein, fat, carbohydrates, etc.) and dietary quality data (Healthy Eating Index) were derived from nutritional analysis software (NDS-R 2011). Statistical analyses included descriptives and repeated-measures ANOVA. Although SNAP participation and eligibility status did not impact the overall success of this dietary intervention, other data suggests that those eligible for SNAP but not participating (n=30) may be at a disadvantage to improving their dietary intake as compared to SNAP eligible and receiving (n=56) or ineligible (n=60) participants. Future research is needed to explore if participant's ability to maintain long-term adherence to the dietary changes differs between groups.

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Chapter 1: Review of Literature	1
Supplemental Nutrition Assistance Program	1
Table 1. History of SNAP	3
Supplemental Nutrition Assistance Program Education (SNAP-Ed)	6
Socioeconomic Status Implications	7
Eligibility	8
Income	8
Table 2. SNAP Income Limits for October 1, 2015 – September 20, 2016	9
Benefits or “Allotments”	9
Table 3. Maximum Monthly SNAP Allotments For October 1, 2015 – September 20, 2016	10
Eligible Food Items	10
Figure 1. Demographic Characteristics of SNAP Participants: Fiscal Year 2010 Nutritional Status of SNAP Participants	11
Nutritional Status of SNAP Participants	12
Table 4. WIC Approved Foods	14
Dietary Intake	14
Dietary Quality	16
Beverage Consumption	17
References	19
Chapter 2: Dietary Intake Changes on an Intervention	25
Abstract	25
Introduction	24
Aims and Hypotheses	27

Methods	28
Subjects	28
Study Design	29
Methods	30
Healthy Eating Index	31
Healthy Beverage Index	32
Data Analysis	32
Results	32
Demographic Characteristics	32
Table 1. Comparison of SIP <i>smart</i> ER Participants’ Demographics Between SNAP Eligible and Receiving, Eligible and Not Receiving, and Ineligible	34
Dietary Intake	36
Table 2. Comparison of SIP <i>smart</i> ER (n=146) Dietary Intake Between Baseline and Six Months	36
Table 3. Comparison of Dietary Variable Intake Between SNAP Eligible and Receiving, Eligible and Not Receiving, and Ineligible Participants (n=146)	37
Figure 1. Comparison of Sugar-Sweetened Beverage (SSB) Consumption Between SNAP Eligibility Groups From Baseline to Six-Months	39
Dietary Quality	40
Table 4. Comparison of SIP <i>smart</i> ER (n=146) Healthy Eating Index Scores Between Baseline and Six Months	41
Table 5. Comparison of Healthy Eating Index Subcomponents and Total Scores Between SNAP Eligible and Receiving, Eligible and Not Receiving, and Ineligible Participants (n=146)	42

Figure 2. Comparison of Healthy Eating Index Total Score Between SNAP Eligibility Groups From Baseline to Six-Months	44
Beverage Consumption	45
Table 6. Comparison of SIP <i>smart</i> ER (n=146) Healthy Beverage Index Scores Between Baseline and Six Months	46
Table 7. Comparison of Healthy Beverage Index Subcomponents and Total Scores Between SNAP Eligible and Receiving, Eligible and Not Receiving, and Ineligible Participants (n=146)	47
Figure 3. Comparison of Healthy Beverage Index Total Scores Between SNAP Eligibility Groups From Baseline to Six-Months	49
Discussion	50
Conclusion	53
References	55
Chapter 3: Future Directions and Conclusion	61
References	65

Chapter 1: Review of Literature

Supplemental Nutrition Assistance Program

The Supplemental Nutrition Assistance Program (SNAP), the largest U.S. nutrition assistance program, is under the U.S. Department of Agriculture's (USDA) Food and Nutrition Service (FNS). Eligibility is determined by income, expenses, and assets.¹ Those with lower socioeconomic status (SES) are typically eligible and receive SNAP benefits. SNAP participants are more likely to have increased energy intake, which leads to poor health outcomes and obesity, resulting in additional medical costs.^{2,3,4} Possible factors that contribute to the correlation between SNAP participation and obesity may include limited access to fresh and affordable food, sedentariness (moving less than 2 hours per day), high levels of stress, depression, and anxiety, greater exposure to marketing of obesity-promoting products, and limited access to health care.^{5,6}

The level of benefits awarded to SNAP participants is based on the cost of the Thrifty Food Plan, a nutritious, low-cost diet plan developed by the USDA's Center for Nutrition and Policy Promotion.⁶ Benefits are awarded based on income and household size, with lower income households receiving higher benefits.

FNS administers SNAP at the federal level, by determining eligibility requirements and benefit levels. State agencies are responsible for daily operations of the program and play a key role in determining participant eligibility, calculating benefits, and issuing benefits to participants according to the federal rules.¹

Table 1 describes SNAP's history in detail, but recently there has been controversy over whether to align SNAP with the current version of the Dietary Guidelines for Americans (2015 DGA).⁷ Further debate exists when determining why and when sugar-sweetened beverages

(SSB) were added as eligible food items. In September 2010, New York City Mayor Michael Bloomberg proposed to the USDA to allow a pilot program to prohibit food stamp recipients from buying non-diet soda and other SSB in New York City.⁸ Mayor Bloomberg cited the costly negative health impacts (i.e., obesity and diabetes) associated with the products. In response to the heightened controversy, the USDA's FNS responded with a report titled "Implications of Restricting the Use of Food Stamp Benefits."⁹ In July 1941, "soft drinks, such as ginger ale, root beer, sarsaparilla, pop, and all artificial mineral water, whether carbonated or not" were removed from the eligible food stamp list. Merchants were told not to sell those items for blue or orange stamps.¹⁰ On April 8, 1964, the House of Representatives passed their version of the Food Stamp Act of 1964, which excluded "soft drinks, luxury foods, and luxury frozen foods as defined by the Secretary" from purchase. However, when the bill went back to the Senate, they removed the exclusion of soft drinks (and luxury foods) because they presented an "insurmountable administrative problem."¹⁰ The Senate protested the dictionary's definition of "soft drinks," stating "those not containing spirituous liquor, so that milk, orange juice, coffee, and other beverages would technically be excluded." The Senate cited studies that showed "food stamp households concentrated their purchases on good basic foods. For example, fruit and vegetable consumption was largely accounted for by seasonally abundant fresh items; potatoes, greens, tomatoes, cabbage, apples, and assorted citrus fruits." Nevertheless, Senator Paul H. Douglas of Illinois proposed an amendment to prohibit the use of food stamps to purchase "carbonated soft drinks."¹⁰ Senator Douglas' amendment was not included in the bill that the Senate passed unanimously on August 11, 1964, and President Johnson signed the bill into law on August 31, 1964.¹⁰

Table 1. History of SNAP

Events	Date	Changes
Initial Food Stamp Program	1939-1943	On May 16, 1939, the first Food Stamp Program (FSP) was headed by the U.S. Secretary of Agriculture. The FSP allowed participants to buy orange stamps that equaled their normal food expenditures. For every dollar worth of orange stamps purchased, the individuals would receive fifty cents worth of blue stamps that could be used to purchase surplus commodity foods. This program ended in 1943, when the administration determined unmarketable food surpluses and unemployment no longer existed. ¹
Pilot Food Stamp Program	1961-1964	Eighteen years later, on February 2, 1961, President John F. Kennedy initiated a new pilot FSP. In order to alleviate hunger and help people living in poverty and farmers, the new program still made it mandatory to purchase food stamps, but removed the concept of blue stamps for surplus foods. This pilot FSP emphasized the intake of perishable foods. By January 1964, the pilot FSP had reached 380,000 participants in 22 states. ¹
Food Stamp Act of 1964	1964	On January 31, 1964, President Johnson called on Congress to pass legislation that would make the FSP permanent. The overall goals of this act were to strengthen the agricultural economy and provide improved levels of nutrition for low-income households. The practical aims were to bring the FSP under congressional control in order to make regulations and laws. New provisions were set in place, such as prohibition of purchasing alcoholic beverages and imported foods, division of responsibilities between the state and federal governments, and limitation of expenditures to \$75 million the first year, \$100 million for the second year, and \$200 million for the third year. It was estimated that the national FSP would serve 4 million participants and cost \$360 million annually. ¹
Major Legislative Change	1970-1974	<p data-bbox="716 1413 1498 1560">During the early 1970s the main concern was how to balance FSP access with accountability. Major pieces of legislation during this time shaped the great restructuring of the FSP in 1977.¹</p> <ul style="list-style-type: none"> <li data-bbox="716 1560 1498 1602">• <i>P.L. 91-671 (Jan. 11, 1971)</i>¹ <ul style="list-style-type: none"> <li data-bbox="764 1602 1498 1675">○ Establishment of national standards of eligibility and work <li data-bbox="764 1675 1498 1787">○ Allotments were mandated to be equivalent to the cost of a nutritionally adequate diet (as opposed to “normal food expenditures”) <li data-bbox="764 1787 1498 1860">○ Purchase requirements were limited to 30% of household income <li data-bbox="764 1860 1498 1890">○

		<ul style="list-style-type: none"> ○ Formation of an outreach program ○ Expansion to Guam, Puerto Rico, and the Virgin Islands ● <i>Agriculture and Consumer Protection Act of 1973 (August 10, 1973)</i>¹ <ul style="list-style-type: none"> ○ Inclusion to drug addicts and alcoholics in treatment and rehabilitation centers ○ Semi-annual allotment adjustments ○ Mandated the USDA to form temporary eligibility standards during for disasters ○ Introduction of a new category of eligible items to purchase with food stamps: seeds and plants ● <i>P.L. 93-86 (July 12, 1974)</i>¹ <ul style="list-style-type: none"> ○ Authorized the USDA to pay 50% of all states' costs for administering the program ○ Requirement for efficient and effective administration by the state <p>The FSP was available nationwide by July 1, 1974 and participation was recorded at almost 14 million.¹</p>
The Food Stamp Act of 1977	1977	<p>The purchase requirement forced FSP participants to pay a defined amount of their income in order to received food stamps, which was seen as a barrier to participation.¹¹ EPR (eliminate the purchasing requirement) was implemented on January 1, 1979. The law also:¹</p> <ul style="list-style-type: none"> ● Removed categorical eligibility ● Created statutory income eligibility requirements at the poverty line ● Recognized 10 categories of excluded income ● Established the fair market value (FMV) test for evaluating vehicles as resources ● Penalized households whose heads voluntarily quit their jobs ● Restricted student and alien eligibility ● Removed the requirement that households must have cooking facilities ● Established the principle that stores that are eligible must sell a substantial amount of staple foods (i.e., meat, poultry, or fish, bread or cereal, vegetables or fruits, and dairy products)
Cutbacks of 1981-1982	1981-1982	<p>The Executive Branch and Congress scrutinized the large and costly FSP and legislation in 1981 and 1982 included:¹</p> <ul style="list-style-type: none"> ● Addition of gross income eligibility test in addition to the net income test for most households ● Temporary freeze of the shelter deduction cap adjustments as well as the standard deduction and constraints on future adjustments

		<ul style="list-style-type: none"> • Annual adjustments in food stamp allotments (no longer semi-annual) • Mandatory retrospective budgeting and periodic reporting • Increased consideration of non-elderly parents who reside with their children and non-elderly siblings who live together in one-household • Ban of Federal funding use for outreach purposes • Puerto Rico FSP replacement with a block grant for nutrition assistance
The Mid- to Late 1980s	1985-1990	From 1985-1987 there were small improvements (i.e., removal of sales tax on food stamp purchases, reinstatement of categorical eligibility, eligibility for the homeless, and increased nutrition education) in the FSP due to severe domestic hunger problems. The Hunger Prevention Act of 1988 and the Mickey Leland Memorial Domestic Hunger Relief Act in 1990 accomplished various feats such as, applying a multiplication factor to the Thrifty Food Plan costs, therefore increasing benefits, making outreach an optional activity for states, and instituting severe penalties for violations by individuals or participating firms. ¹
Electronic Benefit Transfer	1988-2004	Electronic Benefit Transfer (EBT) is an electronic system that permits a recipient to approve transfer of their government benefits from a Federal account to a retailer account to pay for products received. Food stamp recipients apply for their benefits as usual, by filling out a form at their local food stamp office. After eligibility and level of benefits are established, an account is established in the participant's name and food stamp benefits are deposited in the account monthly. The EBT card is a plastic card with a personal identification number that is assigned or chosen by the recipient to give access to the account. Some of the pros of EBT is that it decreases fraud by eliminating paper coupons, which were often stolen, lost, or sold. Another benefit of EBT is that during each food stamp transaction, EBT creates an electronic record which identify instances where food benefits are exchanged for cash, drugs, or other illegal goods. ¹
The Personal Responsibility and Work Opportunities Reconciliation Act of 1996	1996	The mid-1990s is considered a period of welfare reform. The Aid to Families with Dependent Children was replaced with a new block grant called Temporary Assistance to Needy Families. The Personal Responsibility and Work Opportunities Reconciliation Act (PRWORA) created major changes to the SNAP program, such as eliminating most legal immigrant's food stamp eligibility and placing a time limit on food stamp receipt for able-bodied adults without dependents who are not working at least 20 hours per week. ¹

The Farm Bill of 2002	2002	The 2002 Farm Bill expanded eligibility for food stamp benefits. During the 1990s, SNAP participation declined more than expected due to changes in the PRWORA (i.e., immigrant’s eligibility and time limit) and high unemployment rates. In order to increase participation, the USDA focused on program access and simplification of program rules. Some reforms to the bill were loosening eligibility requirements for immigrants, adjusting the standard deduction to vary by household size and each year for inflation, and removing the cost neutrality requirement for EBT systems. In 2000, food stamp participation was at 17.2 million and increased to 26 million participants by mid-2006. ¹
The Farm Bill of 2008	2008	Participation reached an all-time high of 29 million people per month in August 2008 due to the combination of the 2002 Farm Bill and the focus on outreach and increased access to FSP benefits participation. Part of the increase in participation rate might have been due to the economic slowdown and rise in unemployment rates. The 2008 Farm Bill was enacted May 22, 2008. The law changed the name of the Food Stamp Act of 1977 to the Food and Nutrition Act of 2008 and the name of the federal program to the Supplemental Nutrition Assistance Program or SNAP. The 2008 Farm Bill institutionalized traditional FNS priorities: strengthening integrity, upholding state flexibility, using nutrition education to improve health, and increasing access. ¹

Supplemental Nutrition Assistance Program Education (SNAP-Ed)

SNAP-Ed is a federally funded grant program for individuals who are eligible for SNAP.¹² The USDA’s FNS and National Institute of Food and Agriculture (NIFA) oversee SNAP-Ed. FNS determines national policies and procedures by providing program monitoring and administrative oversight, facilitates resource sharing, and delivers technical assistance. NIFA facilitates communication among federal, state, and local partners, and provides leadership to cooperative extension/land-grant university program implementers for effective nutrition education and obesity prevention interventions. The USDA’s Economic Research Service (ERS) supports nutrition education through research and evaluation studies.¹²

The purpose of SNAP-Ed is to provide evidence-based information to improve the health of SNAP eligible persons. SNAP-Ed teaches SNAP participants and income-eligible SNAP individuals about proper nutrition and cost effective tips for purchasing food.¹³ SNAP-Ed is recommended but not required for SNAP participants. It should be noted that any one is eligible for SNAP-Ed, regardless of SNAP eligibility and participation status. The goal of SNAP-Ed is to provide educational programs, messaging, and policy, systems, and environmental interventions through community/public health approaches. Specifically, SNAP-Ed focuses on the likelihood that people eligible for SNAP will make healthy food choices within a limited budget and choose physically active lifestyles consistent with the DGA and the Food Guidance System.¹² SNAP-Ed participants also learn methods to increase physical activity. SNAP-Ed builds partnerships with community organizations where the communities have social marketing campaigns, nutrition education classes, among other events.¹³ SNAP-Ed serves as an educational opportunity for individuals who are SNAP eligible.

Socioeconomic Status Implications

Socioeconomic status (SES) is a term used to describe education, income, and occupation.¹⁴ Low SES is associated with a higher likelihood of increased consumption of SSB, and fruit drinks among adults and overall lower-quality diets than nonparticipants.^{15,16} This increase in beverage intake and decrease in dietary quality of low SES individuals can lead to poor health outcomes such as obesity, diabetes, and hypertension.³

The Centers for Disease Control and Prevention describes the obesity pandemic as “common, serious and costly.”⁴ From 2011-2014, over one-third (36.5%) of adults in the U.S. were obese (body mass index [BMI] ≥ 30 kg/m²).^{4,17} Obesity is correlated with chronic health conditions such as heart disease, type 2 diabetes and certain types of cancer, all of which are

some of the leading causes of preventable death.⁴ In 2008, the U.S. spent an estimated \$147 billion on medical costs.⁴ The medical costs for people who were obese were \$1,429 higher compared to those of normal weight.⁴ Americans who live in the most poverty-dense counties are those most prone to obesity. Counties with poverty rates >35% have obesity rates 145% greater than wealthier counties.⁵

Eligibility

To obtain SNAP benefits, households must meet certain criteria, such as a resource and income test. Each household may have \$2,250 in countable resources (i.e., bank account), or \$3,250 if at least one person is 60 years or older or disabled. Certain resources, such as home and lot, Supplemental Security Income (SSI) from Temporary Assistance for Needy Families (TANF), and most retirement plans, are not counted in the resource and income test. Individual states determine procedures for handling vehicles, however, most states exclude the household's primary vehicle as an asset.¹⁸

Income

Households must meet income tests unless all members are receiving TANF, SSI, or some form of government general assistance. Most households are required to meet both gross and net monthly income limits (**Table 2**).¹⁸ Households with an elderly person or a person who is receiving certain types of disability payments only have to meet the net monthly income limits.¹⁸ Gross monthly income must be at or below 130% of the poverty line or \$2,177 (about \$26,100 a year) for a three-person family in fiscal year 2016. Net monthly income, or income after deductions are applied for items such as housing costs and child care, must be less than or equal to the poverty line (about \$20,100 a year or \$1,675 a month for a three-person family in fiscal year 2016).¹⁹

Table 2. SNAP Income Limits for October 1, 2015 – September 20, 2016^{ab}

Household Size	Gross monthly income (\$) ^c (130 percent of poverty level)	Net monthly income (\$) ^d (100 percent of poverty level)
1	1,276	981
2	1,726	1,328
3	2,177	1,675
4	2,628	2,021
5	3,078	2,368
6	3,529	2,715
7	3,980	3,061
8	4,430	3,408
Each additional member of household	+451	+347

^aTable adapted from Food and Nutrition Service website⁸

^bSNAP gross and net income are higher in Alaska/Hawaii

^cGross income: household’s total, non-excluded, income, before any deductions have been made

^dNet income: gross income minus allowable deductions

Benefits or “Allotments”

An allotment is a term that represents the amount of benefits the household receives.

Table 3 displays the allotment eligibility standards for household size versus the maximum monthly allotment created by USDA’s FNS¹⁸. Household allotment is calculated by multiplying the net monthly income by 0.3 (since SNAP households are expected to spend about 30 percent of their resources on food). The result is subtracted from the monthly maximum allotment for the household size.¹⁸

Table 3. Maximum Monthly SNAP Allotments For October 1, 2015 – September 20, 2016^a

Household Size	Maximum Monthly Allotment (\$)
1	194
2	357
3	511
4	649
5	771
6	925
7	1,022
8	1,169
Each additional person	+146

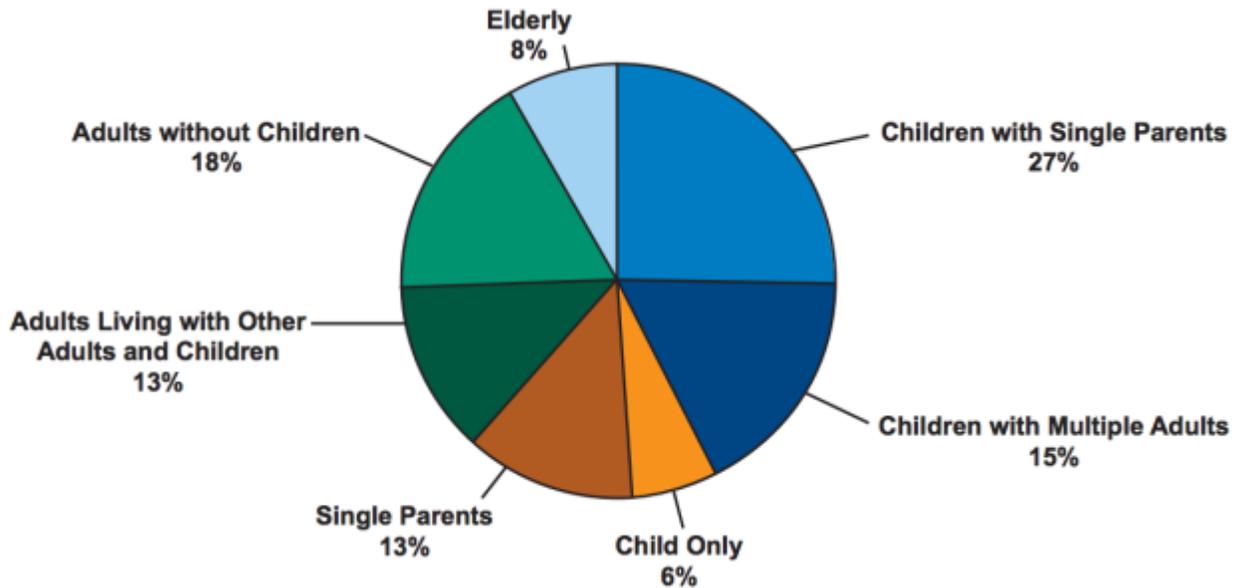
^aTable adopted from the Food and Nutrition Service website¹⁸

Eligible Food Items

According to The Food and Nutrition Act of 2008, an eligible food is any food item or food product for home consumption, as well as seeds and plants, used to produce food for consumption.²⁰ SNAP participants often find it challenging to know the purchasing benefits with the Electronic Benefits Transfer (EBT).²¹ Eligible food items include breads and cereals, fruits and vegetables (fresh, frozen, canned, dried, and juices), meats, fish, poultry, dairy products, soft drinks, candy, cookies, snack crackers, ice cream, seafood steak, and bakery cakes.²⁰ Ineligible food items include beer, wine, liquor, cigarettes or tobacco, as well as nonfood items, such as pet foods, soaps, paper products, household supplies, vitamins/minerals and medicines, hot food, or food eaten in the store (i.e. ready-to-eat deli items).²⁰ Very rarely, restaurants in some areas are authorized to accept SNAP benefits from qualified homeless, elderly, or disabled people in

exchange for low-cost meals. The vast majority of participants cannot use SNAP benefits at restaurants.²⁰

Figure 1. Demographic Characteristics of SNAP Participants: Fiscal Year 2010^a



^aFigure from Building a Healthy America²²

SNAP serves a large and diverse population of Americans. SNAP participation reached 43,376,981 persons in June 2016.²³ As seen in **Figure 1**, almost half (47%) of SNAP participants are children. Most of the households with children are single parent families while 8% of program participants are elderly (≥ 60 years old).²² Some states have had consistently high and low rate trends compared to others. States with higher SNAP participation rates include, Iowa, Illinois, Maine, Michigan, Missouri, Oregon, Tennessee, Washington, and West Virginia, while California, New Jersey, Nevada, Utah, and Wyoming had significantly lower participation rates.²² As of August 2016, Virginia had a total of 309,207 households and 815,137 total persons participating in SNAP.²³

Nutritional Status of SNAP Participants

There are many barriers to obtaining a nutritionally dense diet for SNAP participants. According to a review by a diverse group of nutrition experts, the high cost of nutrient-rich foods, inadequate SNAP benefits, environmental factors associated with poverty, and limited access to purchasing healthy foods were four barriers that influenced nutritional quality of the diet of SNAP participants.²⁴ These experts generated six suggestions to help overcome these barriers:

1. Incentives to purchase nutrient-rich food that is consistent with the DGA
2. Limiting the purchase of nutrient-poor foods and beverages with benefits
3. Improving nutrition education
4. Modifying the frequency of SNAP benefit distribution
5. Enhancing the SNAP retailer environment
6. Increasing state and federal coordination and consistency of program implementation²⁴

Out of these six suggestions, this review will focus on the impact of improving nutrition education on dietary intake. It is important to note that education for SNAP participants is not required; however, they may also participate in Women, Infants, and Children (WIC), which provides mandatory nutrition education, which may confound some findings.

WIC is part of the Special Supplemental Nutrition Program was piloted in 1972. WIC provides federal grants to states for supplemental foods, health care referrals, and nutrition education for low-income pregnant, breastfeeding, and non-breastfeeding postpartum women, and to infants and children up to age five who are found to be at nutritional risk.²⁵ “Nutritional risk” meaning that the applicants are screened by health professionals for medical based risks (i.e., anemia, underweight, smoking, maternal age, history of pregnancy complications, or poor

pregnancy outcomes) and diet-based risks (i.e., not consuming the DGA recommended amount of protein or iron in their diet).²⁵ Applicants must have income at or below 185% of the U.S. Poverty Income Guidelines or be enrolled in TANF, SNAP, or Medicaid.

WIC is a public health nutrition program under the authority of USDA and is funded annually through the U.S. Senate and House Appropriations Committee.²⁶ The USDA's FNS drafts the annual budget proposal for the federal fiscal year (Oct 1- Sept 30). Congress then determines the level of funding that WIC will receive each year. After the appropriation passes Congress and is signed into law, grants are provided to each state and administered at the local level by county and city health centers, or private nonprofits.²⁶

Numerous studies show that WIC has had positive health outcomes. The program has reduced premature births, fetal and infant deaths, the incidence of low-iron anemia and has increased access to regular health care, pregnant women's consumption of key nutrients (i.e., iron, protein, calcium, and Vitamins A and C, diet quality).²⁶ In 2007 the food packages were revised for the first time since 1980 to align with the Dietary Guidelines for Americans and infant feeding practice guidelines of the American Academy of Pediatrics.²⁷ It was mandated that all WIC state agencies had to implement the new packages by October 2009. **Table 4** details the specifics of the updated WIC approved foods list. These new packages kept some of the basic WIC foods: milk, cheese, eggs, fruit juice, iron-fortified cereal, beans, peanut butter, infant formula, and (for breastfeeding women) tuna. The new packages reduced the amount of milk, cheese, eggs, fruit juice, and sometimes infant formula. They also offer fruits, vegetables, whole grain bread, moved from low-fat or non-fat milk, and the substitution of soymilk, tofu, and yogurt for milk and cheese.²⁷ It should be noted that WIC's approved foods list differs from

SNAP’s eligible foods list, possibly influencing dietary intake, dietary quality, and beverage consumption of SNAP eligible and participating individuals who also receive WIC benefits.

Table 4. WIC Approved Foods^a

WIC Foods	Allowable Alternatives	Key Nutrients Provided
Fruits and vegetables	Fresh, frozen, canned, and dried	Vitamins A, C, and E, folate, potassium, fiber
Commercially prepared baby fruits/vegetables and meat	Fresh bananas	Vitamins A, C, and E, folate, potassium, fiber, (iron and zinc in baby meat)
Milk	Soy beverage and tofu	Protein, calcium, vitamins A and D, folate, riboflavin
Whole Grain Cereals	None	Iron, B vitamins, folate, fiber, zinc
Whole wheat bread	Brown rice, oatmeal, whole grain barley, bulgur, soft corn or whole wheat tortillas	Iron, B vitamins, magnesium, zinc, fiber
Light tuna	Salmon, sardines, mackerel	Protein, folate
Canned and dry beans/peanut butter	None	Protein, B vitamins, folate, fiber
Cheese	None	Protein, calcium, vitamins A and D, riboflavin
Juice	None	Vitamin C, folate
Eggs	None	Protein, vitamins A and D
Iron-fortified infant formula	Best alternate source of essential nutrients for non-breastfeeding infants	Iron

^aTable from the National WIC Association website²⁶

Dietary Intake

Various studies showed mixed results of improvement for dietary intake for SNAP participants and nonparticipants. A USDA study looked at foods typically purchased by SNAP households to identify 1) what food items are purchased by SNAP households and 2) how do foods purchased by SNAP households compare to food purchases made by non-SNAP households.²⁸ The report found that both SNAP and non-SNAP households had similar

purchasing patterns. The data also revealed that expenditures for SNAP households and non-SNAP households purchased most of their food in a relatively small number of similar food item categories, showing similar food choices between the two groups.²⁸

A cross-sectional analysis 1999-2008 NHANES data (n=3,835) showed that participation in the FSP had a positive association with the consumption of meats, added sugars, total fat, and SSB.¹⁶ Although no adults met all the food and nutrient guidelines for this study, approximately 13-22% of low-income adults did not meet any food and nutrient guidelines.¹⁶ When compared with SNAP nonparticipants, participants consumed 39% fewer whole grains, 44% more fruit juice, 56% more potatoes, 46% more red meat, and women consumed 61% more SSB.¹⁶ This study helped further emphasize the disparities in dietary intake between SNAP participants and nonparticipants. Compared to the DGA, very few low-income adults consumed the recommended amounts of whole grains, fruits, vegetables, fish, and nuts/seeds/legumes, regardless of SNAP-participation status.²²

Conversely, some studies show that dietary intake has also been shown to improve with SNAP participation. Randomly selected mothers or primary caregivers (n = 6,355) participated in a cross-sectional telephone survey that was conducted using the Automated Self-administered 24-Hour Recall dietary assessment tool.²⁹ The purpose was to measure fruit and vegetable intake, calories from high-fat foods, SSB intake, and dietary quality (HEI -2010). Researchers found that mothers from high SNAP-Ed reach census tracts ate more cups of fruits and vegetables and consumed fewer calories from high-fat foods. It was determined that SNAP-Ed was effective in altering consumption of certain food and beverage types, but not at improving overall dietary quality.²⁹ This study identified a need for more studies to investigate caloric balance in

association with levels of SNAP-Ed interventions.²⁹ Overall, SNAP-Ed has shown to have a positive influence on increasing dietary intake of certain foods (i.e., fruits and vegetables).^{29,30}

Dietary Quality

Most Americans' diets, including both SNAP participants and nonparticipants, do not meet the standards for the DGA according to results measured by the Healthy Eating Index (HEI). The HEI contains 12 food groups/categories and is used to evaluate dietary quality. The overall average score on the HEI-2005 was a 58 out of a possible 100.²² SNAP participants scored slightly lower (52) compared to income eligible nonparticipants (56) and higher-income nonparticipants (56).²² Increasing SNAP participants' food expenditure is shown to improve diet quality, but only the improvement is very small. In one observational study, a 10% increase in the amount SNAP participants can spend on food increases a household's HEI-2005 score by approximately 0.30%.³⁰ According to HEI scores from 1999-2004, SNAP participants were shown to have slightly poorer dietary quality when compared to those not participating in SNAP.

In 2014, a systematic review summarized 25 peer-reviewed studies (from January 2003 to August 2014) that provided data on dietary quality and dietary intake for SNAP participants and nonparticipants.³¹ The review found that daily caloric, macronutrient, and micronutrient intake of SNAP participants did not vary from that of nonparticipants; but dietary quality did differ. Adult SNAP participants scored lower on the HEI than nonparticipants.³¹ It was concluded that SNAP effectively alleviates food insecurity in terms of caloric, macronutrient, and micronutrient intake, but SNAP participants have a harder time meeting key dietary guidelines. Andreyeva et. al explains that this difference in dietary quality may be due to SNAP participants using the most financially efficient method to obtain calories (inexpensive and nutrient-poor food products).³¹ Consuming higher energy-dense foods might also explain why

SNAP participants eat fewer meals per day, but their energy intake is not different than that of nonparticipants.³¹

Beverage Consumption

According to a systematic review of the literature, SSB intake is significantly greater for low-income SNAP participants versus higher-income SNAP nonparticipants.³¹ A cross-sectional analysis of SSB consumption by source of purchase using 24-hour dietary recall data from NHANES 2003-2010 (n = 17,891) was used to examine the association between SNAP participation and SSB calorie consumption.³² It was found that SSB account for approximately 12% (258 kcal) of total daily caloric intake for SNAP participants compared to SNAP nonparticipants who consumed 6% (153 kcal) of total daily intake of calories from SSB. SSB prevalence and caloric intake trends were flat over the 2003-04 to 2009-10 period, which may be a result of increased SNAP-Ed interventions.³²

Consumption of SSB, alcohol, and other caloric beverages (juice and milk) was compared between current SNAP participants, former participants, and nonparticipants utilizing one day of dietary intake data from the NHANES 2005-2008 (n = 4,594) adults 20 years-old and older.³³ This study controlled for observable characteristics (i.e., gender and race), and in contrast the findings from a study using NHANES 2003-2010 data, it was found that SNAP participants, former participants, and nonparticipants were all equally likely to consume SSB.^{32,33} There were also no differences in alcoholic beverage (which cannot be purchased with SNAP benefits) or juice and milk consumption between SNAP participants and nonparticipants.³³ In the 2016 USDA report that compared purchasing patterns between SNAP and non-SNAP households, both households spent more money on soft drinks than any other item (SNAP households spend 5% vs. non-SNAP households spend 4%).²⁸ SNAP participation and adherence to water and SSB

intake recommendations were studied in a cross-sectional, random-digit phone survey with questions from the Behavioral Risk Factor Surveillance System and beverage intake questionnaire (n = 930).³⁴ Recommendations for water were more easily attained than SSB recommendations, highlighting the difficulty in decreasing SSB consumption. No correlation was found between SNAP participation and meeting SSB recommendations.³⁴ After reviewing the literature, most studies found no significant differences in beverage consumption based on SNAP eligibility and participation status.

The inconsistencies between the findings in these studies highlight the need for more beverage intake research among SNAP participants and nonparticipants.^{31,29,33,34} Although informative, the previous cross-sectional work is limited by the lack of literature addressing the impact of SNAP participation on the effectiveness of interventions.

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Chapter 2: Dietary Intake Changes on an Intervention

Abstract

It is unknown if participation in the Supplemental Nutrition Assistance Program (SNAP) influences the magnitude of improvement in dietary intake in response to dietary interventions. Thus, the objective of this investigation is to examine differences in dietary intake between SNAP participants, those eligible for SNAP, but not receiving (non-participants), and those ineligible for SNAP, in response to an intervention targeting a reduction in sugar-sweetened beverage (SSB) consumption. Adult participants (n=146) from Southwest Virginia were enrolled in a 6-month, community-based trial. Participants provided SNAP enrollment status and three 24-hour dietary recalls at baseline and 6-months. Dietary variables (SSB, macronutrients, etc.) and dietary quality data (Healthy Eating Index [HEI-2010]) were derived from nutritional analysis software (NDS-R 2011). Statistical analyses included descriptives (mean \pm standard deviation and frequencies) and repeated-measures ANOVA. Although all participants improved their dietary quality and decreased SSB consumption over the intervention, when comparing the magnitude of change between SNAP participants (n=56), non-participants (n=30), and ineligible-participants (n=60) no significant differences in dietary intake or quality were found. It is important to note that participation in SNAP and eligibility status did not attenuate nor strengthen the effectiveness of this dietary intervention. While similar strategies may prove effective, it is essential to explore if participant's ability to maintain long-term adherence to the dietary changes differs between groups.

Introduction

The Supplemental Nutrition Assistance Program (SNAP) is the United States' largest nutrition assistance program. During the fiscal year of 2014, roughly 46 million people participated in SNAP, contributing to about \$70 billion in benefits.³⁵ Several studies have explored the relationship between SNAP participants and nonparticipants. Particularly, they have investigated differences in dietary intake, dietary quality, and beverage consumption between the two groups.

According to a recent United States Department of Agriculture (USDA) report, it was demonstrated that SNAP participants and nonparticipants have similar purchasing patterns, which might influence their dietary intake.²⁸ In this study, SNAP participants were identified if they had any transaction in which SNAP was used to pay for at least half of the total purchase. All other transactions were recognized as SNAP nonparticipants. Despite the USDA report, most studies reviewed found that people with SNAP had better dietary intake of certain foods (i.e., fruits and vegetables) as compared to nonparticipants.^{29,36}

According to measurement by the Healthy Eating Index (HEI), SNAP participants and nonparticipants, do not meet the standards for the Dietary Guidelines for Americans (DGA). However, even when controlling for food expenditures, SNAP participants still scored lower (HEI overall score =52) compared to income eligible nonparticipants (HEI overall score = 56).²² A 2014 systematic review summarized 25 peer-reviews studies and found that daily caloric, macronutrient, and micronutrient intake of SNAP participants did not vary from that of nonparticipants.³¹ Despite the lack of difference in dietary intake between SNAP participants and nonparticipants, the study found that SNAP nonparticipants had better dietary quality as compared to SNAP participants.³¹

Some studies have found sugar-sweetened beverage (SSB) consumption differs between the groups. Specifically, one study found that SSB account for approximately 12% (258 kcal) of total daily caloric intake for SNAP participants and 6% (153 kcal) of total daily caloric intake for nonparticipants. Conversely, one study looked at NHANES 2005-2008 data (n=4,594) to compare consumption of SSB, alcohol, and other caloric beverages (juice and milk) between SNAP participants and nonparticipants. This study was consistent with many other studies reviewed that showed SNAP participants and nonparticipants were equally likely to consume SSB, alcohol, juice, and milk.^{32,33,34} However, no studies have explored the effect SNAP eligibility and participation have on the effectiveness of dietary interventions. With such a large population participating in SNAP, it is important to assess the impact SNAP participation has on participants' ability to adhere to dietary intervention recommendations.

Aims and Hypotheses

The purpose of this investigation is to compare dietary changes in response to a sugar-sweetened beverage (SSB) reduction trial between SNAP eligible and participating, eligible and not participating, and ineligible participants. Specifically, we aim to look at changes in dietary intake components, dietary quality using the Healthy Eating Index [HEI]), and beverage consumption using the Healthy Beverage Index [HBI]).

Aim 1: Does eligibility and participation in SNAP enhance, diminish, or not impact the effectiveness of a SSB reduction trial at improving dietary intake components (calories, macronutrients, added sugar, energy density, SSB)?

Hypothesis 1: The majority of available studies showed higher quality dietary intake between SNAP participants and nonparticipants.^{28,29,36} Thus, it is hypothesized that SNAP eligible and receiving participants will show differences in dietary intake over a

six-month intervention as compared to SNAP eligible and not receiving and ineligible participants.

Aim 2: Does eligibility and participation in SNAP enhance, diminish, or not impact the effectiveness of a SSB reduction trial at improving dietary quality?

Hypothesis 2: Several studies showed lower HEI scores between SNAP participants as compared to nonparticipants.²² It is hypothesized that SNAP eligible and receiving participants will show no differences in dietary quality over a six-month intervention as compared to SNAP eligible and not receiving and ineligible participants.

Aim 3: Does eligibility and participation in SNAP enhance, diminish, or not impact the effectiveness of a SSB reduction trial at improving beverage quality?

Hypothesis 3: Overall, the literature reviewed was mixed, with some studies finding that SNAP nonparticipants consumed greater amounts of SSB, milk, and fruit juice compared to SNAP participants. Other studies showed no correlations based off of SNAP eligibility and participation status.^{32,33,34} No studies have examined changes in HBI scores for SNAP eligible and receiving, eligible and not receiving, and ineligible participants. However, as *SIPsmartER* is a SSB reduction trial, it is hypothesized that SNAP eligible and receiving participants will show differences in beverage quality over a six-month intervention as compared to SNAP eligible and not receiving and ineligible participants.

Methods

Subjects

Adult participants (n = 301) from Southwest Virginia were enrolled in a six-month, community-based behavioral randomized controlled trial known as Talking Health.³⁷ The

primary objective of Talking Health was to determine the effectiveness of a six-month intervention aimed at decreasing SSB consumption (SIP*smart*ER), as compared to a group targeting physical activity behaviors (MoveMore).³⁷ For the purpose of this secondary analysis, only data from participants randomized into SIP*smart*ER were used (n = 155).

Study Design

SIP*smart*ER was a six-month intervention developed using the Theory of Planned Behavior and health literacy concepts.³⁷ The primary goal of SIP*smart*ER was to decrease SSB consumption to the recommended less than eight fluid ounces per day. In order to target SSB reduction, participants were educated on all beverage categories, and a green light, yellow light, red light beverage system was developed to aid participants in making informed beverage choices.³⁷

There were three small group classes (90-120 minutes in duration) with approximately 6-10 participants. Classes included hands-on demonstrations, verbal presentations, pictorial information, and materials with simplified language (i.e., <8th grade, when possible). The SIP*smart*ER condition evaluated SSB media messages and incorporated basic, computational, and analytical nutrition numeracy skills.³⁷ During the first class, each participant completed a personal action plan that included motivational factors to change behaviors, behavioral goals, as well as barriers and strategies for achieving those goals. Behavioral diaries were given to each participant and participants were encouraged to write in them daily, serving as the basis of information they report to the interactive voice response (IVR).³⁷ One week after the first class, but prior to starting the IVR calls, each participant received a live teach back telephone call. The purpose of the teach back call was to promote comprehension of objectives and recall key concepts from the first class.³⁷

Participants received 11 IVR calls (a typical IVR call ranged from 5-10 minutes), every week for the first three weeks and then bi-weekly for the remainder of the intervention. The calls were designed to reinforce key intervention messages, provide new content, and lead participants through a personal action planning procedure. The calls began with participants entering their previous week's behavior (i.e., *SIPsmartER* = average daily fluid ounces of SSB). Based on the participant's progress, he/she was routed into one of three IVR paths: 1) meeting or exceeding goals, 2) not meeting goals, but some progress, or 3) no progress. In order to strengthen perceptions of behavioral control and increase behavioral intentions, the feedback loop and behavioral reinforcement strategies were customized for each path. As participants reached the recommended level of SSB intake, the calls facilitated maintenance goals. Participants were able to identify new barriers that may have been encountered and to change strategies used to overcome ongoing or new barriers.³⁷

Even though *SIPsmartER* is a SSB-reduction trial, it is beneficial to analyze other variables (i.e., dietary intake components and dietary quality variables) besides SSB-related variables. The rationale behind this concept is called spontaneous change. It was found that there were many spontaneous changes that occurred for *SIPsmartER* participants as compared to the MoveMore group.⁴¹ There were significant HEI improvements for empty calorie, total vegetable, and HEI scores as well as significant decreases in total energy intake, trans fat, added sugars, and total beverage energy. Despite *SIPsmartER* participants' involvement in a SSB-reduction trial, they experienced additional spontaneous and positive dietary changes.⁴¹

Methods

Talking Health data, including demographics (age, gender, race, ethnicity, income level, employment status, number of children, education level, and SNAP participation),

anthropometrics, and dietary intake, were collected at baseline and six-months between March 2012-March 2014.³⁸

Height, weight, and calculated body mass index (BMI) were collected at baseline and six-months. A calibrated digital Tanita scale (Model: 310GS) and portable research-grade stadiometer were used to assess participant's body weight (nearest 0.1 kg) and height (cm), without shoes and in light clothing.

Participants completed three 24-hour dietary recalls at both baseline and six-months. Research assistants, supervised by PhD-level registered dietitian nutritionists, conducted three non-consecutive 24-hour dietary recalls over a two-week period (two weekdays and one weekend).³⁷ The first recall was completed during the in-person assessment and two additional unannounced recalls were completed via telephone. The dietary recalls were analyzed using Nutrition Data System for Research (NDS-R) nutritional analysis software (Nutrition Coordinating Center, 2011). Intake of specific dietary variables, including total energy intake (kcal), energy density (kcal/g), carbohydrates (% kcal), protein (% kcal), fat (% kcal), added sugar (g and % kcal), and SSB (fl oz) were extracted from the recalls.³⁷

Healthy Eating Index

The HEI-2010 is a method of assessing dietary quality. The HEI-2010 is comprised of twelve food groups/categories. Dietary quality data (HEI-2010) was calculated from 24-hour dietary recalls using NDS-R (2011), including HEI subcomponents (total fruit, total vegetable, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, fatty acids, refined grains, sodium, empty calories) and total HEI scores³⁷. For this secondary analysis, total fruit, total vegetable, whole grains, total protein foods, refined grains, empty calories, sodium, fatty acids, and total HEI scores were assessed.

Healthy Beverage Index

The HBI is a method of assessing overall beverage intake quality.³⁹ The HBI is composed of eight beverage categories as well as a total beverage energy and fluid consumption components.³⁹ HBI subcomponent scores (water, tea and coffee, low-fat milk, diet soda, 100% fruit juice, alcohol, whole milk, sugar-sweetened beverages, total beverage calories, total fluid consumption) and total HBI score were calculated from NDS-R dietary data.⁴⁰

Data Analysis

Statistical analyses were performed using SPSS statistical software version 23 (IBM, Armonk, NY, USA, 2015). As nine participants did not return at six-months and their SNAP eligibility information was not recorded at baseline, they were excluded from this secondary analysis, thus giving a final analytical sample size of 146 participants. Demographics were analyzed using descriptive statistics (mean±standard deviation and frequencies) and demographic differences between SNAP eligible and participating, eligible and not participating, and ineligible participants were assessed via ANOVAs (comparing means across conditions) and χ^2 tests (comparing proportions across conditions). Repeated-measures ANOVAs were used to assess for differences between groups (i.e., SNAP eligible and participating, eligible and not participating, and ineligible participants) over time. A Bonferroni correction (0.05/20) was applied to set the significance level at $p \leq 0.0025$. Results of the intention-to-treat (baseline-value-carried-forward) analyses are presented.^{42,43}

Results

Demographic Characteristics

Overall, SIP*smart*ER participants were mostly Caucasian (90%) females (79.5%), with a mean age of 41.8 ± 13.4 years and a mean BMI of 33.2 ± 9.2 kg/m² (56% were considered obese

[BMI \geq 30 kg/m²]). Two-thirds of SIP*smart*ER participants also had an education level greater than a high school diploma and a mean annual income of \$21,473 \pm 15,742.

Comparison of SNAP eligible and receiving (n=56), eligible and not receiving (n=30), and ineligible participants (n=60) showed no difference between gender, age, race, ethnicity, or BMI. Yet, the education level attainment between the three groups significantly varied (p \leq 0.001), with SNAP eligible and receiving having the lowest number of participants with an education level greater than high school graduate. Additionally, income levels varied significantly (p \leq 0.001), with SNAP eligible and receiving (\$11,071 \pm 5,638) and SNAP eligible and not receiving (\$11,500 \pm 6,215) having significantly lower mean incomes as compared to SNAP ineligible participants (\$36,167 \pm 13,697 (**Table 1**)).

Table 1. Comparison of SIPsmartER Participants' Demographics Between SNAP Eligible and Receiving, Eligible and Not Receiving, and Ineligible

Characteristics	Total SIPsmartER Participants (n=146) n (%)	SNAP Eligible and Receiving (n=56) n (%)	SNAP Eligible and Not Receiving (n=30) n (%)	SNAP Ineligible (n=60) n (%)	Test Statistic & Significance Between 3 Groups
Sex					
Male	30 (20.5)	7 (12.5)	10 (33)	13 (22)	$\chi^2 = 5.272$ p = 0.072
Female	116 (79.5)	49 (87.5)	20 (67)	47 (78)	
Age (years); mean±SD	41.8±13.4	41.8±13.3	38.5±14.6	43.5±12.7	F = 1.417 p = 0.570
Race					
White	132 (90)	49 (87)	26 (87)	57 (95)	$\chi^2 = 7.264$ p = 0.297
African American	10 (7)	5 (9)	3 (10)	2 (3)	
Other	1 (1)	0 (0)	1 (3)	0 (0)	
More than 1 race	3 (2)	2 (4)	0 (0)	1 (2)	
Ethnicity					
Hispanic or Latino	2 (1)	0 (0)	2 (7)	59 (98)	$\chi^2 = 9.073$ p = 0.059
Not Hispanic or Latino	141 (97)	54 (96)	28 (93)	0 (0)	
Not sure	3 (2)	2 (4)	0 (0)	1 (2)	
BMI (kg/m ²); mean±SD	33.2±9.2	34.0±9.4	33.4±8.9	32.2±9.3	F = 0.564 p = 0.570
BMI categories					
Underweight (≤18.4)	2 (1.5)	1 (2)	0 (0)	1 (2)	$\chi^2 = 4.697$ p = 0.583
Normal weight (18.5-24.9)	28 (19)	7 (12.5)	6 (20)	15 (25)	
Overweight (25-29.9)	34 (23.5)	16 (28.5)	5 (17)	13 (21.5)	
Obese (≥30)	82 (56)	32 (57)	19 (63)	31 (51.5)	

Education Level					$\chi^2 = 44.185$ p ≤ 0.001
<High school	17 (12)	13 (23)	1 (3)	3 (5)	
High school graduate	30 (20.5)	18 (32)	8 (27)	4 (7)	
Some college	60 (41)	16 (29)	19 (63)	25 (41.5)	
College graduate	31 (21)	8 (14)	2 (7)	21 (35)	
Graduate School	8 (5.5)	1 (2)	0 (0)	7 (11.5)	
Household Income (\$); Mean±SD	21,473±15,742	11,071±5,638	11,500±6,215	36,167±13,697	F = 112.853 p ≤ 0.001

Dietary Intake

Although, on average, all SIP*smart*ER participants' dietary intake significantly improved throughout the intervention (**Table 2**), no significant differences were found between SNAP eligible and receiving, eligible and not receiving, and ineligible participants from baseline to six-months for the dietary variables listed in **Table 3**.

Table 2. Comparison of SIP*smart*ER (n=146) Dietary Intake Between Baseline and Six Months

Variables	Baseline (mean±SD)	Six Months (mean±SD)	Mean Change (mean±SE)	P-value
Total energy intake, kcals	1970±1102	1679±1098	-291±580	0.001
Energy density, kcal/g	0.8±0.3	0.7±0.3	-0.1±0.2	0.010
Carbohydrates, % kcal	50.7±9.9	47.2±10.8	-3.5±9.4	0.001
Protein, % kcal	14.7±4.2	16.6±4.9	1.9±0.4	0.001
Fat, % kcal	33.8±7.65	35.5±9.2	1.7±8.0	0.014
Added sugar, g	103.1±72.4	67.2±64.3	-35.9±4.4	0.001
Added sugar, % kcal	21.0±11.2	15.7±10.9	-5.3±0.8	0.001
Sugar-sweetened beverages, fl oz	30.9±25.9	18.4±19.1	-12.5±23.3	0.001

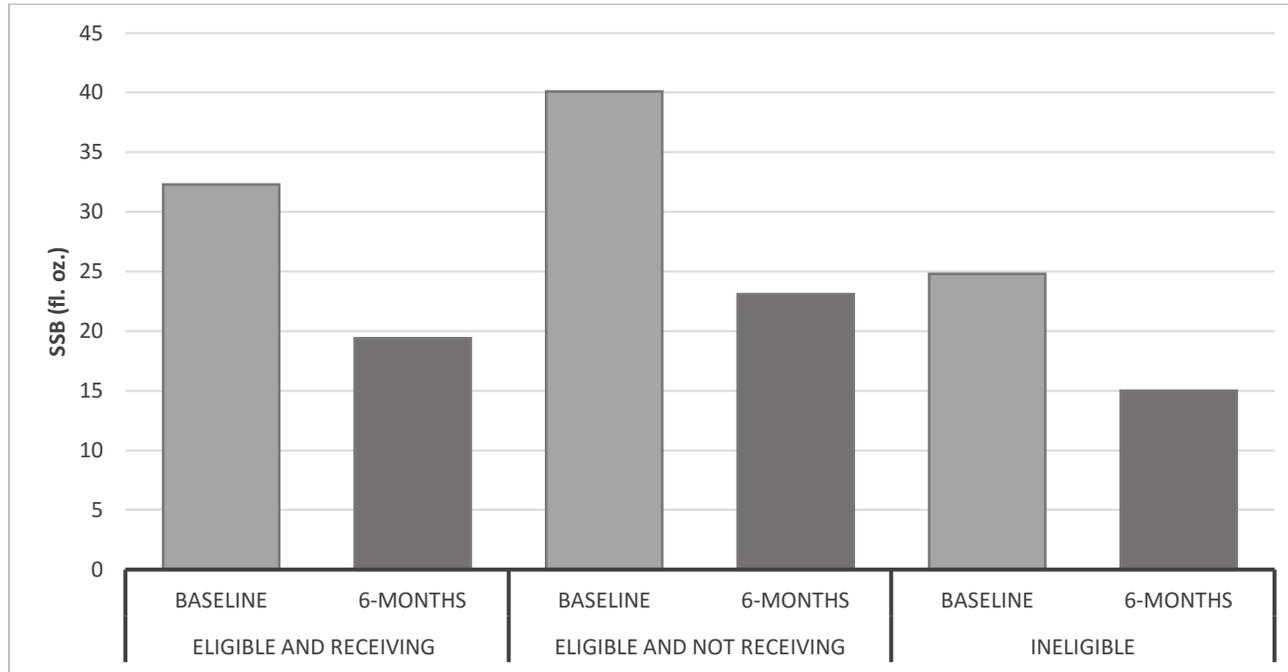
Table 3. Comparison of Dietary Variable Intake Between SNAP Eligible and Receiving, Eligible and Not Receiving, and Ineligible Participants (n=146)

Dietary Variable	SNAP Eligibility Group	Baseline (mean±SD)	Six-months (mean±SD)	Group by time difference (p-value)*	Mean difference baseline to six-month (mean±SE)	P-value for each group
Total energy intake, kcals	Eligible and Receiving (n=56)	1890±1384	1609±1398	0.974	-280±509	0.001
	Eligible and Not Receiving (n=30)	2160±103	1849±1129		-311±606	0.009
	Ineligible (n=60)	1950±803	1659.31±703		-290±636	0.001
Energy density, kcal/g	Eligible and Receiving	0.8±0.3	0.7±0.4	0.498	-0.1±0.2	0.137
	Eligible and Not Receiving	0.8±0.3	0.8±0.3		0.0±0.2	0.713
	Ineligible	0.7±0.3	0.7±0.3		0.0±0.3	0.026
Carbohydrates, % kcal	Eligible and Receiving	52.0±10.6	48.2±11.6	0.904	-3.8±9.8	0.005
	Eligible and Not Receiving	52±10.4	48.4±10.8		-3.7±12.1	0.104
	Ineligible	48.7±8.8	45.7±10.8		-3.0±7.5	0.003
Added sugar, g	Eligible and Receiving	108.3±72.5	70.0±59.7	0.832	-38.3±56.0	0.001
	Eligible and Not Receiving	126.3±91.5	88.6±93.5		-37.8±65.8	0.004
	Ineligible	86.5±57.4	53.9±46.4		-32.6±44.1	0.001
Added sugar, % kcal	Eligible and Receiving	23.9±13.1	18.4±11.6	0.861	-5.4±10.7	0.001
	Eligible and Not Receiving	23.0±10.9	17.0±10.8		-6.0±12.0	0.010
	Ineligible	17.5±8.1	12.6±9.4		-4.9±7.3	0.001
Protein, % kcal	Eligible and Receiving	14.5±4.2	16.4±4.5	0.992	1.9±4.7	0.004
	Eligible and Not Receiving	13.3±4.3	15.2±4.7		1.9±5.4	0.059
	Ineligible	15.6±3.8	17.4±5.2		1.8±4.5	0.003
Fat, % kcal	Eligible and Receiving	33.3±7.7	35.1±9.5	0.964	1.9±7.6	0.071
	Eligible and Not Receiving	33.1±8.3	34.8±7.7		1.6±9.6	0.366
	Ineligible	34.7±7.3	36.2±9.7		1.5±7.7	0.142

Sugar-sweetened beverages, fl oz	Eligible and Receiving	32.3±24.2	19.4±19.5	0.384	-12.9±20.3	0.001
	Eligible and Not Receiving	40.1±39.8	23.1±24.9		-17.0±33.5	0.009
	Ineligible	24.8±15.7	15.0±14.7		-9.8±19.6	0.001

*P-value set at ≤ 0.0025 based on the Bonferroni Test.

Figure 1. Comparison of Sugar-Sweetened Beverage (SSB) Consumption Between SNAP Eligibility Groups From Baseline to Six-Months*



*All groups significantly decreased SSB consumption from baseline to six-months ($p \leq 0.01$), however, no significant group by time differences were demonstrated.

Dietary Quality

Dietary quality was assessed via HEI-2010 scores (**Table 4**). *SIPsmartER* participants significantly increased their HEI scores for total vegetables, sodium, empty calories, and total HEI scores from baseline to six-months. Despite these overall changes for all *SIPsmartER* participants, there were no significant between group differences for eligible and receiving, eligible and not receiving, and ineligible participants from baseline to six-months (**Table 5**).

When comparing HEI subcomponent scores and total scores for SNAP eligible and receiving, eligible and not receiving, and ineligible participants, there were significant changes within several groups. Total vegetable and fatty acid scores significantly improved for both the SNAP eligible and receiving group and the ineligible group, but the SNAP eligible and not receiving group score did not improve. Although there was not a significant group by time difference for total HEI scores, the ineligible participants demonstrated a significant improvement over the six-month intervention, while the eligible and receiving and eligible and not receiving groups did not.

Table 4. Comparison of SIP_{smart}ER (n=146) Healthy Eating Index Scores Between Baseline and Six Months

Healthy Eating Index Variables (Possible Score)	Baseline (mean±SD)	Six- months (mean±SD)	Mean Change (mean±SE)	P-value
Total Fruit (0-5)	0.9±1.4	1.1±1.6	0.1±1.7	0.478
Total Vegetables (0-5)	2.5±1.5	2.8±1.6	0.3±0.1	0.035
Whole Grains (0-10)	2.4±3.3	2.7±3.6	0.3±0.3	0.378
Total Protein Foods (0-5)	4.2±1.2	4.4±1.3	0.2±0.1	0.156
Fatty Acids (0-5)	4.3±3.1	4.0±3.1	-0.3±0.3	0.366
Refined Grains (0-10)	5.8±3.2	5.9±3.5	0.1±0.3	0.898
Sodium (0-10)	3.8±3.1	3.2±3.2	-0.6±0.3	0.033
Empty Calories (0-20)	10.1±5.3	12.7±5.6	2.6±0.4	0.001
Total HEI Score (0-100)	42.4±12.4	45.4±13.0	2.9±12.3	0.005

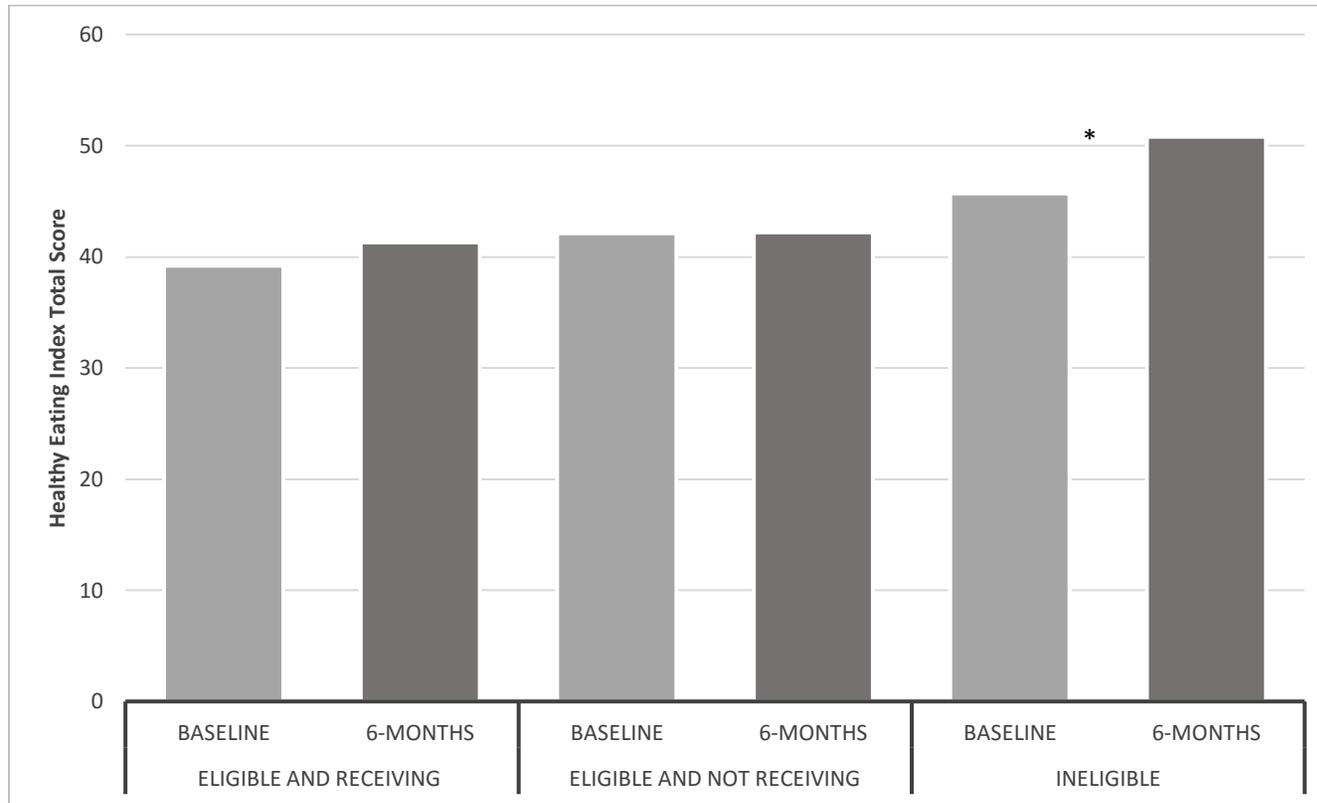
Table 5. Comparison of Healthy Eating Index Subcomponents and Total Scores Between SNAP Eligible and Receiving, Eligible and Not Receiving, and Ineligible Participants (n=146)

Healthy Eating Index Variables (possible score)	SNAP Eligibility Group	Baseline (mean±SD)	Six-month (mean±SD)	Group by time difference (p-value)*	Mean difference baseline to six-month (mean±SE)	P-value for each group
Total fruit (0-5)	Eligible and Receiving (n=56)	0.8±1.3	0.8±1.3	0.368	0.0±1.5	0.834
	Eligible and Not Receiving (n=30)	0.6±1.0	1.1±1.8		0.5±1.9	0.176
	Ineligible (n=60)	1.3±1.6	1.2±1.6		-0.1±1.8	0.866
Total Vegetables (0-5)	Eligible and Receiving	2.1±1.4	2.6±1.6	0.477	0.4±1.4	0.029
	Eligible and Not Receiving	2.6±1.5	2.6±1.6		0.0±1.8	0.965
	Ineligible	2.8±1.5	3.1±1.6		0.3±1.7	0.166
Whole Grains (0-10)	Eligible and Receiving	1.8±3.1	2.0±3.3	0.337	0.2±3.9	0.792
	Eligible and Not Receiving	2.5±3.5	2.1±3.2		-0.4±3.3	0.451
	Ineligible	2.8±3.3	3.6±3.8		0.8±4.2	0.144
Total Protein Foods (0-5)	Eligible and Receiving	4.1±1.4	4.3±1.5	0.986	0.2±1.3	0.311
	Eligible and Not Receiving	3.9±1.2	4.0±1.3		0.1±1.7	0.605
	Ineligible	4.4±0.9	4.6±1.0		0.2±1.2	0.377
Fatty Acids (0-5)	Eligible and Receiving	4.6±3.0	3.5±2.7	0.043	-1.1±3.6	0.025
	Eligible and Not Receiving	4.8±3.3	4.4±3.5		-0.4±4.0	0.609
	Ineligible	3.6±3.0	4.2±3.1		0.6±3.3	0.192
	Eligible and Receiving	5.7±3.4	5.6±3.4	0.173	-0.1±4.1	0.760

Refined Grains (0-10)	Eligible and Not Receiving	6.4±3.3	5.5±3.8		-1.1±4.6	0.260
	Ineligible	5.6±3.1	6.4±3.4		0.8±4.0	0.162
Sodium (0-10)	Eligible and Receiving	3.6±3.3	3.2±3.1	0.488	-0.4±3.7	0.442
	Eligible and Not Receiving	4.9±3.4	3.6±3.6		-1.3±3.9	0.079
	Ineligible	3.4±2.6	2.9±3.2		-0.5±3.1	0.207
Empty Calories (0-20)	Eligible and Receiving	9.1±5.5	11.2±5.7	0.611	2.1±4.9	0.002
	Eligible and Not Receiving	8.8±5.8	11.8±6.1		3.0±6.4	0.018
	Ineligible	11.6±4.6	14.5±4.8		2.9±4.1	0.001
Total HEI Score (0-100)	Eligible and Receiving	39.2±10.8	41.3±10.7	0.155	2.1±11.1	0.166
	Eligible and Not Receiving	42.1±13.6	42.2±11.3		0.1±14.4	0.975
	Ineligible	45.7±12.5	50.8±14.0		5.1±12.1	0.002

*P-value set at ≤ 0.0025 based on the Bonferroni Test.

Figure 2. Comparison of Healthy Eating Index Total Score Between SNAP Eligibility Groups From Baseline to Six-Months



*Significant difference at $p=0.002$

Beverage Consumption

The Healthy Beverage Index was used to assess the quality of beverage consumption (**Table 6**). Overall, SIP*smart*ER participants had significantly higher scores for several of the HBI subcomponents, including tea and coffee, low-fat milk, diet soda, whole milk, sugar-sweetened beverages, total beverage calories, total fluid consumption, and total HBI scores after the six-month intervention. Furthermore, improved but non-significant increases for water and total fluid consumption were demonstrated. Despite overall changes for all SIP*smart*ER participants, there were no significant between group differences for SNAP eligible and receiving, eligible and not receiving, and ineligible participants from baseline to six-months (**Table 7**). However, within groups, SSB and total fluid consumption HBI scores significantly improved for the ineligible group ($p=0.001$, 0.009 , respectively), but not for SNAP eligible and participating and eligible and not participating groups. Furthermore, the total HBI score significantly improved for eligible and receiving ($p=0.008$) and ineligible ($p=0.001$) groups but not for the eligible and not receiving group ($p=0.138$).

Table 6. Comparison of SIP*smart*ER (n=146) Healthy Beverage Index Scores Between Baseline and Six Months

Healthy Beverage Index Variables (possible score)	Baseline (mean±SD)	Six Months (mean±SD)	Mean Change (mean±SE)	P-value
Water (0-15)	10.4±6.0	11.0±6.0	0.6±0.4	0.168
Tea and Coffee (0-5)	4.8±1.0	4.4±1.6	-0.4±0.1	0.004
Low-fat Milk (0-5)	4.9±0.8	4.6±1.3	-0.3±1.4	0.034
Diet Soda (0-5)	4.2±1.8	3.8±2.1	-0.4±1.8	0.004
100% Fruit Juice (0-5)	4.8±1.0	4.7±1.2	-0.1±0.1	0.258
Alcohol (0-5)	4.8±1.0	4.9±0.82	0.1±0.8	0.319
Whole Milk (0-5)	4.4±1.6	4.8±1.1	0.4±1.7	0.018
Sugar-sweetened Beverages (0-15)	1.3±4.3	4.3±6.8	3.0±6.8	0.001
Total Beverage Calories (0-20)	4.4±7.5	8.7±9.5	4.3±9.0	0.001
Total Fluid Consumption (0-20)	16.4±4.4	17.0±4.2	0.6±3.8	0.064
Total HBI Score (0-100)	60.5±13.5	68.2±18.0	7.7±16.6	0.001

Table 7. Comparison of Healthy Beverage Index Subcomponents and Total Scores Between SNAP Eligible and Receiving, Eligible and Not Receiving, and Ineligible Participants (n=146)

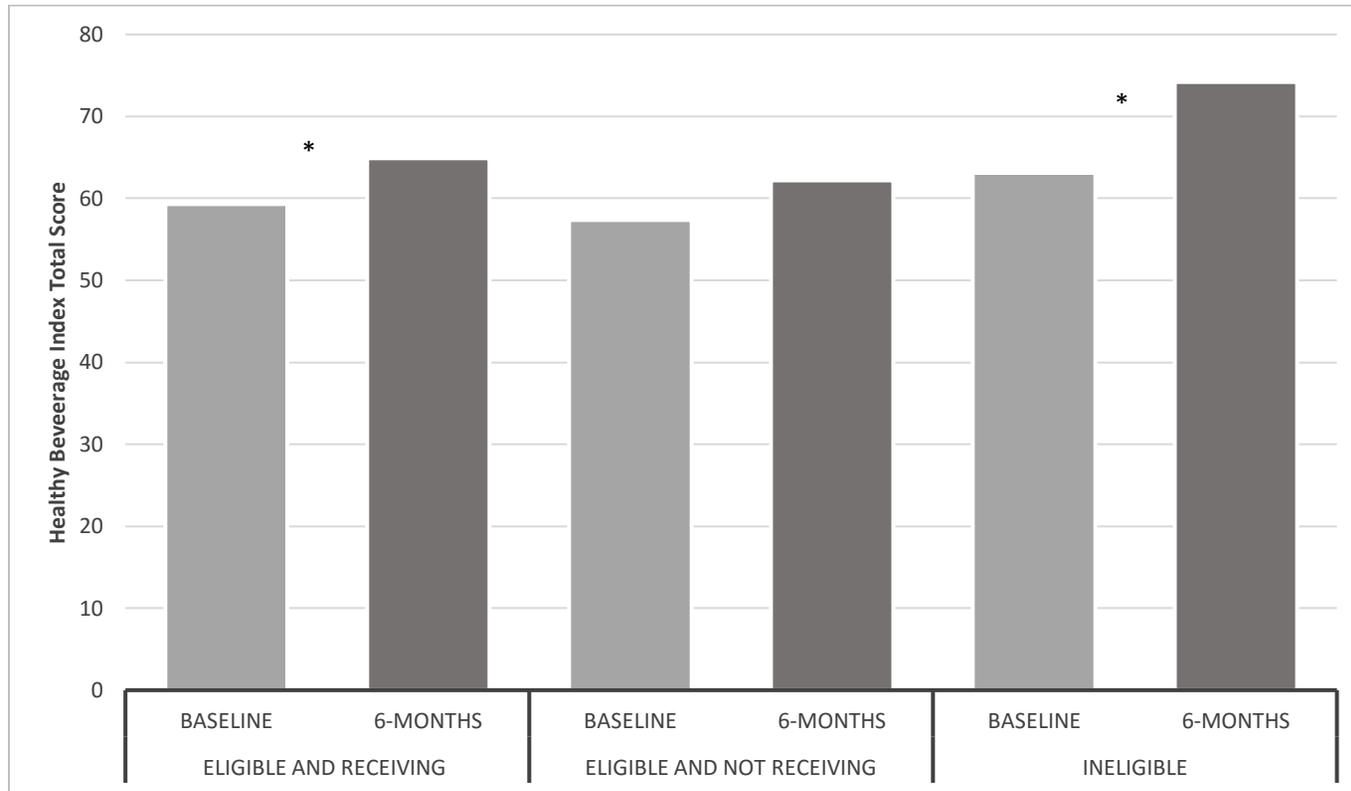
Healthy Beverage Index Variables (Possible Score)	SNAP Eligibility Group	Baseline (mean±SD)	Six-Month (mean±SD)	Group by time difference (p-value)*	Mean difference baseline to six-month (mean±SE)	P-value for each group
Water (0-15)	Eligible and Receiving (n=56)	9.5±6.3	10.4±6.2	0.697	0.9±5.7	0.249
	Eligible and Not Receiving (n=30)	9.2±6.8	9.1±6.8		-0.1±5.2	0.922
	Ineligible (n=60)	11.7±5.1	12.4±5.2		0.7±4.5	0.272
Tea and Coffee (0-5)	Eligible and Receiving	4.7±1.1	4.3±1.8	0.710	-0.4±1.4	0.024
	Eligible and Not Receiving	5.0±0.0	4.5±1.5		-0.5±1.5	0.083
	Ineligible	4.8±1.1	4.5±1.5		-0.3±1.7	0.260
Low-fat Milk (0-5)	Eligible and Receiving	5.0±0.0	4.6±1.3	0.510	-0.4±1.3	0.044
	Eligible and Not Receiving	5.0±0.0	5.0±0.0		**	**
	Ineligible	4.7±1.3	4.4±1.6		-0.3±1.7	0.260
Diet Soda (0-5)	Eligible and Receiving	4.0±2.0	3.4±2.4	0.546	-0.6±1.9	0.018
	Eligible and Not Receiving	4.3±1.7	4.2±1.9		-0.1±2.1	0.662
	Ineligible	4.4±1.6	4.0±2.0		-0.4±1.7	0.058
100% Fruit Juice (0-5)	Eligible and Receiving	4.7±1.1	4.6±1.3	0.395	-0.1±1.2	0.568
	Eligible and Not Receiving	5.0±0.0	4.7±1.3		-0.3±1.3	0.161
	Ineligible	4.8±1.1	4.8±1.3		0.0±0.9	1.000
Alcohol (0-5)	Eligible and Receiving	4.9±0.7	5.0±0.0	0.880	0.1±0.7	0.322
	Eligible and Not Receiving	4.7±1.3	4.7±1.3		0.0±1.3	1.000
	Ineligible	4.8±1.1	4.8±0.9		0.0±0.6	0.321

Whole Milk (0-5)	Eligible and Receiving	4.1±1.9	4.6±1.3	0.393	0.5±1.8	0.033
	Eligible and Not Receiving	4.8±0.9	4.8±0.9		0.0±1.3	1.000
	Ineligible	4.5±1.5	4.8±0.9		0.3±1.8	0.159
Sugar-sweetened Beverages (0-15)	Eligible and Receiving	1.4±4.4	3.5±6.4	0.321	2.1±6.1	0.010
	Eligible and Not Receiving	0.5±2.7	3.0±6.1		2.5±6.9	0.057
	Ineligible	1.8±4.9	5.8±7.4		4.0±7.2	0.001
Total Beverage Calories (0-20)	Eligible and Receiving	4.3±7.7	7.6±9.6	0.369	3.3±8.6	0.006
	Eligible and Not Receiving	3.0±6.3	6.5±8.7		3.5±7.7	0.017
	Ineligible	5.3±7.9	10.9±9.4		5.5±9.9	0.001
Total Fluid Consumption (0-20)	Eligible and Receiving	16.7±4.3	16.8±4.2	0.085	0.1±3.4	0.849
	Eligible and Not Receiving	15.9±4.8	15.7±5.1		-0.1±3.8	0.848
	Ineligible	16.5±4.3	17.9±3.5		1.4±4.0	0.009
Total HBI Score (0-100)	Eligible and Receiving	59.3±12.4	64.9±17.5	0.112	5.6±15.2	0.008
	Eligible and Not Receiving	57.4±11.7	62.2±16.0		4.8±17.2	0.138
	Ineligible	63.1±14.9	74.2±17.8		11.1±17.2	0.001

*P-value set at ≤ 0.0025 based on the Bonferroni Test.

**No consumption of low-fat milk was reported for this group.

Figure 3. Comparison of Healthy Beverage Index Total Scores Between SNAP Eligibility Groups From Baseline to Six-Months



*Significant difference at $p \leq 0.01$

Discussion

These findings suggest that the overall effectiveness of a SSB intake reduction intervention was not influenced by SNAP eligibility and participation status. Further, these results show that there were no differences between SNAP eligible and receiving, eligible and not receiving, and ineligible participants' adherence to the SSB intake reduction intervention. However, although there was not a significant group by time difference between SNAP eligibility groups, the ineligible participants demonstrated a significant improvement in overall dietary quality over the six-month intervention, whereas the eligible and receiving and eligible and not receiving groups did not. Furthermore, the eligible and not receiving group did not significantly improve their SSB HBI score and total HBI score, as compared to those participating in SNAP and those ineligible, who did improve. When further analyzing the results, the ineligible group improved the most, showing significant enhancements in nine variables (total energy [calories], added sugar [grams and percent calories], SSB [fl. oz.], empty calories, total HEI score, SSB [HBI score], total beverage [calories], and total HBI score). The SNAP eligible and receiving participants also improved in five variables (total energy [calories], added sugar (grams and percent calories), SSB [fl. oz.], and empty calories). The SNAP eligible and receiving participants did not improve in any dietary intake, dietary quality, and beverage consumption variables. Thus, the eligible and not receiving participants may be at a disadvantage for improving dietary intake at the same rate as those receiving or ineligible for SNAP benefits.

Contrary to the hypothesis for dietary intake, eligibility and participation in SNAP did not impact the effectiveness of a SSB reduction trial at improving dietary intake components (calories, macronutrients, added sugar, energy density, and SSB). It was hypothesized that SNAP eligible and receiving participants will show a greater improvement in dietary intake over a six-

month intervention as compared to SNAP eligible and not receiving. Furthermore, it was hypothesized that SNAP ineligible participants will show a higher quality dietary intake as compared to both SNAP eligible and receiving and SNAP eligible and not receiving groups. Previous investigations have demonstrated significant differences in intake between those participating in SNAP and those who are not, with SNAP participants consuming greater amounts of added sugar, total fat, SSB, fruit juice, whole grain, potatoes, and red meat consumption.¹⁶ While, some studies showed similar or improved dietary intake.^{28,29} In this study, all SNAP eligibility groups demonstrated similar improvements in dietary intake over the six-month intervention, despite SNAP eligibility and participation status.

Although changes in specific dietary variables were relatively similar across groups, the hypothesis that SNAP eligible and receiving participants would not demonstrate greater improvements in dietary quality was confirmed with ineligible participants showing a significant increase in total HEI scores as compared to the other two groups not demonstrating a significant change. These findings were congruent with other studies, which showed lower HEI scores between SNAP eligible and participating groups versus SNAP eligible and not participating or ineligible groups.^{22,31} One observational study found that SNAP participants scored lower (52) compared to nonparticipants (56) and higher-income non participants (56).²² Comparably, in this study the average total HEI score at six-months for SNAP eligible and not receiving was lower (41) as compared to eligible and not receiving (42) and ineligible (51) participants.

Similar to the dietary intake hypothesis, it was theorized that SNAP eligible and receiving participants would demonstrate greater improvements in beverage quality over the six-month intervention as compared to SNAP eligible and not receiving participants. It was also hypothesized that SNAP ineligible participants will show higher quality HBI scores as compared

to both SNAP eligible and receiving and SNAP eligible and not receiving groups. Multiple studies have found no relationship between SNAP participation and beverage consumption. A cross-sectional analysis found that SNAP participants, former participants, and nonparticipants were equally likely to consume SSB.³³ Similarly, another cross-sectional, random-digit phone survey found no correlation between SNAP participation and meeting SSB recommendations.³⁴ This hypothesis was also supported by these findings, which showed no differences between groups for beverage quality. On the contrary, these results showed significant improvements in SSB and total HBI scores for SNAP eligible and participating and ineligible groups but not for the SNAP eligible and not participating group.

This study is not without limitations. SNAP participants are also allowed to participate in WIC (Women, Infants, and Children) if eligibility requirements for both programs are met.²⁵ Similarly, SNAP participants can also partake in SNAP-Ed classes and SNAP-Ed classes are open to the public regardless of SNAP eligibility and participation status. Participation in these two programs could have altered the study's results. WIC is a Special Program that affects only a certain population, whereas SNAP is an entitlement program where anyone who is income eligible can receive benefits. The WIC program has a stricter list of approved foods than SNAP eligible foods, which could affect the purchasing patterns, dietary intake, dietary quality, and beverage consumption of individuals who participate in both SNAP and WIC. SNAP-Ed provides nutrition education programs to SNAP participants, which have been shown to improve dietary quality.

A proxy to determine *SIPsmartER* participants' SNAP eligibility status was created. Participants were asked at baseline to state their income level range. Eligibility was determined by taking the mean income of the range. Since SNAP eligibility is determined by more than just

income, this income proxy serves as a limitation to our study. Households must meet certain income and resources (e.g., owning a vehicle) tests to receive SNAP benefits. Other considerations of eligibility include, deductions, employment requirements, special rules for elderly or disabled persons, and immigrant eligibility. This proxy provided a way to determine eligibility from income, but failed to account for other factors (i.e., resources) involved in determining SNAP eligibility status.

Due to the sample size (n=146), the study is not powered to detect changes between groups. It should also be noted that the sample included college students. Since the proxy was developed based on income, some participants might have reported their parents' income if they were dependents or their income as college students. This further limits the ability to adequately determine eligibility status.

This study also had many strengths. This study investigated potential differences between SNAP eligibility and participation while individuals were on a dietary intervention. Additionally, this study utilized SNAP eligibility groups established by the USDA (SNAP eligible and receiving, eligible and not receiving, and ineligible participants), while most of the literature examines only SNAP participants versus nonparticipants (includes eligible and ineligible participants), which causes confounds related to income status.⁴⁴

Conclusion

Although all SIP*smart*ER participants' dietary intake, dietary quality, and beverage consumption significantly improved over the six-month intervention, no significant difference in the magnitude of change in dietary intake between SNAP eligible and receiving, eligible and not receiving, and ineligible participants was demonstrated. Even though SNAP participation and

eligibility status did not impact the overall effectiveness of this dietary intervention, the within group data suggests that those eligible for SNAP but not participating may be at a disadvantage to improving their dietary intake as compared to those at a similar household income who receive SNAP benefits or ineligible individuals at a higher income level. Future research should emphasize the importance of SNAP eligibility and participant's ability to maintain long-term adherence to the dietary changes.

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Chapter 3: Future Directions and Conclusions

The Supplemental Nutrition Assistance Program (SNAP) is the largest nutrition assistance program in the United States.¹ SNAP has helped millions of food insecure Americans purchase food since the late 1930s.⁷ The program serves roughly 46 million people and costs the United States Department of Agriculture about \$70 billion per year.¹ Despite *SIPsmartER* participants, as a whole, significantly improving their dietary intake, dietary quality, and beverage consumption over the six-month intervention, this study demonstrated that there were no significant differences in the magnitude of change in dietary intake between SNAP eligible and receiving, eligible and not receiving, and ineligible groups. However, the within group data suggests SNAP eligible and not receiving participants may be at a disadvantage to improving their dietary intake when compared to those at a similar income level but receiving SNAP benefits or those at a higher income level and thus ineligible for SNAP benefits. With such a large number of recipients and committed budget, it is important to continue investigating the potential role SNAP eligibility and participation status has on a participant's ability to maintain long-term adherence to the dietary changes.

We conducted a secondary analysis from Talking Health's *SIPsmartER*, a six-month community-based randomized control sugar-sweetened beverage (SSB) reduction trial.³⁷ The primary goal of *SIPsmartER* was to decrease SSB consumption to the recommended less than eight fluid ounces per day. Data should be obtained with the primary goal being to accurately assess the magnitude SNAP eligibility and participation status has on the adherence to a dietary intervention. With this targeted outcome, there would be less confounding variables, such as the possibility of participation in Women, Infants, and Children (WIC) and the

Supplemental Nutrition Assistance Program Education (SNAP-Ed) influencing participant's ability to adhere to a dietary intervention.^{25,12}

Randomized controlled trials should be conducted to determine if there is a casual relationship between SNAP eligibility and participation and participants' ability to follow to a dietary intervention. During these studies, it is important to determine SNAP eligibility and participation status and identify other confounding variables (i.e., WIC and SNAP-Ed). Observational investigations could help assess associations between groups and their ability to adhere to dietary interventions. Although these studies allow for more confounding variables to be present, it is the most practical way to assess long-term data on how SNAP eligibility and participation status effects adherence to dietary interventions.

Further research should analyze the possible relationship that exists within SNAP eligible and receiving, eligible and not receiving, and ineligible groups. This secondary analysis found that SNAP eligible and not receiving participants may be at a disadvantage to improving dietary intake compared to SNAP eligible and receiving and ineligible participants. Specifically, SNAP eligible and not receiving participants were shown to be at a disadvantage for total vegetable and fatty acid intake, and overall dietary quality (total Healthy Eating Index score). It would be beneficial to have more randomized control trials to determine the effect being income-eligible but not receiving SNAP benefits would have on participant's ability to improve their dietary consumption.

According to a qualitative review, there are four barriers to obtaining a nutritionally dense diet for SNAP participants, 1) the high cost of nutrient-rich foods, 2) inadequate SNAP benefits, 3) environmental factors associated with poverty, and 4) limited access to purchasing healthy foods. To overcome these barriers, one suggestion is to improve nutrition education. Our

study was a secondary analysis of Talking Health's SIP*smartER*, which provided nutrition education to its participants.³⁷ Nutrition education for SIP*smartER* participants included three small group classes (90-120 minutes each) with hands-on demonstrations, verbal presentations, pictorial information, and materials with simplified language (i.e., <8th grade, when possible). Each participant received a live teach back telephone call to promote comprehension of objectives and recall key concepts from the first class.³⁷ This form of nutrition education helped participants improve their SSB consumption, the primary goal of the study. Improving nutrition education for SNAP participants, especially SNAP eligible and not receiving individuals, may help improve dietary intake and dietary quality scores.

It is also important to note one of our main findings, that the SNAP eligible and not receiving group, was at a disadvantage for total vegetable intake, fatty acid score, and overall dietary quality. These participants represent individuals who meet the eligibility requirements for SNAP but are not receiving benefits. Despite numerous websites offering information on how to sign up for SNAP and the United State Department of Agriculture's Food and Nutrition Service (FNS) website describing its outreach efforts, "FNS works with State and local agencies, advocates, employers, community and faith-based organizations, and others to reach out to eligible low-income people who are not currently participating in SNAP" there is still a large population of individuals who qualify but do not receive SNAP benefits⁴⁵ It is estimated that a quarter of eligible Americans do not sign up to participate in SNAP.⁴⁵ As SNAP policy and outreach is developed, our study highlights a population of individuals that should be treated as a top priority to address.

In summary, future directions for research assessing dietary intake changes in response to dietary interventions for various SNAP eligibility and participating groups include randomized

control trials that are well-designed and take confounding variables into account as well as more observational studies to assess the long-term effects SNAP eligibility and participation status has on adherence to dietary interventions. More research should be conducted to assess the context around SNAP eligible and not receiving participants being at a disadvantage for improving dietary intake. These investigations will help researchers develop strategies for certain SNAP eligibility groups to maintain long-term adherence to dietary changes.

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