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## **The Association of Sugar-Sweetened Beverage Intake and Body Mass Index of University Students Living On and Off Campus**

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## **Abstract**

**Background:** The obesity epidemic in America has become an important topic of public health concern. With an increase of sugar-sweetened beverages (SSBs) in the American diet, much research has been done examining the relationships between obesity, weight gain, body mass index (BMI) and SSBs. Recently, this research has expanded to examining these variables among specific populations, such as university students, to learn how detrimental these beverages have become to the American diet. It is imperative that research is continued to learn more information surrounding university students, weight gain, and its relationship with SSB intake.

**Purpose:** It is the purpose of this study to determine if there is a relationship between SSB consumption and BMI among university students, and if this relationship differs based on students' residency.

**Methods:** Utilizing a snowball sample, participants were recruited from a large, public university in the Northeastern United States, via email listservs, Canvas, and various social media platforms. Participants were considered eligible for participation if they were over the age of 18 years old and a current student at Montclair State University. Participants were asked questions regarding their demographics, motivations for purchasing SSBs, locations for purchasing and consuming SSBs, and a beverage recall. Data were collected in Limesurvey software and exported into Statistical Analysis Software Package (SPSS, IBM) version 24, for analysis. Data analysis included descriptive statistics for descriptive demographics, locations of purchasing and consuming, and motivations for purchasing and consuming, independent sample t-tests to examine differences between groups such as commuters and residents, males and

females, and Pearson's  $r$  correlations to determine relationships between variables such as BMI and SSBs.

**Results:** Of the 200 participants, the majority were undergraduates (81.5%), female (77.5%), Caucasian (66%), and half residential students (50%). One-third (33%) of this sample was overweight or obese as determined by their BMI. Overall, students living on campus have a higher BMI than those living off campus (BMI of  $25.29 \pm 5.35$ , and  $23.97 \pm 4.03$ , respectively) by about  $1.32 \text{ kg/m}^2$ . The average SSB intake among this sample was  $13.98 \pm 22.91$  fluid ounces per day, which is two ounces below the national average. This equates to an average of 155 calories per day from SSBs. The students consuming the most SSBs were residential students and students with a meal plan, consuming  $16.25 \pm 26.58$  and  $19.49 \pm 27.33$  fluid ounces, respectively. Similarly, there was a significant positive relationship between SSB intake and BMI among all students, but especially those living on campus, and those with a meal plan. Correlation of SSB intake and BMI between undergraduate students and graduate students was also found to be positively associated. This correlation is slightly stronger among men than women meaning males consuming excess SSBs are more likely to have an increased BMI. Students most frequently reported consuming SSBs because they enjoy the taste (72%) and to mix with alcohol (50%). Most students reported that they do not consume SSBs to enhance their academic or athletic performance (90%). Even though students living on campus and students with a meal plan are consuming the most SSBs, the majority of these students (62% of commuters and 69% of students with a meal plan) are purchasing SSBs at off-campus locations.

**Conclusions:** The results of this study reveal that there is a significant, positive relationship between SSB intake and BMI among this population of university students. As SSB intake increases, BMI does as well. Students living on campus and students with a meal plan are not only consuming the most of these beverages  $16.25 \pm 26.58$  and  $19.49 \pm 27.33$  fluid ounces, respectively, but are also experiencing the implications of it, by having a higher BMI than their peers consuming less SSBs. The importance of these findings is that it shows the significance of SSB intake among a university sample in Northern New Jersey. With SSBs being largely consumed among this sample, this relationship should be more closely examined to decrease the risk of obesity among young adults attending university. The completion of this research allows for public health professionals to create an appropriate nutrition education intervention for college students with different living arrangements to decrease the consumption of SSBs overall.

MONTCLAIR STATE UNIVERSITY

“The Association of Sugar-Sweetened Beverage Intake and Body Mass Index of University  
Students Living On and Off Campus”

by

Tyler Marie Marchei

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“THE ASSOCIATION OF SUGAR-SWEETENED BEVERAGE INTAKE AND BODY  
MASS INDEX OF UNIVERSITY STUDENTS LIVING ON AND OFF CAMPUS”

A THESIS

Submitted in partial fulfillment of the requirements

For the degree of Master of Science in Nutrition and Food Science

By

TYLER MARIE MARCHEI

Montclair State University

Montclair, NJ

2017

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**List of Abbreviations**

BEVQ	Beverage Intake Questionnaire
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
HFCS	High Fructose Corn Syrup
LCS	Low Calorie Sweetener
MSU	Montclair State University
SEM	Social-Ecological Model
SSBs	Sugar Sweetened Beverages
TPB	Theory of Planned Behavior
U.S.	United States

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## Chapter I: Introduction

### Overview

The obesity epidemic has cost the American healthcare system almost \$210 billion dollars per year, or \$79 dollars for each obese individual.<sup>1</sup> Research indicates that in 2015, 22.5% of college students were overweight and 11.5% of college students were obese.<sup>2</sup> Due to the prevalence of obesity, specifically childhood obesity, this generation of young adults is among the first with shorter life expectancies than their parents.<sup>3</sup> The lack of exercise and overconsumption of calories through processed foods and packaged goods are primarily responsible for this epidemic.<sup>4</sup> Research shows that consuming added sugars, specifically from beverages, can cause an increased risk of developing type two diabetes and cardiovascular diseases along with obesity.<sup>5-8</sup> The research on sugar-sweetened beverages (SSBs), although comprehensive, has not been analyzed thoroughly in the college-aged population.

There is an abundance of research on intake of caffeinated drinks such as energy drinks and coffee beverages amongst college students, but few on SSBs overall. SSBs are often considered beverages with added sugar such as juices that are not 100% juice, sweetened tea, coffee beverages, soda, energy drinks, and sports drinks.<sup>9</sup> With servings of SSBs nearly doubling in size, consumption of such beverages are also steadily increasing, especially within this population.<sup>10,11</sup> In 2014, Yale University published a report exposing the \$866 million dollars spent by the soda industry in advertising their products. About 56% of these advertisements were created to be viewed by children and teens. This report, *Sugary Drinks FACTS 2014*, found that beverage companies spend four times the amount of money advertising SSBs as they do water or 100% fruit juice.<sup>12</sup>

Previous research studying SSB consumption among college students in Alexandria, Egypt showed an increase of both soft drinks and energy drinks correlating with an increased body mass index (BMI).<sup>13</sup> Research in America has shown that 65% of college students are consuming SSBs daily, and on average more than 12 milligrams of caffeine a day.<sup>14</sup> Studies have examined the relationship between dietary habits of college-aged students and BMI, finding that most students are not meeting the daily requirements for nutrients due to lack of time, poor eating habits, and readily available unhealthy foods.<sup>15-18</sup>

On-campus dining is an integral part of student life at a university and plays a huge role in not only serving the students but also influencing this population into making dietary choices.<sup>19</sup> Previous research suggests that those living off campus have a healthier diet than those actually living on campus, because there is often salty snacks, SSBs, and processed foods kept in their residence halls.<sup>18</sup> This may be due to the fact that those living with their parents are consuming more home cooked meals. Other prior studies have varied showing that students who live on campus with a prepaid meal plan are more likely to receive the recommended fruit and vegetable servings per day, by almost 1.8 servings, in comparison to their peers who are living at home with their parents. This may be due in part to the variety of foods offered at the on-campus dining establishments.<sup>20</sup> Similarly, more recent research showed students living off campus with roommates were more likely to be overweight/obese, smoke, and have a higher alcohol consumption than those students living in on-campus housing or living at home with their family.<sup>21</sup> However, previous research has not shown a comparison of SSB intake between students who reside on campus and students that reside off campus.

## **Purpose**

The purpose of this study is to determine if there is a relationship between SSB consumption and BMI among university students, and if this relationship differs based on their residency. Due to the nature of this cross-sectional research, a causal relationship cannot be determined.

Examining these relationships will allow for the following research questions to be addressed:

- RQ1: Is there a direct correlation of SSB intake and BMI in university students?

H1: There will be an overall positive relationship between SSB consumption and BMI in university students, regardless of their housing.

- RQ2: Does the association of SSB and BMI differ between residency type?

H2: Compared to their peers living off campus, university students living on campus will exhibit a stronger positive relationship between SSB intake and BMI.

- RQ3: What are the biggest motivators for university students to consume SSBs?

H3: The biggest motivators reported by university students to purchase and consume SSBs are because they enjoy the taste and for the perceived benefits of caffeine, such as to wake up or stay awake longer.

- RQ4: Are students with a meal plan more likely to consume SSBs?

H4: Students with a meal plan are more likely to consume SSBs compared to those without a meal plan.

The first hypothesis being tested (H1) is that with an increase in SSBs, BMI of those students will also increase. This hypothesis is premised by the fact that SSBs are



empty calories adding excessive sugar into the diet causing weight gain.<sup>22</sup> The results of this research will determine if SSB consumption is a risk factor for obesity in university students, and which students specifically are most at risk, those living on campus or off campus.

The second hypothesis (H2) is based on the idea that on-campus dining tends to be unhealthier than home-cooked meals<sup>18,21,23</sup>. Moreover, “all you can eat” style cafeterias and retail dining establishments encourage soft drink consumption with its excessive availability to students.<sup>24</sup> At Montclair State University (MSU), the population being studied, residential students with less than 30 credits must purchase a meal plan, thus causing them to eat on campus more than their commuting peers.<sup>25</sup>

The third hypothesis (H3) being tested is based on previous studies that have found that university students purchase and consume SSBs because they enjoy the taste and because of the caffeine content.<sup>13,14</sup> Because of this information, we hypothesize that university students in this sample choose to consume such beverages for similar reasons.

The fourth and final hypothesis (H4) being tested is that due to the availability of SSBs on campus, students that have a meal plan are more likely to purchase and consume such beverages. This is because students that live on campus generally spend more time on campus and those living on campus with a meal plan spend the most time eating on campus. Due to the accessibility of SSBs in all dining establishments (as determined by researcher and participant observation), students with a meal plan are hypothesized to consume more of these in comparison to their peers who are eating meals in their home, where SSBs may be less available.

## Significance

Currently, there is no known research comparing SSB intake and BMI of university students and comparing total consumption between students living off campus and students living on campus. This research will bridge the gap in literature by determining if there is a correlation between consumption of SSBs and BMI of university students based on their housing. Comparisons of dietary habits have been made between students living on campus and students living off campus.<sup>21,23</sup> Additionally, there is extensive research on consumption of SSBs among college students.<sup>9,12,13,21,26-</sup><sup>29</sup> However, there is no research combining all these factors (i.e. residency, BMI, and SSB intake). Much of the previous research has been inconclusive, showing little or no correlation between BMI and residency or BMI and type of meal plan. Most research on university students and SSB consumption focuses on intake, caffeine consumption, knowledge, and motivators for consumption.<sup>13,30,31</sup> None of these previously published studies, however, looked at the intake of SSBs in correlation to BMI and housing. This research will uncover information on the students' motivators for purchasing/consuming such beverages, and what environmental factors may be influencing their decisions such as their housing and meal plan.

The findings of this study will help researchers and educators to better understand the dietary habits and motivators of university students and the impact that these decisions can make on their health. Learning the motivators and dietary habits of this population will help professionals to build a framework for nutrition education interventions. The population at risk for obesity and other metabolic diseases can benefit from these interventions by becoming more aware of their risks and lowering their

consumption of these sugary drinks. If the demand for these drinks on college campuses decreases, university dining facilities will have no other choice than to reassess their contracts with the beverage industry.

Conducting this thesis research will provide information to public health professionals and nutrition educators to determine if there is an association between SSB intake, a BMI  $\geq 25$  among college students, as well as what effect if any, living on campus has on this relationship. This research will give insight to the motivations for and against purchasing and consuming sweetened beverages among a large college population. By understanding these motivations, health professionals can create appropriate nutrition interventions on university campuses to educate all students on the risks of excess SSB intake.

### **Defining Key Terms**

The following definitions are used throughout this research and are stated below for consistency and to provide a concise description of terms.

1. Sugar-sweetened beverages (SSBs)-any liquids that are sweetened with various forms of added sugars such as brown sugar, corn sweetener, corn syrup, dextrose, fructose, glucose, high-fructose corn syrup, honey, lactose, malt syrup, maltose, molasses, raw sugar, and sucrose. Examples- soda (not sugar-free), fruit drinks, sports drinks, energy drinks, sweetened waters, and coffee and tea beverages with added sugars.<sup>9</sup>
2. Body Mass Index (BMI)- body weight in kilograms divided by square of height in meters. BMI is used to quantify the amount of tissue mass in a person and to

categorize them as underweight, healthy weight, overweight, or obese. The BMI categories are as follows: Underweight (<18.5), Normal Weight (18.5-24.9), Overweight (25.0-29.9), Class I Obese (30-34.9), Class II Obese (35.0-39.9).<sup>32</sup>

3. Beverage Intake Questionnaire (BEVQ-15)- A validated quantitative survey tool to self-report daily and weekly beverage consumption across various beverage categories.<sup>33</sup>
4. Soda/Soft drink-a carbonated beverage with sweetener (i.e., Coca Cola, Pepsi, Mountain Dew)
5. Energy Drink- a beverage containing stimulants, usually caffeine. They may or may not be carbonated and include sugar or other sweeteners as well as other extracts and amino acids. (i.e., Monster, Red Bull, etc.)
6. Low-calorie sweetener- provides sweetness without carbohydrates or calories such as aspartame, saccharin, sucralose, acesulfame potassium. (i.e., Sweet N Low, Equal, Splenda, Truvia)

## **Chapter II: Literature Review**

Since 1980, the obesity rates in American adults have doubled from 15% to 30% in many states.<sup>34</sup> Childhood obesity has more than tripled since and continues to grow at an alarming rate.<sup>35</sup> With 1/3<sup>rd</sup> of United States (U.S.) children currently overweight or obese, 25% of the adolescent population will be unfit to serve in the American military as adults due to their anticipated health issues.<sup>36</sup> Due to the stress that extra weight causes on the body, obesity increases the risk of more than 30 major diseases, such as metabolic syndrome, hypertension, atherosclerosis, certain cancers, coronary heart disease, stroke, sleep disorders, high cholesterol, dyslipidemia, respiratory disorders, type 2 diabetes, gall bladder disease, mental illness, and premature mortality.<sup>37,38</sup> Further, seven of the top 10 causes of death in the U.S. are illnesses caused by obesity, all of which are preventable conditions.<sup>39</sup> This epidemic is causing a strain on the individuals suffering with obesity, and on the entire U.S. economic system as a whole. This chapter provides a comprehensive literature review surrounding sugar-sweetened beverages (SSBs) and university students, as well as to identify previous studies on the topic.

### **Sugar-Sweetened Beverages**

Consumption of excess sugar, specifically in liquid form, is known to cause an increased risk for many metabolic disorders such as diabetes and cardiovascular disease.<sup>5-8</sup> Findings from previous studies have shown that those consuming one to two servings of SSBs each day have a 26% increased risk of developing type two diabetes.<sup>26</sup> Not only are these beverages adding empty calories in the diet, but they are also replacing

more healthy drinks that would otherwise be in the diet, such as 100% fruit juice and water.<sup>40</sup>

The SSB industry has rejected the efforts to create an excise tax and limit portion sizes of SSBs sold to the public.<sup>41</sup> In 2012, The New York City Board of Health proposed a ban on the sale of single consumption SSBs at a size greater than 16 fluid ounces.<sup>41</sup> This ban was rejected by the New York City Supreme Court in 2013 which has raised a controversial debate throughout the U.S. about whether the government should be able to control sales of such beverages.<sup>41</sup> This was a huge step in the field of public health to decrease the consumption of sweetened drinks, but did not come to fruition. Due to this demand for action, more research on the health effects of SSBs needs to be published to create changes within the community.

According to the Centers for Disease Control and Prevention (CDC), approximately 1/3<sup>rd</sup> of U.S. adults are consuming one or more SSB daily. Of those adults that consume at least one SSB per day, the age group with highest prevalence of consumption is adults between the ages of 18 and 24 at 43.3%. According to the data collected from the 2003-2012 NHANES, the frequency of SSB consumption is high among adults, it is highest in males, non-Hispanic African Americans, the unemployed, and those without a high school education.<sup>42,43</sup> (See Appendix A) As most university students are between the ages of 18 and 21, prior research proves that this is an extremely important population to further study.<sup>44</sup>

### **Risk Factors for Obesity**

The overall cause for weight gain or weight loss is an energy imbalance in the body. If calories consumed equal calories burned each day, then weight will remain the

same.<sup>45</sup> Obesity is generally caused by an excess of consumption, or lack of physical activity, leading to a positive energy balance. In America, it is usually a combination of each that is causing weight gain. Due to fast-paced lifestyles, Americans are working more hours per week, consuming more calories than needed, and not getting enough physical activity to compensate for the excess energy intake.<sup>10,11,15</sup> With a heavy reliance on processed foods, the American diet has shown an increase in sodium, fat, sugar, and carbohydrate consumption, and a decrease in exercise.<sup>46</sup> Naturally, these cumulative risk factors are causing many Americans to be overweight or obese.<sup>47</sup> Making healthy changes, such as increasing fruit and- vegetable intake while decreasing consumption of refined sugars and processed foods, can considerably decrease a person's risk for obesity.<sup>45,48</sup>

While dietary habits and energy imbalances are factors that can be prevented, there are many risk factors for obesity that are unmodifiable. Researchers have discovered more than a dozen specific gene defects that cause obesity<sup>49</sup>, and there are many medical conditions and medications that may cause hormone imbalances or weight gain. Some genetic conditions that may cause obesity include Praeder-Willi Syndrome, Bardet-Biedl Syndrome, Alström Syndrome, and Cohen Syndrome.<sup>45</sup> These syndromes may cause unstable appetites, abnormal weight loss/gain, genetic changes, and weak muscle tones.<sup>50-53</sup> Endocrine disorders such as hypothyroidism, Cushing's syndrome, and various tumors may cause obesity due to increased appetite and decreased metabolism.<sup>45</sup> Studies on identical twins show that obesity is caused by factors that are 60% genetic and 40% environmental, suggesting that appetite and satiety are primarily based on genetics, whereas eating behavior is determined by environment.<sup>49</sup> These

researchers pointed that the genetic makeup of humans has adapted and been passed down for millions of years, and the spike of obesity in the last 30 years cannot be attributed solely to genetics. This information leads the healthcare system to look at the preventable risk factors that *are* causing obesity.<sup>49</sup>

### **Obesity Among University Students**

According to the American College Health Association-National College Health Assessment, in 2015, 22.5% of students surveyed were classified as overweight, and 11.5% were classified as obese according to their body mass index (BMI).<sup>2</sup> The obesity epidemic, while affecting the entire nation, has increased the most within the college population.<sup>30</sup> Between the years of 1991 and 2001, obesity rates among young adults aged 18-29 doubled from 7.1% to 14%.<sup>54</sup> Unhealthy dietary habits are one of the top risk behaviors college students face, and are also a leading factor contributing to the obesity epidemic among this population.<sup>55</sup> This period of life is characterized by many changes for individuals attending university. Leaving home for the first time allows students to grow and explore in a way that they have never done before. Unfortunately, this period of exploration includes maturation and new responsibilities, such as personal time management, cooking for oneself, and social pressures to partake in various activities.

Obesity among university students is a problem in and of itself as most habits established during this period of time carry into the next phases of life.<sup>28</sup> This is an extremely malleable life phase in which college students are transitioning into an independent lifestyle. During college years, students are building the foundations of



lifelong habits that can either be characterized by healthy or unhealthy choices. These habits can determine their risk of disease in the years to come.<sup>21</sup>

### *Weight gain*

Recent studies show that young adults, specifically those at university, are the most at risk for weight gain due to unhealthy eating habits, in comparison to young adults of the same age, not attending university.<sup>30</sup> This period of transition from childhood to adulthood is a critical period for weight gain. Research on freshman and sophomore university students in a southern public university in the U.S. has shown a significant amount of weight gain takes place within the first year of college and continues into the rest of their college careers. Gropper et. al., measured 150 students in the years of 2007-2009 examining weight, body fat percentage, and waist circumference at the beginning freshman year, start of sophomore year, and at the end of sophomore year. Nearly 70% of this sample gained weight within their first two years enrolled at university, for an average of 2.5 pounds of weight gain. The weight changes in this sample are also coupled with an equally significant increase in body fat percentage and waist circumference.<sup>56</sup>

A longitudinal study conducted by Deliens et al. followed American university students during their first two years of college, measuring body composition and physical fitness. This study showed that most weight gain took place within the first year at university, and males gained more weight during this time than their female peers.<sup>57</sup> Multiple studies show that American university students, on average, gain between 3.9 and 9.4 pounds in the first two years alone.<sup>16,56</sup> During this period of transition, college students are often, for the first time, providing for themselves and

making their own dietary choices, and research indicates that these dietary choices are typically unhealthy.<sup>58</sup> With unhealthy dietary behavior being one of the top health risk factors for college students, it is evident that this is where most of the excess weight is originating from.<sup>29,55</sup> The accumulation of poor dietary habits and lack of physical activity is to blame for the energy imbalance, thus playing a large role in the obesity epidemic among this population.

### Sugar-Sweetened Beverages and Obesity

Obesity has risen drastically in all ages and ethnic groups in America, as has the consumption of SSBs (Figure 1).<sup>40,59</sup> The consumption of added sugars, specifically in liquid form, has been strongly associated with metabolic diseases such as type two diabetes, heart disease, stroke, high blood pressure, high fasting glucose, and obesity.<sup>5-8,60</sup> Such research has shown that an increase in SSB intake is also positively associated with weight gain in both children and adults.<sup>26,40</sup>

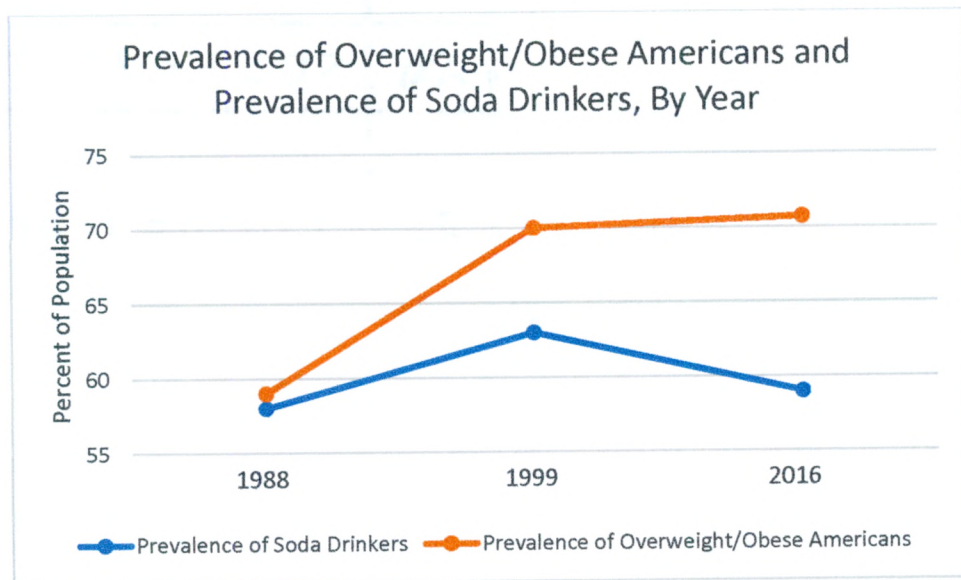


Figure 1: Prevalence of Overweight/Obese Americans and Prevalence of Soda Drinkers, by Year, NHANES 1988-1994, 1999-2004, 2015-2016<sup>42,61,62</sup>

As depicted in Figure 1, the rates of soft drink consumption and overweight/obese adults in America have shown similar patterns over time. In 1988, soft drink consumption was low, with only about 58% of the population drinking daily. Similarly, the rates of overweight and obesity are low with about 59% of the population being categorized as overweight or obese. Simultaneously, these numbers rose when soft drink consumption rose in the 1990s and early 2000s, with 63% of the population consuming soft drinks daily, and 70% of the population being overweight or obese. In more recent times, soft drink sales have declined due to the rise in diet soft drinks and the stigma surrounding high-fructose corn syrup.<sup>63</sup> In 2016 59% of the population was consuming soft drinks daily and 70.7% of the population was overweight or obese. While this data only examines soft drink consumption, rates of other SSBs are similar, and in fact, many have risen due to the recent decline in soft drink sales. Through this figure, it is evident that trends of overweight/obese adults have closely replicated the trends in soft drink popularity.

There are multiple proposed reasons as to why sugary drinks may cause weight gain, including the high glycemic load of these beverages, low satiety of liquids, empty calories, the metabolic properties of fructose, and the idea that people may be consuming such drinks in addition to other unhealthy lifestyle behaviors.<sup>40,60</sup> Studies have shown that diets with a high glycemic load affect blood glucose, cholesterol, and can cause heart disease as well as being conducive to weight gain.<sup>64</sup> Meals with a high glycemic load cause the body to go into postprandial hyperglycemia- or high blood glucose. High blood glucose promotes postprandial carbohydrate oxidation, instead of lipid oxidation, which causes the body to store fat rather than burn it.<sup>64</sup>

Low satiety of SSBs is due to the beverages being nutrient poor, and in the form of liquid calories, which the body can burn off quickly.<sup>65</sup> Previous evidence has shown that liquids fail to trigger hormones in the brain that cause satiety, or the feeling of being full.<sup>64</sup> Further, the metabolic properties of fructose may have a relationship with weight gain as it has an extremely low satiety in comparison to other sugars. Fructose in SSBs is typically high fructose corn syrup (HFCS) which may also induce insulin resistance and impaired glucose tolerance (IGT).<sup>66</sup>

Further, studies show that replacing SSBs with almost any other beverage decreases weight, blood glucose, and in some cases, the prevalence of metabolic diseases.<sup>67</sup> Substituting SSBs with plain water or a sugar-free alternative is recommended for the prevention of type two diabetes. Replacing just one serving of SSBs a day with one serving of water may decrease the risk of type two diabetes by 7%.<sup>67</sup>

### **Sugar-Sweetened Beverages and University Students**

National research has shown that many young adults and university students have diets high in fat, sugar, salt, and SSBs. These dietary habits, while problematic in themselves, also have a relationship with eating outside of the home frequently.<sup>46</sup> Previous studies state that the average young adult is consuming at least 16 ounces of SSBs daily.<sup>9</sup> Consumption of soft drinks and energy drinks alike have a strong correlation with overweight and obese BMIs among university students.<sup>13</sup> The Beverage Guidance Panel shows that the average American diet has increased by almost 300 calories in the past decades, and 50% of those calories are from SSBs alone.<sup>68</sup> Due to this increase in SSB intake, there is a need for more research surrounding the correlation between BMI of university students and their consumption of SSBs.

While most age groups consume SSBs, young adults have the highest rates of consumption. About 33% of U.S adults are consuming one or more SSBs per day.<sup>63</sup> Of those 1/3<sup>rd</sup> adults, the age group with the highest consumption are adults between the ages of 18-24. Young adults in the U.S. are consuming nearly triple the amount as older adults.<sup>69</sup> It is imperative to look at the habits of this population since they will be the next generation of professionals, and during the college years they are creating habits that will carry into their adult lives.

### **University Students and Dietary Habits**

Due to the nature of the college lifestyle, convenience foods and fast foods tend to be a large part of students' diets.<sup>21</sup> A college diet is typically low in fresh fruits, vegetables, and dairy products, but high in fat, salt, and sugar.<sup>70,71</sup> Of the seven nutrients of concern established by the *Dietary Guidelines*, (calcium, potassium, fiber, magnesium, vitamin A, C, and E), young adults in the U.S. are not consuming enough of six out of seven.<sup>15</sup> The college culture is that of all-you-can-eat cafeterias and retail dining establishments on campus that encourage over-consumption of less desirable foods and under-consumption of fresh, healthful foods.<sup>46,72</sup> While this type of culture is reflective of the American food culture, it may not be generalizable to other parts of the world where college campuses do not frequently have all-you-can-eat dining halls.<sup>31</sup>

Research suggests that the more involved someone is with their food preparation, the more likely they are to consume a healthful diet; but in a study of university students and food preparation, 1/3<sup>rd</sup> of participants admit to not having enough time to prepare their food.<sup>46,73</sup> Students living on campus, specifically with meal plans, are less likely to

prepare their food at all, compared to their peers living off campus, but rather purchase pre-prepared foods or choose to eat outside the home.<sup>46</sup>

## **University Students and Beverage Consumption**

### *Caffeine Consumption*

There is a strong correlation between caffeine consumption and obesity, not due to caffeine intake necessarily but because of the SSBs that often become the vessels for caffeine consumption.<sup>14</sup> Research has shown that energy drinks in healthy young adults may lead to obesity due to the combination of sucrose and caffeine causing carbohydrate oxidation and reduced lipid oxidation.<sup>27</sup> Caffeine consumption among university students is a huge factor that affects dietary habits. One of the most popular reasons for caffeine consumption among college students is staying awake longer.<sup>13,14</sup> Students who participated in various clubs and organizations at university overall consumed 60.7% more caffeine than the students that did not participate in activities.<sup>14</sup> Men are 1.5 times more likely to drink energy drinks than women, while alcohol drinkers are 2.5 times more likely to use energy drinks than those who do not consume alcohol.<sup>27</sup> Studies show that university students are consuming five times more than the recommended daily caffeine amount. These same students recalled the many negative side effects of caffeine usage, and 51% admitted experiencing caffeine withdrawal. Overall, these students still found it more important to use caffeine for its perceived health benefits than the risks of the health detriments on the body.<sup>8</sup>

Of those that drink energy drinks, 60% reported trying them for the first time while in college. The most popular places for trying energy drinks were the home, bars,

and recreational areas. Most students also reported trying their first energy drink in the company of a friend and to improve the taste of alcoholic drinks.<sup>27</sup> It is evident from these studies that many SSBs such as energy drinks are not only highly consumed by university students, but also perceived as a social drink. Caffeine consumption while not entirely at fault for obesity among university students, is a habit that can be part of an entire system that contributes to obesity due to the excessive caloric and carbohydrate intake in many of these beverages.

### *Alcohol consumption*

Alcohol consumption of college students in their 20s is consistently higher than young adults in their 20s not enrolled in university.<sup>74,75</sup> Studies show that students living off campus are smoking more and consuming more alcohol than those living on campus or with their families.<sup>21</sup> As previous research stated, alcohol consumption leads to excess calorie consumption from the drinks themselves, as well as from the snacking that happens during drinking.<sup>76</sup> At seven calories per gram, alcohol has a higher caloric content than both protein and carbohydrates which are four calories per gram, and only second to fat at nine calories per gram.

## **Differences Between University Students Living On and Off Campus**

### *Meal plan*

Previous work has shown that university students have varying eating habits depending on where they reside. Brunt et al. suggests that students living off campus without parents were more likely to be overweight or obese.<sup>21</sup> Due to the independence that these students have away from their parents to make their own dietary choices and

prepare their own meals, they may be making poorer choices than if they were living at home with parents. This same study also showed that students with a meal plan were consuming more dairy, fruits, and vegetables than those without a meal plan. Overall, the students living off campus were consuming less nutrient dense foods.<sup>21</sup> Similarly, Brown et al. found that students living on campus with a meal plan were consuming more fruits and vegetables than their peers residing elsewhere.<sup>20</sup> Studies have shown that students consuming more energy dense, nutrient poor foods gain higher amounts of excess weight, leading to obesity and other metabolic syndromes.<sup>47</sup> Laska et al. reported that students living on their own or with their parents were consuming meals less regularly and less frequently compared to those living on campus.<sup>23</sup> University residents that lived on campus also reported eating the least amount of fast food compared to those living off campus with friends or family. This study stated that, overall, students living on campus had better dietary habits and intake than those living off campus, since the students living on campus reported having more availability to healthful foods. The conclusion of this study was that a structured meal plan not only makes healthy foods more available, but also encourages variety in the diet and better eating habits in general.<sup>18</sup> While previous research has contradicted such findings, in both studies however, even the student population with the most ideal dietary intake was still at risk for future complications based on their inability to meet national health recommendations for most food groups.<sup>20,23</sup>

### **Factors Affecting Food and Beverage Choices**

The United States has the highest consumption of soft drinks (carbonated, sweetened beverages) per capita in the world.<sup>14,77</sup> More than 65% of students are



consuming SSBs on a daily basis, and the rate of energy drink consumption has been on the rise.<sup>13</sup> Soft drinks alone contribute more energy to the American diet than any specific food, and soft drinks are the largest source for “liquid energy.”<sup>40,78</sup> Consumption of SSBs is positively associated with eating meals while watching television/playing video games, availability of soft drinks in the home, frequency of fast food consumption, lack of breakfast consumption, and participating in on-campus activities.<sup>13,14,79,80</sup> Ezzat et al. affirmed this information in a study that demonstrated that participants who were raised with soft drinks in the home were more likely to consume soft drinks than their peers who did not have soft drinks available in their homes.<sup>13</sup>

Furthermore, a study of SSB consumption in university students in Egypt showed that students at normal BMI are more likely to consume soft drinks than those who are underweight and overweight. This research also showed that students with a BMI classified as overweight or obese are most likely to prefer diet soft drinks with low calorie sweeteners (LCS) to traditional soft drinks.<sup>13</sup> Other research on LCS supports this data, showing that almost 12% of adults consume LCS. Women use LCS more than men, as well as those with higher education levels, higher incomes, and non-Hispanic whites.<sup>59</sup> Overall, males tend to consume more soft drinks and energy drinks than females, while females prefer soft drinks to energy drinks. The consumption of the two combined, however, show a significantly positive relationship with increased BMI.<sup>13</sup> The importance of previous research on LCS is because the substitution of LCS instead of traditional sugar in their beverages may show a decrease in weight, adiposity, and metabolic diseases.<sup>60</sup> This research is critical to determining potential motivators for consuming SSBs or drinks with LCS, to create an appropriate intervention with this

population. The substitution of LCS to traditional sweeteners in a beverage can remove excess sugar and calories in those beverages.

### *Individual Factors*

Research shows that many young adults are unfamiliar with the Dietary Guidelines for Americans.<sup>15</sup> Students who are knowledgeable of the current Dietary Guidelines, however, are more likely to have better diets than those who are not familiar with the recommendations.<sup>81</sup> An important part of a healthy diet is having a variety of foods from each food group. In a focus group of 24 university students discussing their culinary self-efficacy, knowledge of a healthy diet, and barriers to healthy eating, students explained the importance of variety. Of all the themes discussed, health perceptions were of the largest group. Students mentioned “balance and moderation” as an important part of a healthy diet. Secondary to balance and moderation were themes such as cooking techniques, portion sizes, and eating out infrequently.<sup>31</sup>

Using the Theory of Planned Behavior (TPB) to understand SSB consumption shows that behavioral intentions have the most impact on an individual’s decision to drink these beverages. TPB is an individual level based behavioral model that explains and predicts behavior.<sup>82</sup> Utilizing TPB to predict and understand consumption of SSBs, there are six possible constructs that can be used to explain behavior (Figure 2). The constructs established in TPB to explain behavior include attitude, behavioral intention, subjective norms, social norms, perceived power, and perceived control. The construct of behavioral intentions has the most significant relationship of all the constructs, followed by attitude, perceived behavioral control, and subjective norms.<sup>83</sup> Behavioral intention, as a construct, is the idea that a person will likely engage in that behavior, and it is the

largest predictor for behavior. Using TPB and its constructs could help to determine an individual's motivations for purchasing or consuming SSBs without accounting for other environmental factors. Attitudes and social norms towards SSBs are largely related to media and how these beverages are depicted. As more research is published on the dangers of such beverages, the stigma surrounding consumption and perceived health deficits cause consumers to purchase less.<sup>41</sup> Creating social norms to consume other items such as water and 100% fruit juice will change the attitudes of the consumers from the perceived social norm of soft drinks to be a popular item. Behavior intention, perceived power, and perceived control all have a significant role in purchasing and consuming specific items. These constructs involve the intention to decide, and the ease in doing so. Health education interventions can use TPB by giving the population easier choices and making individuals feel confident in their decision making to purchase and consume healthy items. Subjective norms and social norms involve the normative actions set by society. Creating a standard of health in which consuming SSBs in excess is unacceptable and uncommon, will afford health practitioners to decrease consumption levels.

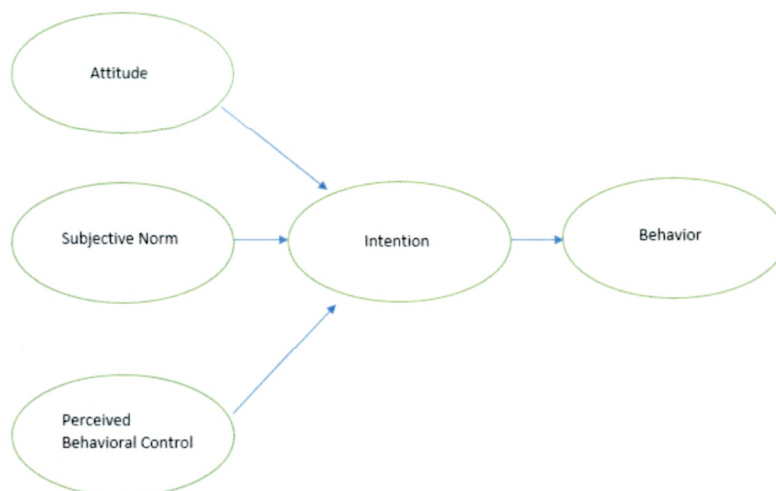


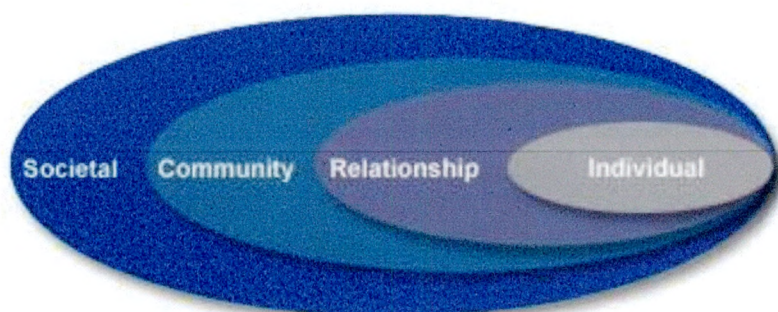
Figure 2 The Theory of Planned Behavior

### *Contextual Factors*

The Social-Ecological Model (SEM) was introduced as a model of human development to explain how humans are influenced and affected by internal and environmental factors. It was first developed in the 1970s and went on to become an established theory of human behavior in the 1980s.<sup>84</sup> The SEM has been used to implement changes in public health by utilizing multi-level interventions. This is done by understanding the various levels of influence that lead a person to make decisions, and to intersect at these various locations. The SEM has been used to create interventions for obesity, physical activity, cancer, and other health related models.<sup>84</sup> The Centers for Disease Control and Prevention (CDC) use an adaptation of this model and apply it to their various health education practices.<sup>84</sup> (Figure 3)

Using the SEM to understand dietary choices allows for researchers to gather more information than just the individual's choices without making ecological assumptions for an entire population. This model observes person-environment

interactions, as well as personal factors, social norms, and the timing of these factors. The SEM does not just look at these factors separately, but recognizes how they may overlap and intersect at any given point in a person's life.<sup>84</sup>



*Figure 3 The Social-Ecological Model: A Framework for Prevention, CDC, 2015<sup>84</sup>*

The first sector of this theory concerns the individual, focusing on those factors that are unique to each person. Sex, socioeconomic status, attitudes, beliefs, and behaviors are all examples of individual aspects. For example, students who perceive themselves as eating well are more likely to meet the recommendations for young adults than those who do not perceive themselves as having a healthy diet.<sup>85</sup>

The second circle of the model is the interpersonal or relationship sector. Among this sector lies the individual's relationships with family and friends, social networks, peers, support groups, etc. This sector is extremely important in interventions as it is where peer influence could hinder or help make changes, and where social marketing campaigns may take place. For instance, students raised in a household that prioritized family meals are more likely to replicate this behavior into adulthood; these students also consume more fruits and vegetables than those who eat alone.<sup>85</sup> Students who cook alone and eat alone are also more likely to live alone. Removing the social aspect of cooking and eating meals tends to cause grocery shopping and preparing meals seem like more of

a chore than an enjoyable part of the day.<sup>31</sup> The more people cook and eat together, the more likely they are to have a healthy diet overall. Studies also support the idea that removing the socialization often associated with sharing meals may determine whether these individuals develop the culinary knowledge necessary to cook for oneself.<sup>46</sup>

Overall, students who do not enjoy cooking or make it a social event are less likely to develop meal preparation skills and, thus, are less likely to have a healthy diet.<sup>46,72,85</sup>

The third circle of the SEM is the community the individuals are a part of. This area encompasses their settings, usually the city or town in which they reside. The community influences what types of organizations, businesses, and schools the individual attends.

The economic status of the community is extremely important for availability of businesses, such as grocery stores and access to health care organizations. The second circle of relationships often overlaps with the third sector of community, as individuals usually share their settings with the many people they have relationships with such as schools and community centers. In fact, studies show that factors related to the home are more likely to support healthy eating while factors outside the home are more closely related to unhealthy eating habits. For example, those who spend more time cooking in the home and preparing meals with fresh foods and have regular meal schedules are more likely to have healthy dietary patterns. Factors outside the home, such as “eating on the run,” purchasing food on campus, fast food consumption, and eating while using media, are significantly less likely to have healthy dietary habits.<sup>73</sup> While this contradicts prior information stating that students living on campus are found to have healthier diets, the factor of “eating outside the home” may apply to the on campus population- and the

residence halls in which they reside. Students living on campus may be preparing meals in their residence hall, which many consider their “home.”

The final sector of the SEM is the societal structures and systems of the community, such as the media, public works department, governmental agencies, and federal/local regulations.<sup>86</sup> For example, Americans tend to utilize restrictive diets for weight loss, following current trends in the media such as diets low in carbohydrates, gluten free diets, and the Paleo diet. When surveying participants on their perceptions of healthy eating, it is important to consider current trends at that time. A study on cross-cultural comparisons of American and Chinese undergraduate students’ perceptions of healthy eating showed the importance of media in research.<sup>24</sup> Many of the American participants mentioned restricting certain foods and food groups such as carbohydrates. With the media covering increased carbohydrate and added sugar intake as risk factors for obesity and diabetes, diets such as The Atkins Diet<sup>87</sup> that restrict carbohydrates are growing in popularity.

By looking at these four different sectors simultaneously for a specific individual, public health professionals can create an appropriate intervention that meets needs of the individual where they already are, and engage the different people in their life. In fact, previous research on SEM in nutrition shows that using the model to intersect at various locations is effective in nutrition related interventions, such as the CDC improving lunch time purchasing behaviors in students, thus, causing improvements to diet quality.<sup>84,88</sup> Interventions with adults have been successful with improving nutrition policies in the work place using a similar design.<sup>88</sup>

Utilizing the SEM to examine the barriers to healthy eating, it is evident that the community they are a part of and their relationships with others do indeed have a large impact on decision making of this population. If research shows that young adults that eat outside the home are more likely to be making unhealthy dietary choices, SEM can be used to create an intervention for those eating outside the home, in those specific locations. The relationships that people have with others are extremely important because as mentioned, people that eat alone are more likely to be making unhealthy choices.<sup>73</sup> These relationships can be a huge part of a potential intervention. Lastly, on the individual level, perception and knowledge has a large role in dietary choices. An intervention focusing on the barriers and knowledge of these individuals would allow for health education practitioners to get to the root of the issue.

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### **Barriers to a Healthy Diet**

Barriers to eating healthy can be assessed looking at the SEM because some of the barriers are personal and some are environmental. Most students understand the



importance of cooking in the home, however, they find grocery shopping and preparing meals a chore.<sup>31</sup> Aside from the obvious lack of time in a college student's day, their budgets are often inadequate to purchase healthy foods.<sup>31</sup> All of the students in the study *Culinary Efficacy* by Murray et al. reported needing financial assistance in one way or another, and stated that the amount they are receiving is still not enough to support themselves and consume a healthy diet.<sup>31</sup> Lack of financial resources, while a main concern, is also coupled with another common barrier: lack of transportation.<sup>31</sup> Both residents living on campus and commuter students may find themselves in a "food desert," a location without access to fresh fruits and vegetables and whole foods, typically in impoverished areas, struggling to reach a large chain grocery store and feeling pressured to purchase less healthy items from other businesses that may not exactly support a healthy diet.<sup>89,90</sup>

Another barrier to eating healthy for college students is the lack of time. In one study, 1/3<sup>rd</sup> of the participants reported "not having enough time" as a barrier to healthy eating.<sup>46</sup> Not only are these students struggling to find time to cook, but some have yet to find the time to learn the basics of meal preparation. Studies show that college students are most often eating "on the run" and consuming breakfast only about four days a week.<sup>21,24,28,73</sup> Students recommend that health educators pay attention to the main barriers that college students encounter to preparing healthy, low cost meals in a short amount of time.<sup>31</sup> The opinions of these students are extremely important for future health education to be successful among this specific population.

The three main barriers university students face when trying to eat healthy are lack of time and resources in the individual sector, environmental barriers such as lack of

access to supermarkets, and learned behaviors from the culture and childhood (whether they prefer eating in groups or alone, or if they were taught meal preparation skills).

Using the SEM to understand these barriers, researchers can intervene at each appropriate sector to make changes at the individual and environmental level.<sup>31,84</sup> Even students with knowledge of a healthy diet have many barriers to eating well, because knowledge does not necessarily translate to action.<sup>82</sup>

## **Chapter III: Methodology**

### **Research Questions**

Extensive research has studied the association between weight status and dietary habits among university students; however, there are few comparisons between students that live on campus and students that live off campus, and their relationships with diet and weight status.<sup>4,16,21,28,30,55,58,70,70,74,81</sup> No research to date has observed obesity rates of university students in relation to sugar-sweetened beverage (SSB) intake and residency. This study will be the first to examine a relationship between the following factors: SSB intake in fluid ounces, body mass index in kg/m<sup>2</sup> (BMI), residency (i.e., on-campus in traditional housing, on-campus in apartment style housing, off-campus with parents, or off-campus with roommates) and meal plan status (i.e., unlimited meal plan, swipe meal plan, pay-as-you-go meal plan, or no meal plan).

The purpose of this study is to answer the following research questions:

- RQ1: Is there a direct correlation between SSB intake and BMI in university students?
- RQ2: Does the association of SSB and BMI differ between residency type?
- RQ3: What are the biggest motivators for university students to consume SSBs?
- RQ4: Are students with a meal plan more likely to consume SSBs?

## **Study Population**

Montclair State University (MSU) is a public university in Northern New Jersey overlapping three communities; Clifton, Montclair and Little Falls. The current enrollment is about 20,987 students, with 16,810 undergraduates and 4,177 graduate students. Of those 20,987, approximately 5,200 reside in on-campus housing.<sup>91</sup> The population of MSU is 61% female undergraduates and 71% female graduate students, respectively. MSU ethnicity is primarily Caucasian followed by Hispanic/Latino, with the smallest group of students being American Indian/Alaskan Native. Overall, the population of MSU is overwhelmingly Caucasian, undergraduate, female, commuter students.<sup>92,93</sup> Refer to Table 1 in the Chapter IV: Results for the full demographic makeup of this population.

## **Instrument**

The survey instrument consisted of questions concerning demography, location and motivation for purchasing and consuming SSBs, and a beverage intake questionnaire (BEVQ<sup>33</sup>), comprising five question groups in total. Potential participants were informed that survey completion should take no more than 20 minutes. See Appendix B for the full questionnaire.

*Demographics.* The initial survey instrument was developed with six questions to create a demographic profile for each participant. The first questions were multiple choice, which gathered information about gender, ethnicity, education level, residency, and meal plan. Participants then filled in two open-ended questions that inquired about height in feet and inches, and weight in pounds. Age was not requested of participants

because recalling age may have caused participants to not honestly record their alcohol intake in fear of consequences resulting from underage drinking.

*Locations of Purchasing and Consuming.* The second group of statements asked agreements about locations of purchasing and consuming SSBs. This group of statements was a binary array of “True” or “False” statements specifying where participants consumed these beverages such as at home, school, or during their commute. The second portion of the array of “True” or “False” statements addressed where the participants purchased these beverages, such as off-campus locations, on-campus retail establishments, or in the campus dining halls. These questions were determined based on previous research in the literature review, to narrow down most common locations for consumption.<sup>13,14,18,27</sup>

*Motivations for Purchasing and Consuming.* The next group of statements were designed to identify potential motivators for participants to purchase and consume SSBs. This array used a Likert scale to measure participant motivations. Scores used were “Strongly Agree,” “Agree,” “Neither,” “Disagree,” and “Strongly Disagree.” The statements asked if participants were consuming SSBs for a specific reason -- for energy, for the taste, to enhance academic performance, to enhance athletic performance, or to be mixed with alcohol. Participants were then able to record other reasons they may consume these beverages. These questions were created for construct validity based on supporting literature discussing the most prevalent reasons university students consume SSBs.<sup>13,14,27</sup>

*Beverage Intake Questionnaire (BEVQ-15).* The final group of questions was the BEVQ, which is a validated recall tool developed by the Virginia State Polytech

Institute.<sup>33</sup> This was used for the beverage food frequency questionnaire and adapted for clarity. The original BEVQ-15 is a 15 question recall survey that was used as the framework for the beverage recall portion of this survey. The BEVQ-15 lists 15 beverages in an array and asks participants to recall “How Often” they consumed each beverage weekly, as well as “How Much Each Time” and record how many fluid ounces they consume in each sitting.

Two major changes were made to this BEVQ-15 by breaking one question item into two, and clarifying three items. For the purposes of this study, the 15-item questionnaire became a 16-item questionnaire, breaking the last item into two categories. Item number 15, “Energy & Sports Drinks”, was broken down into two distinct items- “Energy Drinks,” and “Sports Drinks.” This question item was separated because energy drinks and sports drinks are vastly different items (energy drinks contain stimulants, sports drinks do not) and the researchers wanted to be able to analyze them separately to examine their various levels of consumption. Three item lists from the original BEVQ-15 were then adapted for clarity and ease of understanding for the participants. These clarifications were done in conjunction with the original authors of the BEVQ-15 and added into the adapted questionnaire for this study. Item number nine, “Sweetened Tea,” became “Sweetened Tea (black tea with sugar, i.e. Snapple)”. Item number 10, “Tea or Coffee with cream and/or sugar (includes non-dairy creamer),” became “Tea or Coffee with cream (includes non-dairy creamer.)” Item number 11 “Tea or Coffee black, with/without artificial sweetener, (no cream or sugar),” became “Tea or Coffee black (no cream or sugar, but may have an artificial sweetener).”

See Appendix B and C for the adapted BEVQ-15 and original BEVQ-15, respectively.

### **Pilot Study and Participant Survey Completion**

The original questionnaire was piloted prior to actual implementation. The purpose of piloting the survey was to improve the instrument and eliminate ambiguity within the individual questions. The original survey questions were piloted by four individuals to gain feedback on the questions. The participants of the pilot were recruited as a convenience sample, not demographically representative of the sample population. However, all four were students at the university the sample was recruited from. One change made after this initial pilot included asking students for their *education level* instead of their *student status*, as the goal was to determine what year of university they are in.

The adapted BEVQ portion of the questionnaire was then piloted by itself. A small sample of 10 individuals was selected to participate in the pilot study for this research, through convenience sampling on campus. Of the 10 individuals, five were students in the Department of Nutrition and Food Studies and five were from other academic majors including Marketing, Jurisprudence and Political Science, Public Relations, Family and Child Studies, and English Education. The BEVQ was distributed to the individuals online, along with a standard list of beverages and amounts. The participants were directed to complete the BEVQ array, as if the provided list of beverages were those consumed in the past month. The purpose of piloting the BEVQ separately from the rest of the questions and in this manner, was to test the validity of the

questions. The participants were also given the option to provide feedback at the end of the beverage recall and make suggestions to improve the survey.

The accurate response rate for the BEVQ pilot was analyzed through SPSS performing a one sample t-test. The average response was compared to the correct response, proving that this adapted tool was adequate prior to distribution. Results from the pilot showed that the average response was 114.67 +/- .782 fluid ounces and the correct response was 120.07 fluid ounces. The difference was not statistically significant with  $P=.057$ . These results suggest most people in the pilot answered the questions accurately. Therefore, the responses in the actual study will be considered valid responses. From this pilot, it is understood that on average, participants may be underreporting their total beverage intake by about six fluid ounces. The implications of underreporting by six fluid ounces could mean underreporting anywhere from zero calories to 410 calories, depending on the beverages recalled from least caloric (water at zero calories per fluid ounce) to most caloric (hard liquor at 68.18 calories per fluid ounces) on the array.

Comments made after the pilot survey led the researchers to adapt the tool in one way. A new header was inserted into the top of the array stating, "How often (choose one)", and "How much each time (choose one)", to clarify that each beverage needed two responses. Other constructive feedback included that it was inconvenient that the array was so long since it went to two pages, which caused the participants to scroll up and down when filling in the bubbles. One participant stated that they wished that the two questions regarding frequency and amount could be separate questions, but understood that it would require more time when completing the questionnaire (and that it would



make it more confusing for participants to fill out each beverage twice). Another response for the pilot mentioned that there was no option to fill in beverages that one did not consume less than once a week, which may be problematic for participants who often consume specific beverages, but not every week. Overall the feedback for the pilot BEVQ study was positive.

The final survey instrument was administered through MSU email listservs, Canvas groups, and social media venues such as Facebook. The survey was administered over a one week period from March 8th, 2017-March 15th, 2017.

### **Ethical Considerations**

Throughout the development and distribution of the survey, exceptional care was taken to conduct procedures acceptable for human research. This study was approved by the MSU Institutional Review Board prior to administration, deeming the survey acceptable for distribution. (IRB-FY-16-17-510) The data was exported into SPSS for analysis. No identifiable information was collected, participants remained anonymous throughout the entire process. Consent was received from each individual prior to beginning the survey.

### **Sample Recruitment and Data Collection**

The sample for this research was determined by using a snowball convenience approach, a nonprobability sampling technique that utilizes participants to recruit more potential participants. Creating a survey using Limesurvey software allowed researchers

to utilize social media platforms and email listservs to send the survey link to various groups online. At least 10 participants confirmed sending the survey link out to other listservs and groups. These included Canvas listservs like The Graduate Program for Nutrition and Food Science, The Student Campus Recreation Center, and email listservs such as The Village at Little Falls, Residence Life, Red Hawk News, and Commuter News (see Appendix D for examples). Facebook groups for various organizations were also contacted such as Montclair State Dietetics Organization, MSU Office of Greek Life, and any other groups that participants had access to. Online surveys have many advantages over paper and pencil surveys such as collecting data in real time and saving time when inputting data into statistical software. Further, the expenses of online surveying are lower than that of paper or mail in surveys.<sup>94</sup> The convenience of an online survey also allowed for participants to complete it on their own time, in any location. A free online survey tool, such as Limesurvey, saves money from printing paper copies and is more efficient than distributing paper copies. An online based survey allows researchers to reach a larger population, such as students off campus, that they may not be able to reach in person. Research has also shown that online surveys have a higher return rate in comparison to mail in surveys.<sup>95</sup>

To be eligible for the study, participants were required to be 18 years or older and currently enrolled at MSU at the time of survey completion. The first page of the questionnaire explained eligibility and consent. Each participant was required to give consent before continuing to the survey portion.

## Data Analysis

Prior to beginning any analysis, the raw data that was collected from the survey was converted to numbers that allowed researchers to compute relationships. All nominal scales were given numbers based on the order of the question. For example, "Male" was given a value of "1" and "Female" was given a value of "2". For the BEVQ, all recorded numbers were calculated based on a set of values determined by the original researchers of the tool from Virginia Polytech State University<sup>33</sup> See Appendix C for BEVQ-15 conversions and scoring instructions. The column "How Often" was converted to units of "times per day," so 1 time per day being 1, 2 times per day being 2, 3 times per day being 3, never or less than 1 time per week as 0, 1 time per week as .142 (1/7) times per day, 2-3 times per week as .357 (2.5/7), and 4-6 times per week as .714 (5/7) times per day.

The column "How Much" was converted into numbers that represent the amount consumed in fluid ounces, as determined by the original researchers of the tool, due to prior validation of the calculations.<sup>96</sup> As suggested by the original authors, "Less than 6 ounces" became four, "8 ounces" remained eight, "12 ounces" remained 12, "16 ounces" remained 16, and "greater than 20" ounces remained 20. To determine average daily consumption for each beverage, "How Much" in fluid ounces was multiplied by "How Often", or how many times a day. That number was then converted into both grams and calories per beverage so additional analyses could be done.

Prior to analysis, self-reported height in feet and inches and weight in pounds was used to calculate BMI based on the following formula- "BMI= (Weight in Pounds)/(Height in Inches)<sup>2</sup> x 703".

Demography was analyzed using descriptive analysis, and research questions were analyzed using descriptive analysis and correlation technique. All statistical analyses were performed at the alpha level .05, type-1 error.

Demographic analysis was conducted to gather information about participant demographics such as gender, ethnicity, grade level, BMI, residency, and whether they had a meal plan. Descriptive statistics were used to determine the average daily intake of each individual beverage in fluid ounces as well as calories, and to determine statistics for demographics, height, weight, BMI, gender, and the number of undergraduate versus graduate students.

- RQ1: Is there a direct correlation between SSB intake and BMI in university students?

To address RQ1, a relationship between SSB intake and BMI was determined using Pearson's  $r$  correlation among all participants. Average daily fluid ounces and average daily calories of all beverages were calculated for each participant. Beverages were then categorized so daily SSB fluid ounces and daily SSB calories could be calculated for each participant. SSBs were considered sweet tea, soft drinks, energy drinks, coffee drinks with sugar, sports drinks, and sweetened juice beverages that are not 100% fruit juice. Drinks that were not considered SSBs from the BEVQ were; 100% fruit juice, alcoholic beverages, milk beverages, coffee beverages without sugar, unsweetened tea, water, and diet soft drinks. Descriptive statistics were used to determine the means, frequencies, and standard deviations for each beverage consumed.

- RQ2: Does the association of SSB and BMI differ between residency type?

To address RQ2, the data was analyzed to compare the relationship between average daily intake of SSBs in fluid ounces and BMI by student's residency status (on campus versus off campus). Mean frequencies were recorded of students living “on campus, in traditional housing,” and students that live “on campus, apartment housing,” combined, compared to students that recorded living “off campus, with parents,” “off campus, with roommates,” and “off campus, other,” for example living with other family members such as children and significant others, or living off campus alone. A two-tailed Pearson correlation was completed for both groups to determine significance.

- RQ3: What are the biggest motivators for university students to consume SSBs?

To address RQ3, descriptive statistics were used to summarize the motivations for consuming SSBs. Descriptive statistics were used to compute the frequency for each question and response option to determine the participants' highest motivators for purchasing and consuming SSBs. Frequency was analyzed for each question scale to determine the percentage of participants who chose “Strongly Agree,” “Agree,” “Neither,” “Disagree,” “Strongly Disagree.”

- RQ4: Are students with a meal plan more likely to consume SSBs?

To address RQ4, the group of participants was used to examine two variables-SSB intake and meal plan. These students were then split to observe students that recorded having a meal plan, either an unlimited swipe plan, a swipe/block plan, or a pay-as-you-go plan, and they were compared to those students who recorded having no meal plan at all. An independent sample t-test was performed to determine mean SSB intake difference between groups: those with a meal plan versus no meal plan.

### **Additional Data Analysis**

Additional correlations were examined to compare participant BMI by housing type and meal plan. Additionally, the relationship between SSB intake and BMI was analyzed and compared by gender, (male versus female), as well as degree type (undergraduate versus graduate). These two split populations were analyzed to determine potential differences between groups. Cross tabulations were completed to determine consumption between specific groups such as residential students with a meal plan. Frequencies of answered questions about locations of purchasing and consuming SSBs were calculated using descriptive statistics. Frequencies of consumption of alcoholic beverages were calculated using descriptive statistics.

## Chapter IV:

### Results

#### Participant Demographics

Of the total 355 views or attempts at survey completion, a total of 200 complete responses were analyzed, which is a 56.33% completion rate. Table 1 depicts the demographic frequencies of all participants for student status, gender, ethnicity, housing, body mass index (BMI), and meal plan type of this study sample, demographic information for the population of Montclair State University (MSU), and demographics of the United States of America (U.S.). Of the 200 participants, 81.5% were undergraduate students and 17% were graduate students, with 1.5% of the population being "Other," such as having or seeking another advanced degree. This sample used was representative of the population of MSU because the actual population is 80% undergraduate students and 20% seeking advanced degrees such as master's degrees.<sup>91</sup> Of the 163 undergraduate participants, the majority were seniors making up 33% of the total population. Further, 77.5% of the participants were female, leaving 22.5% males. This gender demographic was highly representative of the MSU population with almost 70% of the population being female.<sup>92,93</sup> Self-identification of ethnicity shows that 66% of participants were Caucasian. African American and Hispanic/Latino participants were equal at 12.5% participants each, 7% participants stated that they were Asian. The rest of the sample was comprised of Indian/Middle Eastern/Arab, a mix of multiple races, or other ethnicities not identified. This demographic profile of ethnicities closely represents the population of MSU with Caucasian being the highest percent of students at 54%, followed by Hispanic/Latino and African American being 22.5% and 12% respectively.<sup>91</sup> Of the 200 completed responses, the housing demographic was split with 99 participants

living on campus and 99 participants living off campus, and two not categorized. This is not representative of the MSU population because the population of the university is about 25% residential students, and 75% commuter students, whereas the population of this survey was 50% of each group.<sup>91</sup> Of the 200 fully completed surveys, 38% of the participants reported having a meal plan, while 61% reported not having a meal plan. On average, this sample was consuming 13.98 SSBs per day, or 154 calories. The average BMI for this population was 24.68 kg/m<sup>2</sup>, with 2.5% underweight, 61.5% were at normal or healthy weight, 25% were overweight, and 11% were obese, according to their self-reported height and weight converted to BMI. This is representative to this age group because on average, 34% of U.S college students are overweight or obese; this population has 36% overweight or obese participants.<sup>2</sup>



Table 1: Demographic Profile of Participants

Study Sample (N=200)			MSU <sup>91</sup> % N=20,987	USA <sup>97-99</sup> % N= 323,127,513
	N	%		
<b>Gender</b>				
Male	45	22.5	29.0	49.2
Female	155	77.5	71.0	50.8
<b>Student Status</b>				
<b>Undergraduate</b>	<b>163</b>	<b>81.5</b>	<b>80.4</b>	
• Freshman	15	7.5		
• Sophomore	29	14.5		
• Junior	53	26.5		
• Senior	66	33.0		
<b>Graduate</b>	<b>34</b>	<b>17.0</b>	<b>20.6</b>	
<b>Other</b>	<b>3</b>	<b>1.5</b>		
<b>Housing</b>				
<b>On Campus</b>	<b>99</b>	<b>49</b>	<b>24.8</b>	
• Traditional Housing	44	22.0		
• Apartment Housing	55	27.5		
<b>Off Campus</b>	<b>99</b>	<b>49</b>	<b>75.2</b>	
• With Parents	70	35.0		
• With Roommates	16	8.0		
• Other, Family	6	3.0		
• Alone	7	3.5		
<b>Other, N/A</b>	<b>2</b>	<b>1.0</b>		
<b>Meal Plan</b>				
<b>Meal Plan</b>	<b>78</b>	<b>39.0</b>		
• Unlimited Swipes	21	10.5		
• Swipe Plan	45	22.5		
• Pay as you go	12	6.0		
<b>No Meal Plan</b>	<b>122</b>	<b>61.0</b>		
<b>Ethnicity</b>				
African American	25	12.5	12.0	13.0
Asian	14	7.0	5.5	5.0
Caucasian	132	66.0	54.0	77.0
Hispanic/Latino	25	12.5	22.5	17.0
Indian	2	1.0	0.1	1.0
<b>Other, Mix</b>	<b>1</b>	<b>.5</b>	<b>2.0</b>	
<b>Other, N/A</b>	<b>1</b>	<b>.5</b>		
<b>BMI</b>				
Underweight (<18.5)	5	2.5		2.0
Normal Weight (18.5-24.9)	123	61.5		36.0
Overweight (25.0-29.9)	50	25.0		34.0
Class I Obese (30-34.9)	15	7.5		22.0
Class II Obese (35.0-39.9)	7	3.5		6.0
<b>Average Daily Consumption of SSBs</b>	<b>Fl Oz</b>	<b>Kcal</b>		<b>Fl Oz</b> <b>Kcal</b>
	13.98	154		16        176

## Beverage Intake

Figure 4 shows average daily intake from individual beverages with fluid ounces and calories side by side. This figure shows that over the course of an average week, the most daily calories consumed from a single beverage are from hard liquor, at nearly 70 calories per day, and the least amount of calories consumed per day from a single beverage are from water, at zero calories. The beverage with the highest average fluid ounce consumption per day was water at almost 40 ounces, and the lowest beverage consumed by fluid ounce, was energy drinks at almost .53 ounces. This figure shows that while water is the highest intake by ounce, it is the lowest calorically. Further, hard liquor is the most calorically dense, meaning that although it has one of the lowest consumptions based on fluid ounces, it contributes the most calories. This discrepancy is because water has zero calories, and alcohol is seven calories per each gram.

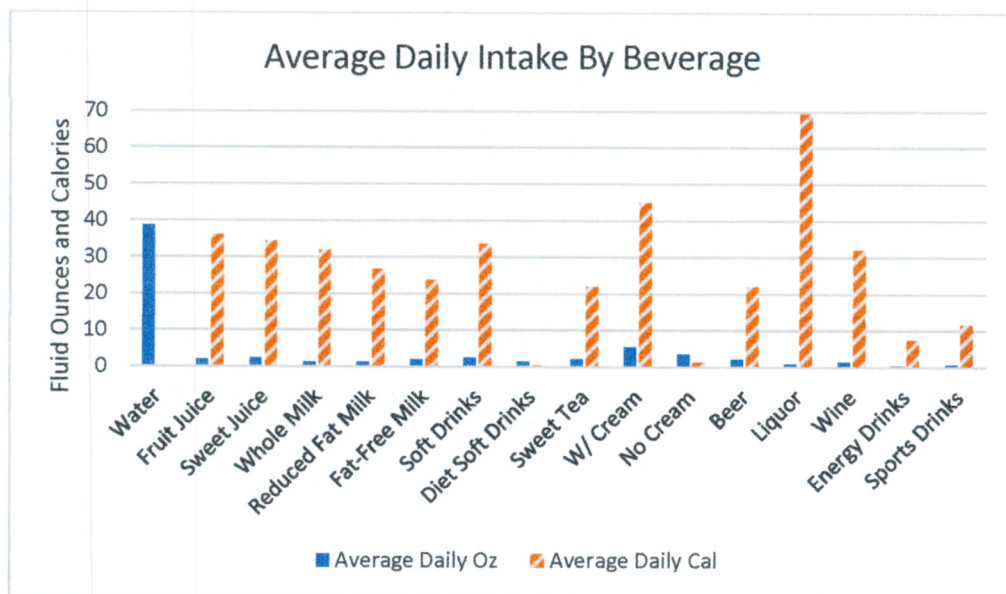


Figure 4 Average Daily Calorie and Fluid Ounce Intake by Beverage

Figure 5 shows the average total daily beverage intake of all beverages, SSBs, and non-SSBs side by side. This table shows visually how many fluid ounces and calories, on average, are making up beverage intake each day. SSBs include a combination of six beverages: sweetened juice beverages, soft drinks, sweet tea, coffee drinks with sugar, energy drinks, and sports drinks. Non SSBs include all other beverages such as water, diet soft drinks, coffee beverages without sugar, unsweetened tea, milk, and alcoholic beverages. Figure 5 shows that there are more calories in the diet from non-SSBs than there are coming from SSBs. This is due in part because alcoholic beverages are not considered SSBs, but they are the most calorically dense. In this sample, almost 125 daily calories from non-SSBs are due to alcoholic drinks. If alcohol was removed from this analysis, there would be more calories from SSBs than non-SSBs by 34 calories.

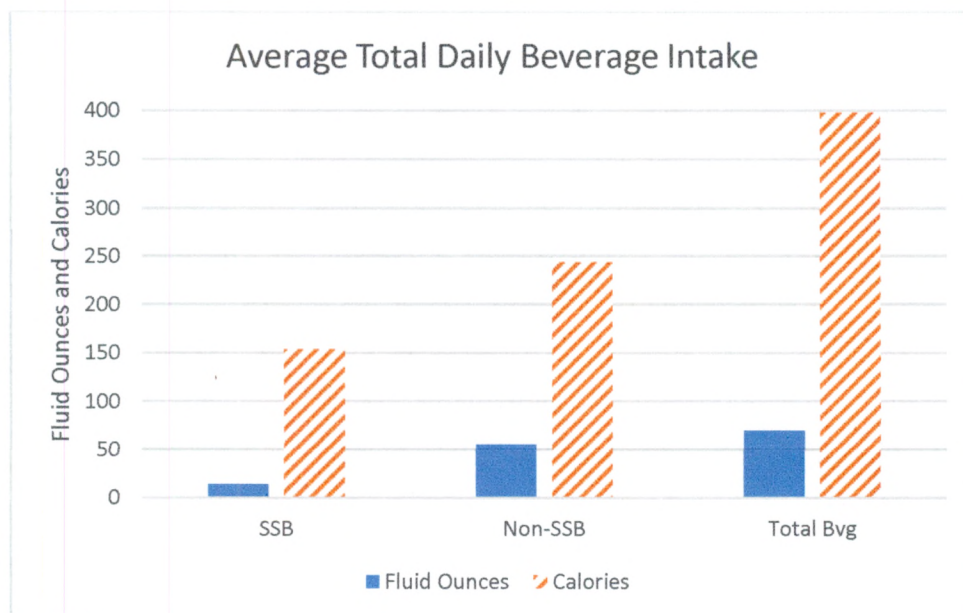


Figure 5 Average Total Daily Beverage Intake in Fluid Ounces and Calories

\*SSBs include: sweetened juice, sweet tea, soft drinks, coffee drinks with sugar, energy drinks, and sports drinks. Non SSBs include: water, 100% fruit juice, milk, diet soft drinks, unsweetened tea, coffee drinks without sugar, and alcoholic beverages.

## **Main Research Findings**

### *Is There a Direct Correlation Between SSB Intake and BMI in University Students?*

The correlation of SSBs and BMI among this sample of university students (n=200) was  $r=.236$  ( $p=.01$ ). Thus, there is a direct correlation between SSB intake and BMI of university students and there is a strong, positive relationship between SSB consumption and an increased BMI of this population. An increased consumption of such beverages is related to an increased BMI.

### *Does the Association Between SSB Intake and BMI Differ by Residency Type?*

The correlation of SSB and BMI of university students (separated by their housing) showed that the correlation within each group, individually, was statistically significant. Statistical significance of on campus students (n=99) was  $r=.232$  ( $p=.01$ ) and off campus students (n=99) was  $r=.194$  ( $p=.01$ ). There is a stronger relationship between SSB consumption and BMI among students living on campus compared to students living off campus.

### *What are the Biggest Motivators for University Students to Consume SSBs?*

Participants were asked their level of agreement to a series of statements to gather information as to why they consume SSBs. Statements included: "I consume sugar-sweetened beverages because they give me energy to wake up or stay awake longer," "I consume sugar-sweetened beverages because I enjoy the taste," "I consume sugar-sweetened beverages to enhance my academic performance," "I consume sugar-sweetened beverages to enhance my athletic performance," "I consume sugar-sweetened beverages mixed in alcohol drinks." Table 2 displays the agreement frequencies for each statement regarding motivations to consume SSBs.

Table 2: Frequencies (n) of Motivators for Consuming SSBs (n=200)

Reason for Consumption	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree	Agree or Strongly Agree
Taste	15% (30)	3.5% (7)	9.5% (19)	48% (96)	24% (48)	72% (144)
Mix with Alcohol	31% (62)	6.5% (13)	12% (24)	32% (64)	18.5% (37)	50.5% (101)
Energy	33% (67)	24% (48)	14% (28)	22.5% (45)	6% (12)	28.5% (57)
Athletic Performance	57% (115)	24% (48)	12% (24)	5% (10)	1.5% (3)	6.5% (13)
Academic Performance	53% (106)	28% (57)	15.5% (31)	1.5% (3)	1.5% (3)	3% (6)

As Table 2 illustrates, most students agreed to drinking SSBs because they enjoy the taste, and half of the students are drinking these beverages mixed in alcohol. Students are not typically consuming these beverages for enhancing academic or athletic performance.

#### *Are Students with a Meal Plan More Likely to Consume SSBs?*

An independent sample t-test was completed for average daily SSB fluid ounces and shows that habits for purchasing and consuming SSBs are significantly different between those that have a meal plan (n=78,  $\bar{X}$ = 19.49, SD=  $\pm$  27.33) and those that do not have a meal plan (n=122,  $\bar{X}$ = 10.45, SD=  $\pm$  18.85), (Sig=.006, 95% CI 2.59-15.48). This information shows that students with a meal plan, on average, are consuming nine ounces more of SSBs than their peers without a meal plan.

*SSB Intake**Table 3: Average SSB Intake by Population*

<b>Population</b>	<b>Average Fluid Ounces</b>	<b>Standard Deviation</b>
On-Campus	16.25	26.58
Off-Campus	11.24	18.02
Meal Plan	19.49	27.33
No Meal Plan	10.45	18.85
Average	13.98	22.91

Table 3 displays information on average SSB consumption, in fluid ounces, by population. This table shows that students with a meal plan consumed more than students without a meal plan: 19.49 fluid ounces (SD= $\pm$ 27.33), and 10.45 (SD= $\pm$ 18.85), respectively. This table also shows that students living on campus, consumed more SSBs than students living off campus, by five ounces, 16.25 fluid ounces (SD= $\pm$ 26.58), and 11.24 fluid ounces (SD= $\pm$ 18.02), respectively ( $p = .006$ ). The average of the entire sample ( $n=200$ ) is 13.98 (SD= $\pm$ 22.91) ounces per day. Students living on campus and students with a meal plan consumed more than the average of the population, and students living off campus and students without a meal plan consumed less than the average of this population.

Only 46 (23%) students in this population ( $n=200$ ) were not consuming any SSBs. Three students (1.5%) are consuming, on average, less than one SSB per day, which equates to less than four servings per week. The remainder of the population ( $n=200$ ) surveyed, 151 students (75%), are consuming at least one SSB each day. Three out of four of this population of students consume one or more SSBs per day, or at minimum, seven each week.

### *BMI Correlations*

After completing an independent sample t-test, the correlation between BMI and residency of on-campus students ( $n=99$ ,  $\bar{X}=25.29$ ,  $SD=\pm 5.35$ ) versus off-campus students ( $n=99$ ,  $\bar{X}=23.97$ ,  $SD=\pm 4.03$ ) was found to be statistically significant ( $p=.052$ , 95% CI, 0-2.64). Students living on campus, on average, have a higher BMI than students living off campus, by  $1.32 \text{ kg/m}^2$ .

An independent sample t-test was completed to find the difference between BMI of students with and without a meal plan. Students with a meal plan, on average, had a BMI of  $25.42\pm 5.4 \text{ kg/m}^2$  and students without a meal plan, on average, had a BMI of  $24.27\pm 4.3 \text{ kg/m}^2$ . With a significance of .054 the difference between the mean BMIs are not statistically significant. However, the difference between these two values is important because it is the difference of being categorized as “overweight” ( $\text{BMI}\geq 25 \text{ kg/m}^2$ ) or at “healthy” weight ( $\text{BMI} = 18.5\text{-}24.9 \text{ kg/m}^2$ ). This t-test shows that students with a meal plan, on average, were overweight, and students without a meal plan were at a healthy weight.

### *SSB Consumption and BMI*

The relationship between SSB consumption and BMI was determined for each gender using Pearson's  $r$  correlation. The correlation of SSB and BMI for females was significant ( $r=.29$ ,  $n=155$ ,  $p=.00$ ) and insignificant for males ( $r=.016$ ,  $n=45$ ,  $p=.919$ ). This shows that an increased consumption of SSBs in females is likely to lead to an increased BMI, but the same cannot be said for male students.

The relationship between SSB consumption and BMI of undergraduate and graduate students was completed by a Pearson  $r$  correlation where  $r=.205$  ( $n=163$ ) and  $r=.535$  ( $n=34$ ), respectively. Among both groups, there is a significant positive relationship between SSB consumption and BMI. The correlation of graduate students was found to be much higher than the correlation of undergraduate students indicating that the relationship among graduate students and SSB consumption and BMI is stronger than that of undergraduate students.

#### *Locations of Purchase and Consumption of SSBs*

Participants were asked to agree with a series of statements regarding their location of purchasing and consuming sugar-sweetened beverages such as “I consume sugar-sweetened beverages in my home,” “I consume sugar-sweetened beverages during my commute,” “I purchase sugar-sweetened beverages in off campus locations,” “I purchase sugar-sweetened beverages in the dining halls on campus,” and “I purchase sugar-sweetened beverages in the retail locations on campus.” Table 4 shows the agreement frequencies to each statement for the locations of purchasing and consuming SSBs. This table displays that most students purchased their SSBs in off-campus locations. Less than half of the population purchased SSBs in the dining hall or retail locations on campus. Similarly, less than half of this population consumed SSBs in their home, the dining hall, or during their daily commute.



Table 4: Frequency of Locations for Purchase and Consumption

Statements	% (#) Participants
Consumption- Home	48% (97)
Consumption- Dining Hall	42% (85)
Consumption- Commute	24% (48)
Purchase- Off-Campus	58% (116)
Purchase- Dining Hall	35% (70)
Purchase- Retail	44% (88)

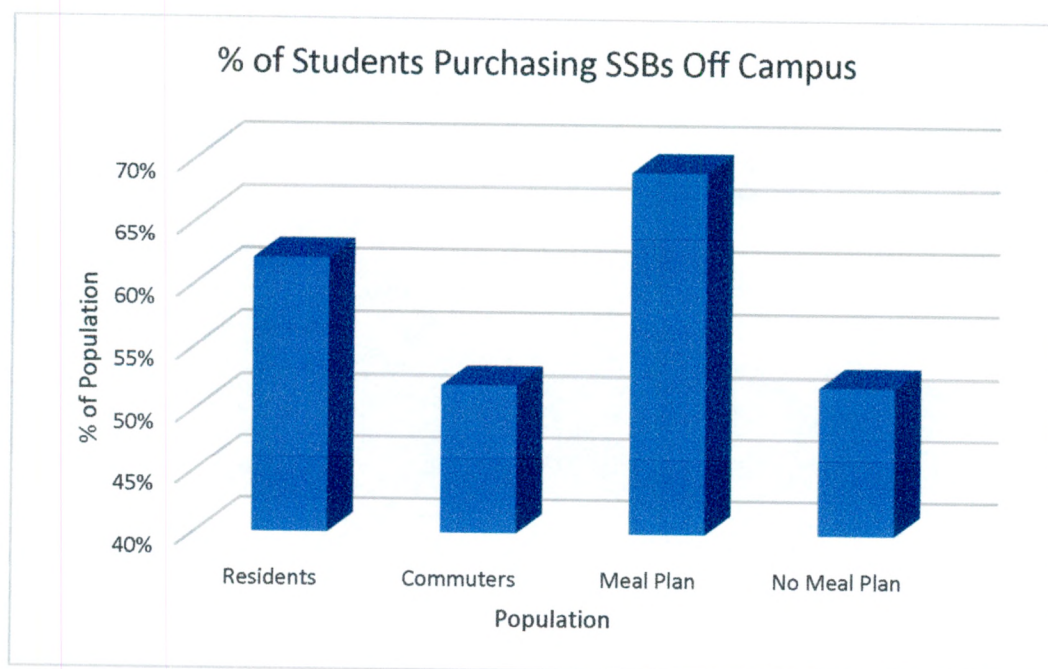


Figure 6 Percentage of Students Purchasing SSBs Off Campus

Figure 6 shows the percentage of each residency and meal plan groups that purchase SSBs off campus. Almost 70% of students with a meal plan purchased their SSBs off campus and 62% of residential students purchased their SSBs off campus. Fifty-two percent of commuters and students without a meal plan agreed to purchasing their SSBs off campus.

### *Other Beverage Consumption*

*Table 5: Average Daily Alcohol Consumption in Fluid Ounces*

	<b>Average Consumption in Fluid Ounces</b>		
	<b>On Campus</b>	<b>Off Campus</b>	<b>Significance</b>
<b>Beer</b>	2.66 ±5.94	1.54 ±3.79	0.026
<b>Liquor</b>	1.26 ±4.19	0.8 ±2.88	0.197
<b>Wine</b>	1.71 ±6.42	1.44 ±4.47	0.594
<b>Total</b>	5.63 ±15.64	3.78 ±8.81	0.147

Table 5 shows the average daily consumption of alcohol in fluid ounces by the on-campus and off-campus residency groups. This data shows that students living on campus, on average, consuming about one ounce more of beer per day than students living off campus ( $p=.026$ ). While the other beverage amounts are not statistically significant, the difference is important because it can be the difference of almost 140 calories, each day.

Of the entire sample ( $n=200$ ), only 17 students (8.5%) recorded consuming energy drinks. Two of those students (2%) were consuming less than an ounce per day, which is on average, less than one serving per week.

## **Chapter V:**

### **Discussion**

Previous work has examined dietary habits of university students based on availability of fresh foods, preparation of meals, and meal plan accessibility.<sup>20,21,23,30,31,46,72,73</sup> However, none of this research has addressed students and their intake of sugar-sweetened beverages (SSBs) based on availability on campus, or examined the possibility that their residency and accessibility to a meal plan has any relationship with their consumption.

As the literature review reflects, numerous studies have shown a correlation between SSB intake and metabolic diseases such as obesity, coronary heart disease, and type two diabetes.<sup>3,5,7,22,26,40,47,59,60,64,66,67,71,77</sup> Previous research has also shown a correlation between body mass index (BMI) of university students based on housing locations.<sup>18,20,23,57</sup> Previous research has indicated the reasons why university students consume SSBs, specifically those containing caffeine.<sup>13,14,27</sup> This study is the first to determine if there is a direct correlation of SSB intake and an increased BMI of university students based on housing in a large public university in the northeastern U.S.

### **Participant Demographics**

The demographics of this sample, while highly representative of the Montclair State University (MSU) population, were not representative of the population of the United States.<sup>91</sup> Most participants were Caucasian, commuter, female, undergraduate students with a BMI in the normal or healthy range. Due to the nature of this sample, this specific study may be generalized to the university from which the sample was drawn from, but not other universities or populations of the same age. The BMI records were

highly representative of the U.S. population of college students, with 1/3<sup>rd</sup> of the population being overweight or obese.<sup>2</sup>

## **Main Research Findings**

### *Relationship Between SSB Consumption and BMI*

The correlation of SSBs and BMI of university students for this sample was determined to be statistically significant. These correlations support Hypothesis One and Two showing that the students living on campus have a higher correlation of SSB intake and BMI, in comparison to those living off campus. This supports the hypothesis that the relationship between obesity and SSB intake is more prevalent in those living on campus at MSU. While this relationship is also significant for commuters, it is not as strong of a relationship. Overall, regardless of housing situation, there is a correlation between SSB intake and BMI of university students that is found to be statistically significant. On average, residents are consuming five ounces more of SSBs per day than commuters.

Previous research has shown varying information on the difference between university students and dietary habits, based on residency type. Some research has shown that students living off campus, without parents, have the worst dietary habits, while students living on campus have more access to fresh foods and thus have a diet higher in variety.<sup>20</sup> Other research, however, has shown that students living off campus with their parents have better dietary habits, due to eating more meals in the home, and less reliance of processed, pre-packaged foods.<sup>21,23</sup> This research shows that in relation to SSBs, students on campus are consuming significantly more than their peers living

elsewhere. This may be due to high availability of SSBs in on-campus dining establishments, or a lack of access to healthier beverages.

### *Motivations for Consuming SSBs*

The data displays that most students who consume SSBs are doing so because they enjoy the taste. While there may be perceived health benefits (or detriments) due to the ingredients in many SSBs, college students are not choosing to consume such beverages mainly because of that, but rather because they enjoy the way they taste. The second highest motivator for consuming SSBs was found to be mixed in an alcoholic beverage. This supports previous literature in that many university students drink SSBs to mask the taste of alcohol.<sup>13</sup> As this research shows, university students in this population, on average, consume five fluid ounces of alcoholic beverages per day (35 ounces a week). It is important to note that about one ounce of those five ounces is hard liquor, which is often mixed with another drink, typically SSBs. Since MSU is a “dry campus” (alcohol is not permitted on campus), most students have reported consuming SSBs off campus, and consuming SSBs with alcoholic drinks. These factors may be related because students are not permitted to have alcohol on campus (with the exception of one residence hall), which may explain why most students are drinking SSBs off campus, because they are purchasing alcoholic drinks mixed with SSBs in off-campus locations.

This data shows that while one of the leading ingredients in many SSBs is caffeine, students are not primarily consuming SSBs for academic or athletic purposes, which supports prior research.<sup>14</sup> About 25% of participants did agree that they consume SSBs for energy, which could, however, be from the carbohydrate content instead of the

caffeine content. It is important to note that not all SSBs have caffeine as an ingredient, but that sweetened, caffeinated beverages do fall under the category of SSBs.

### *Meal Plans and SSB Consumption*

In support of Hypothesis Four, students at MSU who have a meal plan are more likely to be purchasing and consuming SSBs than their peers who do not have a meal plan. The statistically significant difference between the two groups is that students with a meal plan, on average, consume almost nine more ounces of SSBs per day than those without a meal plan. This may be since these students living on campus might have more freedom to choose what they want to eat and drink, in comparison to those students living at home with their parents. This research shows that students with a meal plan are consuming more SSBs, which could directly correlate to the idea that they are “eating outside the home” more often than their peers. As the literature review has shown, students who record eating outside the home more often are more likely making unhealthy choices than those who do not eat outside the home as frequently.<sup>31</sup>

### **Additional Research Findings**

On average, students living on campus have been found to have a significantly higher BMI than those living off campus. Students living on campus, on average, have a higher BMI than commuters by 1.32 kg/m<sup>2</sup>. This contradicts previous literature that has stated students living on campus are at healthier weights than those living off campus.<sup>18-21,23</sup> This could be related to the culture of health at MSU or due to the large amount of commuters at this university, skewing the data. Students with a meal plan have a higher

BMI than students without a meal plan by  $1.1 \text{ kg/m}^2$ . The difference between the two populations, while not statistically significant, is extremely important because it is the difference between being overweight or at normal weight. This also contradicts previous information stating that students with a meal plan may have healthier intake than those without, and thus have a BMI within normal level.<sup>20</sup> The fact that students living on campus and students with a meal plan have a higher BMI may be directly related to the fact that they are consuming more SSBs, or it may be due to the dining establishments on campus. Being that both populations are spending more time on campus, more research needs to be done to discover what exactly it is about being on campus that is causing these students to be overweight.

Correlation between BMI and SSB intake was found to be statistically significant for females ( $n=155$ ,  $r=.29$ ), showing there is a substantial relationship between the two variables. There was no statistical significance between BMI and SSB intake of males ( $n=45$ ,  $r=.29$ ), however, which could be due, in part, to the small sample of males in this population.

The population of this sample was examined by degree status, with 34 students seeking a graduate degree and 163 students in their undergraduate education. Examining relationships of these groups and SSB consumption/BMI showed a significant correlation between the variables and both groups. These two variables showed extreme significance in the population of graduate students, which may not be representative due to the small sample of graduate students. This sample, however, was extremely representative of the demography of MSU in that 80% of the MSU population is undergraduate.<sup>91</sup>

It is noteworthy to mention that the data from this study shows a significant difference in SSB consuming and purchasing habits in those that have a meal plan, in comparison to students without a meal plan. However, most students recorded consuming their SSBs off campus rather than on campus. This supports previous literature that stated the more time students spend out of the home, the more they are likely to consume these beverages.<sup>13</sup> For this sample, students may consider living on campus to be their “home”, and being that they are consuming far more SSBs off campus, they are consuming “out of the home.” More than half of this sample disagreed to consuming SSBs in the home, in the dining hall, and during their commute. More than half of this population recorded purchasing their SSBs in an off-campus location, however, they could be bringing them back to campus for consumption. This could be due in part that SSBs on campus, as well as most food and other items sold on campus, are more expensive than if they were to be purchased in a grocery store or supermarket. More than half of all participants also disagreed to purchasing SSBs in the dining halls and retail locations on campus. This conflicts with previously stated information that showed students with a meal plan are consuming the most SSBs, and most students with a meal plan are purchasing them off campus (69%). This could be in part because students may be using their meal plan to only purchase meals on campus and buy their beverages at a grocery store or supermarket to keep in their room.

### **Beverage Intake**

The Beverage Intake Questionnaire (BEVQ-15) collected information on beverage consumption for individuals, by day and week. This information displays a lot



about the consumption of beverages by this sample of university students. Firstly, on average, students are consuming about 35 ounces of water a day, which is less than half of their needs. Water is not only necessary for all of life's functions, but it also plays a huge role in metabolism, satiety, and weight management.<sup>100</sup> Water was the highest consumed beverage by this population, but still not in the amounts necessary.

This data also shows that, on average, students are consuming five ounces of alcoholic beverages per day, which is more than the recommended amount. The Centers for Disease Control and Prevention (CDC) recommends up to one or two alcoholic beverages per day, a few times a week. However, on average these students are consuming about one serving of alcohol everyday.<sup>101</sup> Students living on campus, on average, are consuming more alcohol than their peers living off campus, by 1.85 ounces, in every category- beer, liquor, and wine. Although the only alcohol beverage intake that was statistically different between residents and commuters was beer, the wine and liquor are still adding excess calories into the resident's diets. It is important to note that this beverage recall was gathered based on consumption per day and week and then divided by the seven days a week. Although alcoholic beverages are only consumed, on average, about five ounces per day, these five ounces are adding more than 120 calories into the daily diet. Due to the makeup of alcohol, the calorie count is seven calories per gram, adding excess calories into this populations' diet.

This data shows that, on average, this sample of university students are consuming about 14 ounces of SSBs per day, or 154 calories. This number is about two ounces below the national consumption average for American adults, according to NHANES.<sup>9</sup> Non-SSBs are contributing more calories to this populations diet due to the

high intake of alcohol containing beverages. If these beverages were to be removed from the diet, this would eliminate more than 150 daily calories, or almost 1,100 calories per week. Removing alcoholic beverages from the diet would show that calories from SSBs are higher than those that are non-SSBs. Seventy-five percent of this population is consuming one or more SSBs each day, and only 23% of this population did not record consuming SSBs. This is more than the national average that previously stated 49% of all adults are consuming SSBs each day, 43% of young adults (age 18-24) are consuming SSBs daily, and 65% of college students are consuming SSBs daily<sup>9,14,63</sup>. This daily intake amount for the current study has been estimated based on beverages recorded by day and week, and averaged out to servings per day. Based on this information, more students are consuming SSBs daily, in comparison to the rest of the population. However, on average, this sample is consuming about two ounces less than the national average. While consumption among this group is more prevalent, the ounces of SSBs consumed daily is less than that of the average (16 fluid ounces vs. 14 fluid ounces).

This population had few students consuming energy drinks (8.5%), and only 7.5% of those students were consuming more than one ounce per day, or at minimum, seven ounces per week. Being that most of this population recorded consuming SSBs for taste and mixed with alcohol, it is not surprising that few were choosing energy drinks as their top choice.

### *Strengths*

There are many strengths to this study through its sampling methods, survey type, and sample size and representativeness. This research is an original contribution to the

field, as it is the first of its kind to compare SSBs, BMI, and residency type, of university students in a large public university in the Northeastern United States.

A main strength to this research was the data collection method which was employed. Since this survey was created using Limesurvey software, it was administered online. This online administration allowed for researchers to collect a large amount of data in a short amount of time, while not costing anything to the researchers, financially. This online survey was advantageous to the process of surveying because it allowed for potential participants to complete it on their own time, from any location. An online survey link also allowed for more students to be reached in a short amount of time, especially students that may not be traditional students on campus every day.

The composition of the sample was a strength to this research, because it was extremely representative of the MSU population. The sample was mostly Caucasian, female, commuter, undergraduate students, at a healthy or normal BMI. Having more than 200 students complete this survey allowed for a representative sample size that could generalize the population of MSU.

Another strength of this study was the use of the BEVQ-15 to create the adapted BEVQ-15 used in this study. The BEVQ-15 has been developed specifically for the recall of beverages over a weekly period.<sup>33</sup> The validity and reliability of this recall tool were determined through previous research, determining it as substantial for use in this research, and then piloted with a small sample to determine validity among this specific population.<sup>96</sup>

### *Limitations*

Despite these strengths, several limitations must be noted. The fact that this research was only conducted at one university with one student body, suggests that these results cannot be generalized to other universities in other locations. The sample size, 200, was very small in comparison to the population of the university, which, at the time of sampling, was 20,897 graduate and undergraduate students. Due to the small staff of researchers and the limited time frame, the sample was chosen by convenience based on students that were members of various Listservs and social media groups that were sent the survey link to participate. Although the sample was not entirely random; the demographics accurately represent the population of the university.

A limitation with the BEVQ-15 tool is that while it is validated, it requires participants to recall beverages consumed both daily and weekly. These numbers are then converted into daily consumption. For example, this research has found that, on average, the sample is consuming about five ounces of alcoholic beverages per day; however, this is actually recalled as 35 ounces a week, in total. The researchers recognize that five ounces per day may not be accurate for some individuals, and that there may be more beverages consumed in one sitting, rather than five ounces each day.

Another limitation accounted for in this study is that both height and weight were self-reported due to time constraints of the study and lack of access to validated tools. Self-reporting height and weight allowed for the researcher to calculate BMI consistently and to support a larger sample size in a brief time frame. In a study validating self-reported height and weight in young adults, on average, 52% of the sample under reported their weight. Females were more often underreporting their weight than males.<sup>102</sup> Being that the majority of this sample is female, the chances of weight being

under reported in this sample is high. If that is the case for this sample, then the rates of overweight/obese students may be higher than reported here and thus the relationship between SSB intake and BMI may be underestimated.

Another limitation to this study is that there are a few different definitions of SSBs. For this study, the validated BEVQ-15 was used as a standard, and the SSBs were calculated using the same items. Previous research has included flavored milks and 100% fruit juice as SSBs, while this study did not.<sup>103</sup> Also, the caloric content of each beverages was estimated, based on the information provided by the original author of the BEVQ-15. Caloric intake of each beverage cannot be deemed 100% accurate as new products come to market every year. SSB intake averages in this study did not, however, include flavored milk as an SSB.<sup>9</sup> Flavored milk is often included in recalls used to examine SSB intake of children, and not among this specific population. If other research does have a different definition of SSBs (such as including flavored milk), then that average amount would be expected to be higher than the amount in this study.

A limitation in most studies involving food tracking or diet journaling is recall bias. Recall bias is the honest mistake of not properly recalling what was consumed and when. This is especially common when participants are instructed to recall multiple items or multiple days at once, as they were when completing the BEVQ-15. While this tool was validated previously by the original authors of the survey, and during the pilot program, recall bias can still be a factor with a valid tool.<sup>33,96</sup>

There is also a limitation with recalling items that are considered “less socially desirable” due to the nature of the item. Many participants may feel embarrassed or guilty to record accurate amounts of items such as food and beverages typically deemed

“unhealthy.” For this specific study, participants were prompted to record SSB consumption and alcohol intake. Many of the participants may understand SSBs and alcohol to have negative health effects and stigma attached to them, thus, causing participants to possibly underreport. Although this data was collected anonymously, which allows for more integrity when answering the questions, underreporting less socially desirable items cannot be ruled out.

This study was not able to look retrospectively to see what the participants were consuming in previous years of college or prior to college in childhood, because it was a cross-sectional study. Being unable to record retrospective data caused the researchers to be unable to look at trends of dietary habits among these students as they aged or transcended into college life. Additionally, this study will not be prospective as the participants did not give identifiable information for a follow-up to occur. Since there is no follow-up information, the researchers will be unable to continue tracking the consumption and BMI of these students as they progress through college and enter adulthood.

This study sampled for only one week, which means that this data may not be used to predict future consumption or BMI for other research. Such a brief period of sampling may easily be affected by the current economy or social trends such as consumption of drinks due to popularity or media coverage. The semester schedule, such as midterm exams and final exams, may also affect consumption, potentially causing the students to have a temporary shift in their diet.

Another limitation to this research is that physical activity was not assessed nor was a dietary recall collected. It is hard to be sure if there is a direct relationship between

SSB consumption and BMI because there are other factors that could affect this relationship that were not measured. For example, if a participant was consuming a high number of SSBs but was more active, this may have skewed the data and the relationship between the factors. Without a dietary recall, the researchers are unable to see what other parts of the participants' diet may affect BMI.

With this research, students' academic majors were not recorded. This may be considered a limitation because the level of health education these students have received is not accounted for. There may be a correlation between students within health-related fields and a healthier diet compared to students in non-health related majors. Since majors were not asked of the participants, we cannot know if this data is affected by field of study of the participants.

The final limitation to this study is BMI as a measurement. BMI does not account for fat or muscle as weight. A participant who may be extremely muscular with a higher BMI may be categorized as obese, but they are more fit than their peer with the same weight held as adipose tissue.

### *Implications for Future Practice*

SEM can be utilized to create a nutrition based intervention for a university population to decrease their consumption of SSBs. Using the SEM, health education professionals can look at the different sectors of the model to intervene. The first sector of the SEM, the individual, will be utilized to interview and collect data from the students; gathering information about how/why they are consuming these beverages. The second sector, relationships, will examine the relationships these students are a part of and how they may affect this intervention. For example, creating an intervention that

includes peers and teachers to participate, will increase the chances of success. The third sector, community, will be a huge part of this intervention, as community of universities is extremely important. Communities at large universities can vary from living communities such as residence halls, social communities like Greek lettered organizations, and athletic communities. Utilizing these communities in which the students are invested in will make the intervention more effective at reaching the population. The fourth sector, societal, can be utilized to reach out to policy makers and enforcement agencies to make changes on a higher level at the university.

The information on motivators of SSB consumption is crucial to health educators when planning interventions with this population. Given that the top reasons for consuming SSBs include taste, mixing with alcohol, and providing energy, it is necessary to find other alternative beverages that are healthier than traditional SSBs, that also taste as good or better. Secondly, these suggestions should provide some type of energy as “I consumed SSBs because they give me energy.” was the third most popular choice among this population. Health education is necessary to not only inform college students on serving sizes of alcohol, but also to suggest more appropriate mixed beverages to be drank with liquor.

Using this information, health education practitioners can recommend alternate forms of “energy” to these students, rather than consuming SSBs, such as tea or coffee without added sugar. More research on this population needs to be done to determine why these students need more energy. Further, it is important to define “energy,” such as the ability to stay awake, or the ability to move/be active. A change in diet, getting more sleep at night, or adding in physical activity could drastically change these student’s



energy level. Utilizing the SEM and TPB to create interventions among this population will allow for practitioners to meet university students in the communities they are already in and break down the barriers the students are experiencing to making healthy dietary choices.

A social marketing campaign strategy to be utilized on campus to increase healthier decisions among this population could be a Healthy Monday Campaign. This campaign would encourage creating healthy habits each Monday of the semester. This campaign would be little or no cost to those implementing the strategy, but can be extremely effective. Research has shown that people are more likely to make a change on a Monday, than any other day of the week.<sup>104</sup> This campaign could be implemented by various groups or clubs interested such as Montclair State Dietetics Organization or Montclair State Public Health Association. Typical social marketing strategies could be utilized such as flyers, posters, and social media messages. These messages could differ this week and reach other health related topics-not just beverage consumption.

#### *Implications for Future Research*

Data from the BEVQ shows that SSBs contribute to almost 50% of calories from beverages, but less than 25% of consumed fluids. This provides information for health educators to educate this population on the empty calories from SSBs. This research suggests that these variables should be studied more among this population. A recommendation would be for The American College Health Association to include beverage intake in the "Nutrition" section of their National College Health Assessment, so larger populations could be assessed.

Future research could expand on this study in many ways. Future research should examine different relationships such as the availability of SSBs and water on campus. This research could also be further tested to identify differences between education level. There may be a significant difference between consumption levels of first year students and last year students. Being that majors were not requested, we cannot assess for field of study and consumption. A future study could replicate this to compare students in health-related and non-health fields of study.

Future research may examine demographic differences between students such as income, socioeconomic status, ethnicity, language, and many other factors not addressed in this study. Research has shown that 90% of non-white, low income, first generation college students do not graduate within six years.<sup>105</sup> This research did not collect information regarding first generation students, income of students, or first language of students. This demographic information regarding the population may identify further relationships regarding demographics and health literacy among university students. Examining such relationships would allow for health educators to create more appropriate interventions for specific populations of college students. Being that MSU is a large, diverse university, a replicated study examining these demographic differences is extremely possible and warranted.

While this research examined the relationship between SSB intake and BMI of university students in different living situations, it did not look at the availability of such beverages in these varying environments. Availability of SSBs in the campus dining establishments was not assessed, nor was this information requested of students living off

campus. Future research can examine the availability of these drinks in each location on campus as well as requesting information regarding availability of SSBs in the home.

Being that this sample consumed more calories from non-SSBs than SSBs, it is also important to examine this relationship. For example, the calories from alcoholic beverages were extremely high, and were also found to be mixed with SSBs by 50% of the population. It is imperative to examine a relationship between alcohol intake and SSB intake among this population.

MSU is a “dry campus” meaning alcoholic beverages are not permitted in campus buildings, regardless of age. With the exception of one residence hall, MSU students, even those over the age of 21, are not able to have any alcoholic drinks on campus. This data has shown that students living on campus, on average, are consuming 1.85 ounces more of alcoholic beverages than their peers living elsewhere. Further research should be conducted comparing MSU as a dry campus to other universities, with “wet campuses,” such as The College of New Jersey, to see if there is a significant difference between consumptions on a dry vs. wet campus. This research could be extended to measuring alcohol consumption of students that are 21 years and older at MSU, comparing the population living in the “dry” buildings and the “wet” building, to see if consumption rates vary between these students at the same university.

#### *Implications for Future Policy*

One policy option to decrease consumption of SSBs among all ages would be to implement a soda tax. A recent study at Harvard shows that soft drinks are extremely price sensitive, raising the price of the item just a few cents may affect the amount sold.

In this research, taxing soft drinks one cent for every ounce (a 20 ounce soda would cost 20 cents more), showed a decrease in purchases by 16%.<sup>106</sup> This same study also separately examined marketing of these beverages by rearranging the items by calorie content and placing signs in the cooler to show a calorie range. By showing consumers the calorie ranges for these beverages, sales decreased by 11%. While there was an overall decrease in SSB sales, there was a larger decrease in lower socioeconomic classes.<sup>106</sup> This may be due in part to this population having a lower budget to spend on groceries, than their peers in the same neighborhood with a higher net income. Overall, giving the consumers the knowledge they need to make more healthful choices has proven to be effective.

At MSU, there are many potential policy adjustments that could be implemented to change the culture of health on campus. The MSU Public Health Association has begun a campaign to install more water filtration stations on campus, which provides free, filtered water to all students. These filtration stations are not yet in every building, but are located in some residence halls, the recreation center, and the student center. Creating more available free, clean water would eliminate the need for a student to make a trip to a vending machine or dining establishment for a drink. Not only is this saving the students money, but it also removes the factor of temptation to purchase other beverages over water, which they may experience when making a purchase. At MSU, bottled water is typically more expensive than a fountain drink or bottled soda. This could be a huge factor affecting purchases by this population. While this research shows more students are not purchasing their SSBs on campus, for those that are, creating better access to water could decrease the purchases.

Using the Theory of Planned Behavior (TPB) health education practitioners can create a campaign to increase water consumption among this population. Giving away free reusable water bottles, for example, is one way that in addition to installing water filtration stations on campus, will increase the likelihood of the students using it. If a student does not have a refillable water bottle to utilize at the hydration stations, the behavioral intentions and perceived power to utilize the water fountains and drink more water, will be much lower.

Another policy change that could be implemented at MSU using the Social-Ecological Model (SEM) would be to include more healthy options in vending machines. As discussed in the literature review, community on a university campus is a huge factor for creating change. For example, in the student center building, there is currently only one vending machine offering foods and drinks that are high protein, low calorie, sugar-free, and gluten-free. By meeting the students where they already are, in comparison to redirecting them to other buildings (i.e. the student center), will increase the likelihood that they will make healthier choices. Bringing in more of these vending machines across campus would allow for students frequenting other buildings to have better access to healthier items.

Main findings from this research shows that there is a strong, positive relationship between SSB consumption and BMI, particularly among students living on campus, and students with a meal plan. This research also reveals that university students are consuming more than the recommended amount of alcohol each week, and not enough of the recommended amount for water. With this information, effective interventions, social

marketing campaigns, and health education frameworks can be developed for this specific population.

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## Appendix

### A. Supplemental Data

#### Factors Associated with High Sugar Intake from Sugar-sweetened Beverages <sup>43</sup>

Characteristics	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age (In 10 years)	0.64 (0.62-0.67)	0.65 (0.62-0.68)
Gender, male vs. female	2.35 (2.12-2.62)	2.40 (2.11-2.73)
Race-		
White	1.00	1.00
Black	1.81 (1.57-2.09)	1.42 (1.22-1.65)
Others	1.23 (1.05-1.43)	.83 (0.70-0.99)
Education-		
< High School	1.00	1.00
High School	1.50 (1.19-1.90)	1.05 (0.81-1.36)
>High School	0.84 (0.67-1.05)	0.66 (0.51-0.85)
Poverty income ratio		
≤1	1.00	1.00
1.1-2	0.75 (0.64-0.88)	1.01 (0.85-1.20)
2.1-4	0.63 (0.54-0.74)	0.92 (0.76-1.10)
>4	0.42 (1.04-1.35)	0.71 (0.59-0.86)

B. Research Study Survey  
a. Consent

The Association of Sugar-Sweetened Beverages and BMI of University Students On and Off Campus

A Thesis By Tyler Marie Marchel  
Northern State University

0%  
100%

Consent

You are invited to participate in a study of The Association of Sugar-Sweetened Beverages and BMI of University Student Living On and Off Campus. The purpose of this research is to determine if there is a relationship between sugar-sweetened beverage intake and body mass index of college students, and whether this may be affected by residency. This study will establish which specific groups of college students are more at risk to become overweight or obese due to availability and consumption of sugary beverages such as soda, energy drinks, sports drinks, and coffee drinks. You were selected to participate in this study if you are an enrolled student at Mountclair State University.

If you decide to participate, please complete the following set of questions to the best of your ability. This survey will take about 15 minutes to complete. You will be asked to answer questions about your dietary intake, residency, university status, self-reported height and weight, purchasing and consumption motivations, and demographic information. You may not directly benefit from this research. However, we hope this research will result in finding a relationship between the BMI of university students in relation to their housing and sugar-sweetened beverage consumption, to benefit previously published work in the field.

There are no known risks to completing this survey. Data will be collected using the Internet. The questionnaire does not request that you fill in any identifiable information such as name, student id number, or contact information therefore your identity is anonymous.

If you decide to participate, you are free to stop at any time. You may skip questions you do not want to answer.

Please feel free to ask questions regarding this study. You may contact me by email at [marchel1@mountclair.edu](mailto:marchel1@mountclair.edu) or by cell, 866-536-4946. You may also contact my thesis sponsor, Dr. Dinaour at [dinaourf@mountclair.edu](mailto:dinaourf@mountclair.edu) or 973-662-5396.

Any questions about your rights may be directed to Dr. Karina Buller, Chair of the Institutional Review Board at Mountclair State University at [revrbowd@msu.mountclair.edu](mailto:revrbowd@msu.mountclair.edu) or 973-662-5139.

Thank you for your time.  
Sincerely,  
Tyler Marchel,  
Department of Health and Nutrition Sciences

By clicking "yes" below, I confirm that I have read this form and will participate in the project described. Its general purpose, the particulars of involvement, and possible risks and inconveniences have been explained to my satisfaction. I understand that I can discontinue participation at any time. My consent also indicates that I am 18 years of age.

[Please feel free to print a copy of this consent.]

The study has been approved by the Mountclair State University Institutional Review Board.

Yes  No



b. Survey

**The Association of Sugar-Sweetened Beverages and BMI of University Students On and Off Campus**

A Thesis By: Tyler Marie Marchel  
Montclair State University

0%   
100%

**Demographics**

• I am-  
Choose one of the following answers

Please choose... ▼  
Please choose...  
Male  
Female  
Other:

**The Association of Sugar-Sweetened Beverages and BMI of University Students On and Off Campus**

A Thesis By: Tyler Marie Marchel  
Montclair State University

0%   
100%

**Demographics**

• What is your education level?  
Choose one of the following answers

Please choose... ▼  
Please choose...  
Freshman  
Sophomore  
Junior  
Senior  
Graduate Student  
Other:

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Montclair State University

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100%

**Demographics**

• Where do you reside?  
Choose one of the following answers

- On campus, traditional housing. (Bohn, Blanton, Stone, Webster, Freeman, Russ, The Heights, Sinatra)
- On campus, apartment housing (The Village at Little Falls, Hawk Crossings)
- Off campus with parents
- Off campus with roommates
- Other:

**The Association of Sugar-Sweetened Beverages and BMI of University Students On and Off Campus**

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100%

**Demographics**

• Do you have a meal plan?  
Choose one of the following answers

- Yes, I have unlimited swipes/blocks
- Yes, I have a swipe/block plan
- Yes, I have pay as you go Flex Dollars or Red Hawk Dollars
- No, I do not have a meal plan

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100%

**Demographics**

• Which of the following best describes you?  
Choose one of the following answers

Please choose... ▼  
Please choose...  
African American/Black  
Asian  
Caucasian/White  
Hispanic  
Native American  
Other:

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0%  100%

**Demographics**

• Please fill in to the best of your ability.

What is your current weight in pounds (lbs)?

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Montclair State University

0%  100%

**Demographics**

• What is your height?

ft

in

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Montclair State University

0%  100%

**Locations**

• Please choose the most accurate answer.

	True	False	Not Applicable
I consume sugar-sweetened beverages in my home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consume sugar-sweetened beverages at the dining facilities on campus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consume sugar-sweetened beverages during my commute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I purchase sugar-sweetened beverages in off-campus locations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I purchase sugar-sweetened beverages in the dining halls on campus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I purchase sugar-sweetened beverages in the retail locations on campus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2 For the sake of this data, sugar-sweetened beverages are defined as:

- soft drinks/ soda (Coca-Cola, Pepsi, Sprite, Ginger Ale, etc.)
- fruit juice beverages that are not 100% fruit (lemonades, fruit ades, punch, etc.)
- coffee drinks with sugar (lattes, frappuccinos, cappuccinos, etc.)
- sweetened tea
- energy drinks/ shots (Redbull, Monster, etc.)
- sports drinks (Gatorade, Powerade, Vitamin Water, etc.)
- alcoholic beverages are not considered sugar-sweetened beverages, but if they are mixed with any of the beverages listed above please recall it in this questionnaire

**The Association of Sugar-Sweetened Beverages and BMI of University Students On and Off Campus**

A Thesis By: Tyler Marie Marchel  
Montclair State University

0%  100%

**Motivations**

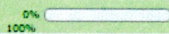
• Please fill in the circle that represents your motivations for consuming/not consuming sugar-sweetened beverages.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
I consume sugar-sweetened beverages because they give me energy to wake up or to stay awake longer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consume sugar-sweetened beverages because I enjoy the taste.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consume sugar-sweetened beverages to enhance my academic performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consume sugar-sweetened beverages to enhance my athletic performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consume sugar-sweetened beverages mixed in alcohol drinks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2 For the sake of this data, sugar-sweetened beverages are defined as:

- soft drinks/ soda (Coca-Cola, Pepsi, Sprite, Ginger Ale, etc.)
- fruit juice beverages that are not 100% fruit (lemonades, fruit ades, punch, etc.)
- coffee drinks with sugar (lattes, frappuccinos, cappuccinos, etc.)
- sweetened tea
- energy drinks/ shots (Redbull, Monster, etc.)
- sports drinks (Gatorade, Powerade, Vitamin Water, etc.)
- alcoholic beverages are not considered sugar-sweetened beverages, but if they are mixed with any of the beverages listed above please recall it in this questionnaire

A Thesis By: Tyler Marie Marchel  
Montclair State University



Motivations

Other reasons I purchase/consume sugar-sweetened beverages:

### c. Adapted Beverage Intake Questionnaire

**You should have TWO bubbles filled in for each line, one for how much each week and one for how much at each time.**

	HOW OFTEN (MARK ONE)					HOW MUCH EACH TIME (MARK ONE)						
	Never or less than 1 time per week (00 to 99)	1 time per week per week	2-3 times per week	4-6 times per week	1 time per day	2+ times per day	3+ times per day	Less than 6 fl oz (3/4 cup)	8 fl oz (1 cup)	12 fl oz (1 cup)	16 fl oz (2 cups)	More than 20 fl oz (2 cups)
Water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
100% Fruit Juice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweetened Juice Beverage/Drink (Fruit acids, lemonade, punch, Sunny D, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Whole Milk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced Fat Milk (2%)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low Fat Fat Free Milk (Skim, 1%, Bulkinik, Soy milk, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soft Drinks, Regular	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diet Soft Drinks, Artificially Sweetened Drink (Crystal Light)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweetened Tea (Black tea with sugar, i.e. Snapple)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tea or Coffee with cream (includes non-dairy creamer)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tea or Coffee, black, (no cream or sugar but may have an artificial sweetener)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beers, Ales, Wine Coolers, Non- alcoholic or Light Beer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hard Liquor (vodka, rum, tequila, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy Drinks (Red Bull, Rockstar, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sports Drinks (Gatorade, Powerade, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**2** For the sake of this data, sugar-sweetened beverages are defined as:

- soft drinks (Coca-Cola, Pepsi, Sprite, Ginger Ale, etc.)
- fruit juice beverages that are not 100% fruit (lemonade, fruit sals, punch, etc.)
- coffee drinks with sugar (latte, frappuccino, cappuccino, etc.)
- sweetened tea
- energy drinks (Red Bull, Mountain Dew, etc.)
- sports drinks (Gatorade, Powerade, Vitamin Water, etc.)

Alcoholic beverages are not considered sugar-sweetened beverages, but if they are mixed with any of the beverages listed above please recall it in this questionnaire.

## C. Original Beverage Intake Questionnaire and Scoring Instructions

**Scoring Sheet for Beverage Questionnaire-15**

Subject ID:

Date:

Type of Beverage	Avg kcal/fl oz	How Often per Day	How Much (fl oz)	Avg Daily fl oz	Avg Dailykcal	Avg g/fl oz	Avg Daily gms
Water	0			0	0	29.625	0
100% Fruit Juice	17.67			0	0	30.83	0
Sweetened Juice Beverage/Drink (fruit ades, lemonade, punch, Sunny Delight)	14.3			0	0	30.68	0
Whole Milk	22.8			0	0	30.5	0
Reduced Fat Milk (2%)	18.7			0	0	30.5	0
Low Fat/Fat Free Milk (Skim, 1%, Buttermilk, Soy Milk)	11.45			0	0	30.48	0
Soft Drinks, Regular	13.3			0	0	30	0
Diet Soft Drinks/Artificially Sweetened Drinks (Crystal Light)	0.3			0	0	29.98	0
Sweetened Tea	10			0	0	31.25	0
Tea or Coffee, w/ cream (1T) and/or sugar (1 t) (includes non-dairy creamer)	8.2			0	0	29.5	0
Tea or Coffee, black, with/without artificial sweetener (no cream or sugar)	0.35			0	0	29.6	0
Beer, Ales, Wine Coolers, Light Beer	10.3			0	0	29.78	0
Hard Liquor (shots, rum, tequila, etc.)	68.18			0	0	29.02	0
Wine (red or white)	20.6			0	0	29.4	0
Energy/Sports Drinks	14			0	0	31.05	0
Total Sugar Sweetened Beverages				0	0		0
Total Beverages				0	0		0

6/13/2012

### Scoring Instructions for Beverage Intake Questionnaire-15

Using the attached scoring form, complete the blank columns as follows:

- 1) **To calculate Average Daily fl oz for each beverage (column 5):** Multiply "How Often" column (column 3) by "How Much" column (column 4) using the following conversion factors:

**Conversion Factors:**

"How Often" (column 3) (in units of "day"):                      "How Much" (column 4) (in units of "fl oz"):

Never or < 1 time per week as 0 per week	<6 fl oz as 4 fl oz
1 time per week as 1 time per week (1/7=.142)	8 fl oz as 8 fl oz
2-3 times per weeks as 2.5 times per week (2.5/7=.357)	12 fl oz as 12 fl oz
4-6 times per week as 5 times per week (5/7=.714)	16 fl oz as 16 fl oz
	>20 fl oz as 20 fl oz

**Column 3 x Column 4 = Average Daily fl oz (Column 5)**

- 2) **To calculate Average Daily Calories for each beverage (column 6):**  
Multiply the calculated Average Daily fl oz (column 5) for each beverage by the respective "avg kcal/fl oz" conversion factor from the scoring form (column 2).

**Column 5 x Column 2 = Average Daily Calories (Column 6)**

- 3) **To calculate Average Daily Grams for each beverage (column 8), if desired:**  
Multiply the calculated Average Daily fl oz (column 5) for each beverage by the respective "avg g/fl oz" conversion factor from the scoring form (column 7).

**Column 5 x Column 7 = Average Daily Grams (Column 8)**

- 4) **To calculate Total Average Daily Beverage Calories (Box A):**  
Add together calculated Average Daily Calories (Column 6) of all beverages consumed.

**Sum of Column 6 = Total Average Daily Beverage Calories (Box A)**

- 5) **To calculate Total Average Daily Beverage Grams (Box B):**  
Add together calculated Average Daily Grams (Column 8) of all beverages consumed.

**Sum of Column 8 = Total Average Daily Beverage Grams (Box B)**

- 6) **To calculate Total Average Daily Sugar Sweetened Beverages (SSB) Calories (Box C):**  
Add together the average daily calories (Column 6) of the following beverages for total SSB calories: Sweetened Juice Drinks, Regular Soft Drinks, Sweet Tea, Coffee with cream and/or sugar, and Energy Drinks.

**Sum of Shaded Beverages in Column 6 = Total Average Daily SSB Calories (Box C)**

- 5) **To calculate Total Average Daily Sugar Sweetened Beverages (SSB) Grams (Box D):**  
Add together the average daily grams (Column 8) of the following beverages for total SSB grams: Sweetened Juice Drinks, Regular Soft Drinks, Sweet Tea, Coffee with cream and/or sugar, and Energy Drinks.

**Sum of Shaded Beverages in Column 8 = Total Average Daily SSB Grams (Box D)**

Citation: Hedrick VE, Savla J, Comber DL, Flack KD, Estabrooks PA, Nsiah-Kumi PA, Ortmeier S, Davy BM. 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; 112:840-849.

## Beverage Questionnaire (BEVQ-15)

**Instructions:**

In the past month, please indicate your response for each beverage type by marking an "X" in the bubble for "how often" and "how much each time".

Participant ID \_\_\_\_\_

1. Indicate how often you drank the following beverages, for example, if you drank 5 glasses of water per week, mark 4-6 times per week.

Date \_\_\_\_\_

2. Indicate the approximate amount of beverage you drank each time, for example, if you drank 1 cup of water each time, mark 1 cup under "how much each time".

3. Do not count beverages used in cooking or other preparations, such as milk in cereal.

4. Count milk added to tea and coffee in the tea/coffee with cream beverage category **NOT** in the milk categories.

Type of Beverage	HOW OFTEN (MARK ONE)							HOW MUCH EACH TIME (MARK ONE)				
	Never or less than 1 time per week (go to next beverage)	1 time per week	2-3 times per week	4-6 times per week	1 time per day	2+ times per day	3+ times per day	Less than 6 fl oz (3/4 cup)	8 fl oz (1 cup)	12 fl oz (1 1/2 cups)	16 fl oz (2 cups)	More than 20 fl oz (2 1/2 cups)
Water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
100% Fruit Juice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweetened Juice Beverage/ Drink (fruit ades, lemonade, punch, Sunny Delight)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Whole Milk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced Fat Milk (2%)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low Fat/Fat Free Milk (Skim, 1%, Buttermilk, Soymilk)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soft Drinks, Regular	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diet Soft Drinks/Artificially Sweetened Drinks (Crystal Light)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweetened Tea	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tea or Coffee, with cream and/or sugar (includes non-dairy creamer)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tea or Coffee, black, with/ without artificial sweetener (no cream or sugar)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beer, Ales, Wine Coolers, Non-alcoholic or Light Beer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hard Liquor (shots, rum, tequila, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wine (red or white)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy & Sports Drinks (Red Bull, Rockstar, Gatorade, Powerade, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (list):	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## D. Recruitment

Master of Nutrition and Food Science Program Community > Announcements  
> Graduate Student Requests that you complete Research Su...



Community


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**Graduate Student Requests that you complete Research Survey - Allow 15 minutes to complete**

Maddy Antosiewicz

Message from Tyler Marchei [marchei1@montclair.edu](mailto:marchei1@montclair.edu)

The study is on the association of sugar-sweetened beverage consumption and body mass index of university students on and off campus.

I am attempting to survey the entire student body of MSU so any current student over the age of 18 is eligible to participate. My study has been approved by the Montclair State University Institutional Review Board.

Here is the link:  
<https://msusurveys.montclair.edu/index.php/899553/lang-en>

Thank you  
Tyler

[Village] ResLife: Room Selection, Find Mr. C...more.

1 message

Red Hawk News <[redhawknews@mail.montclair.edu](mailto:redhawknews@mail.montclair.edu)>  
 Reply-To: [reslife@mail.montclair.edu](mailto:reslife@mail.montclair.edu)  
 To: [reslife-all@lists.montclair.edu](mailto:reslife-all@lists.montclair.edu)

Sun, Mar 12, 2017 at 1:03 PM

### RES LIFE NEWS

Select your roommate(s), win Red Hawk Dollars and where to use them!



Omar Mahmoud <[mahmoudo@mail.montclair.edu](mailto:mahmoudo@mail.montclair.edu)>

Mar 10

to me

Hello All,

You are invited to participate in a survey on the sugar-sweetened beverage intake and body mass index of university students living on and off campus. Montclair State University students over the age of 18 are needed to participate in this thesis research for a current resident assistant graduate student, Tyler Marchei. Any questions regarding the research can be directed toward her at [marchei1@montclair.edu](mailto:marchei1@montclair.edu).

The survey should not take more than 20 minutes of your time.

<https://msusurveys.montclair.edu/index.php/899553/lang-en>

Thank you for your interest in participation.

---

Omar Mahmoud  
 Community Director  
 Office of Residence Life  
 (973) 655-6686  
[mahmoudo@mail.montclair.edu](mailto:mahmoudo@mail.montclair.edu)

**Montclair State University**  
 IT'S ALL HERE

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