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The University of the West Indies

Title: The link between the consumption of Sweetened Beverages and the development of Overweight and Obesity among Students of the UWI ST. Augustine Campus

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THE LINK BETWEEN THE CONSUMPTION OF SWEETENED BEVERAGES AND THE DEVELOPMENT OF OVERWEIGHT AND OBESITY AMONG STUDENTS OF THE UWI ST. AUGUSTINE CAMPUS

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The University of the West Indies, St Augustine Campus

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Abstract

Objective

To investigate the frequency of sweetened beverage consumption and its association with overweight and obesity in the students of The UWI, St. Augustine Campus.

Methodology

This cross-sectional study consisted of 137 (100 females, 37 males) students ≥18 years old, who were enrolled at the University of the West Indies, St. Augustine campus at the time of study. Students' sweetened beverage consumption patterns were assessed by the use of self-administered questionnaires, which consisted of a food (beverage) frequency questionnaire and a 24-hour diet recall. Their anthropometric measurements and blood pressure were taken and recorded to determine their Body Mass Index (BMI) and blood pressure (BP). Analyses were conducted using IBM SPSS Statistics 19.0 (IBM Corporation, Chicago, IL, USA).

Results

Statistically, there were no differences ($p=0.217$) in the consumption of sweetened beverages observed when gender was compared. There was no significant difference in the prevalence of consumption among the age groups ($p=0.225$). There was no significant difference in the BMI between genders ($p=0.847$). A significant association was found for systolic blood pressure and male students ($p\leq0.001$).

No significant relationship was found between sweetened beverage consumption and the development of overweight and obesity.

Conclusion

No significance was found for sweetened beverage consumption and overweight and obesity. Therefore, sweetened beverage consumption is not associated with the development of overweight and obesity among the students of the University of the West Indies, St. Augustine campus. Based on the findings of the study, the null hypothesis is accepted.

Abbreviations

SBs- Sweetened beverages, *SBC*- Sweetened beverage consumption, *BMI*- Body mass index, *WC*- Waist circumference, *VF*- Visceral fat, *BP*- Blood pressure

Introduction

Background

Overweight and obesity develops when the amount of calories consumed exceeds the amount expended by an individual on a consistent daily basis. Calories are the body's fuel for energy. Once it is not expended sufficiently, the body stores the excess calories as fat, which causes weight gain over time.

According to the World Health Organization (WHO), overweight and obesity are the abnormal or excessive fat accumulation that may impair health. The most commonly used measure to determine whether an adult is overweight or obese is the Body Mass Index (BMI) equation, a simple index of weight-for-height. The WHO defines BMI as the weight in kilograms divided by the square of the height in metres (kg/m^2). Based on classifications, a healthy BMI for adults range between 18.5 and 24.9, a BMI between 25 and 29.9 classifies a person as overweight and a BMI of 30 and over classifies a person under the obese category.

Obesity increases the risk for many diet-related chronic diseases including diabetes mellitus, cardiovascular disease, stroke, hypertension, certain cancers, morbidity and mortality (WHO 2013). According to the WHO, obesity is one of today's most blatantly visible – yet most neglected – public health problems.

Overweight and obesity are the fifth leading risk for global deaths. At least 2.8 million adults die each year as a result of being overweight or obese (WHO, 2013). Worldwide, obesity rate has nearly doubled since 1980, with just over 200 million adult men and approximately 300 million adult women obese. These drastic increases in obesity rates show no sign of stopping without dedicated efforts to combat the epidemic (Harvard School of Public Health 2013). In 2012, about 34.9% of the people living in the United States (US) were obese; more than a third of adults. There was no significant change in obesity among men and women. In 2010, 35.8% of women were obese; in 2012, 36.1%. In 2010, 35.5% of men were obese; in 2012, 33.5% U.S. obesity rate levels off, but still an epidemic (Hellmich 2013*)*.

Currently, obesity is a global epidemic, not only in developed countries, but in developing countries also. In 2013, Mexico surpassed the US with an obesity rate of 32.8 %, while the US followed closely behind with an obesity rate of 31.8 % (The Huffington Post 2013). Over the past decades, as the economies of Caribbean countries developed, a steady increase in the incidence of obesity among adults has been observed (Xuereb et al. 2006). In many middle-income countries, such as Trinidad and Tobago (T&T), a high prevalence of diabetes and hypertension has been noted in association with obesity and non-communicable diseases account for most of the deaths, among adults especially (Gulliford et al. 2001). In 2012, Minister of Health Dr. Fuad Khan expressed concern that in the past decade the local obesity rate had risen drastically among our population of 1.3 million (Neaves 2012). Trinidad and Tobago has emerged as the top Caribbean country whose adult population is obese, according to a report released by the United Nations Food and Agriculture Organization (FAO).

In 2013, the United Nations FAO report found that Trinidad and Tobago is ranked sixth among all countries worldwide with 30 per cent of its adult population obese, just behind the United States which has a rate of 31.8 per cent. Health authorities raise awareness via seminars, reports and campaigns about this chronic disease that has now become a leading health issue in the country. Yet, no drastic measures have been put in place to reduce or eliminate the problem. Fast food chains continue to grow immensely and citizens are still ignorant to the fact that we are in fact an overweight country.

The country is well aware of the effects of chronic diseases like hypertension, high cholesterol and diabetes but seems unconscious of the fact that one of the main roots of these diseases stem from obesity (Caribbean three-sixty 2013).

Many risk factors which contribute to the development of this chronic disease have been investigated and identified. However, one of the largest independent contributors to the obesity epidemic which is often overlooked is the increased consumption of sweetened beverages, particularly among the adolescents and young adult's population.

Beverage companies use all the "P's" of marketing to increase sales: product, promotion, packaging, placement, and pricing. Sugary drinks are products that are designed to appeal to humans' powerful preference for a sweet taste. They are promoted with nearly $1 billion a year in advertising, much of which is viewed by teenagers and children (NEJM 2012). They are packaged in single-serving, easy-to-open, re-closable containers to facilitate immediate and continued consumption and in portion sizes that have grown by a factor of 3 to 5 in recent decades. They are placed within easy reach to promote impulse purchases, in vending machines, coolers of convenience stores, and end-aisle displays and checkout lines in grocery stores — and of course in schools. And they are priced with volume-based discounting to encourage consumers to "trade up" to larger sizes. These marketing techniques work synergistically. They have a strong appeal on young people (Sugary Drink Facts *na*) and over the past few decades, consumption of sugary drinks has more than doubled.

Although argued that sweetened beverages do not contribute to weight gain and thus the obesity epidemic, a calorie, regardless of the source has the same effect and the extra calories that these beverages add to the diet might be a significant link to overweight and obesity (Sloan 2011). Sweetened beverages provide "empty calories". These beverages simply add extra calories to your diet, with little to no nutritional benefit and therefore insufficient energy for a person's daily routine. This leads to little satiety and encourages individuals to consume a greater amount of meals and or other sweetened beverages to compensate for the lack of energy from these sweetened beverages (The CDC SSB Guide 2010). The low satiety value of beverages may be explained by the fact that for most of human evolutionary history, water was the only beverage consumed (Wolf et al. 2008); regulation of beverage energy was not of biological importance.

Though the exact mechanism of this weak satiety response is unclear, there are several possibilities to explain the association between SSB consumption and obesity. First, individuals may fail to compensate for the added calories consumed as liquid and may result in excess intakes of sugar and calories. Secondly, the rapid drop in blood sugar that follows the insulin response to consumption of foods high in sugar increases hunger and may thereby increase food consumption. The third possible mechanism is the inability of fructose to stimulate hormones that help regulate satiety. Fourth, the innate desire for the sweet taste can override normal satiety (CDC SSB Guide 2010). And thus, consumption of calories from these sweetened beverages has increased in parallel with the obesity epidemic (Malik et al. 2006).

Rationale/Problem Statement

Before the 1950s, standard soft-drink bottles were 6.5 ounces. In the 1950s, soft-drink makers introduced larger sizes, including the 12-ounce can, which became widely available in 1960 (Coca-Cola 2012). By the early 1990s, 20-ounce plastic bottles became the norm (Jacobson 2005). Today, fountain drinks at fast food restaurants and movie theatres are available in 32-ounces and 64-ounces, even with a free refill in the Unites States.

A study provided evidence that when provided with larger portion sizes, people tended to eat more, with no decrease in later food intake (Wansink et al. 2005). An additional study showed that people given larger beverages tended to drink significantly more, but did not decrease their subsequent food consumption (Rolls et al. 2007).

Numerous social and environmental factors contribute to the increased purchase and consumption of sweetened beverages. Sweetened beverages are now easily accessible and affordable and come in large portion sizes. To date, many international fast food franchises which sell and promote sweetened beverages are located in Trinidad and more are on the way, contributing to the obesity epidemic in this little island.

The association between beverage consumption and obesity remains controversial and most studies often research more than one risk factor simultaneously to determine its contribution to this worldwide epidemic than focusing on one risk factor at a time to determine which one plays the most significant role in its contribution. Also, more studies have been carried out to find the association for children and adolescents than for young adults and adults in Trinidad and Tobago. With the change in environment and lifestyle habits, young adults are at an increased risk for weight gain as they begin college and this has implications for the onset of future health consequences (Buscemi et al. 2011). Epidemiological studies have suggested that unwanted weight gain is especially prevalent during the young adult years, with one study finding that over 37% of male college students and almost 29% of female college students were overweight or obese (National College Health Assessment 2009). Research done by Holm-Denoma (2008) showed that first-year college students gained weight at a rate that is significantly higher than the rate for non-student American adults.

Thus far, fast food consumption and obesity among the UWI St Augustine population has been studied, but the relationship between beverages and obesity in this population has not yet been addressed. Therefore, this study seeks to determine the link between the consumption of sweetened beverages and the development of overweight and obesity in the students of The University of the West Indies (UWI), St Augustine campus.

Purpose of the Study

The purpose of this study was to investigate the relationship between sweetened beverage consumption and the development of overweight and obesity among the students of The University of the West Indies, St. Augustine campus.

Objectives

The Objectives of this study were as follows:

Specific

To investigate the frequency of sweetened beverage consumption and its association with overweight and obesity in the students of The UWI, St. Augustine Campus.

General

1. To assess the frequency and quantity of sweetened beverage consumption among the students of the University of the West Indies, St. Augustine
2. To examine the relationship between sweetened beverage consumption and BMI
3. To examine the relationship between BMI and blood pressure
4. To compare the sweetened beverage consumption between males and females
5. To investigate which gender and age group are at greater risk of being overweight or obese
6. To compare sweetened beverage consumption between faculties
7. To examine the associations between the availability of sweetened beverages and the consumption

Hypotheses

Null Hypothesis: Sweetened beverage consumption is not associated with the development of overweight and obesity

Alternative Hypothesis: Sweetened beverage consumption is associated with the development of overweight and obesity

The general hypotheses of this study were as follows:

1. Regular sweetened beverage consumption contributes to the development of overweight and obesity
2. The UWI St Augustine students consume high amounts of sweetened beverages on a weekly basis
3. Male students consume a greater amount of sweetened beverages than female students
4. Female students will have a higher BMI than male students
5. Students between the ages of 18-19 years old consume sweetened beverages more than students of the older age groups
6. Students in the faculty of Social Sciences (FSS) consume the most sweetened beverages than any other faculty.

Key Terms

Overweight- An excess of body weight in relation to height. BMI= 25-29.9 (Nelms et al. 2010)

Obesity- An excess of body fat or adipose tissue that may impair one's health. BMI ≥30 (WHO 2013)

BMI- weight in kilograms (kg) divided by the square of height in metres (m^2) [BMI= kg/m^2]. BMI correlates well with estimates of adult body composition

Sweetened Beverages- Those that contain caloric sweeteners (CDC Sugar-sweetened beverage guide 2010)

Blood pressure- the force of blood pushing against the walls of the arteries as the heart pumps blood. Blood pressure is measured as systolic (numerator) and diastolic (denominator) pressures. Systolic refers to blood pressure when the heart beats while pumping blood. Diastolic refers to blood pressure when the heart is at rest between beats (NHLBI 2012)

Literature Review

Numerous social and environmental factors contribute to the increased purchase and consumption of sweetened beverages. Sweetened beverages are marketed and advertised aggressively and are sold in large serving sizes. Rapid urbanization within Trinidad has caused sweetened beverages to be readily available and accessible at the convenience of many. These beverages accompany the foods sold at restaurants as though compulsory. At food chains like Subway, KFC and Marios on the UWI St Augustine campus, the students' beverage options seem limited with combo meals. When asked by the cashier their drink of choice, they are prompted to choose "soft drink" by being asked which flavour drink they would prefer, which follows by the list of flavours of soft drinks. If students want a healthier drink alternative, they have to pay extra, therefore being encouraged to consume these "empty calorie" beverages along with their energy dense foods. And while on a budget, students prefer to spend money for a flavoured drink that tastes good to them, rather than one which they can get free. Therefore, it is important to investigate the association between sweetened beverage consumption and the development of overweight and obesity among the students of the University of the West Indies, St Augustine campus.

According to the World Health Organization, overweight and obesity is defined as the abnormal accumulation or excess fat that may impair one's health (WHO 2013). Defined by the WHO, a BMI greater than or equal to (≥) 25 is classified as overweight and a BMI greater than or equal to (≥) 30 is classified as obesity (WHO). The following table depicts the standard BMI classifications (WHO 1995, 2000, 2004):

Table 1: The Global Classification of adult BMI (WHO 2006)

Classification	**BMI(kg/m^2)**	
	Principal cut-off points	**Additional cut-off points**
Underweight	**<18.50**	**<18.50**
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	**18.50 - 24.99**	**18.50 - 22.99**
		23.00 - 24.99
Overweight	**≥25.00**	**≥25.00**
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	**≥30.00**	**≥30.00**
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

Sweetened beverages (SBs) are the largest source of added sugar in the diet and have become popular and widely available (CDC SSB Guide 2010). There is convincing evidence that these sugar-sweetened beverages increase the risk for development of overweight and obesity. Many are misconceived that a sweetened beverage is a “soft drink” or a “soda” only. However, a sweetened beverage is any beverage, carbonated or not which contains any added source of sugar or artificial and caloric sweetener. For this study, a sweetened beverage includes soft drinks, fruit drinks, fruit juice, flavoured water, juice mix, energy drinks, flavoured milk, alcohol, and any beverage where sugar or artificial sweeteners are added such as tea and coffee. Excluded for this study are sports drinks, and liquid meal supplements.

Table 2: The caloric content of selected popular sweetened beverages (USDA ChooseMyPlate.gov 2013)

Beverage Brand	Serving Size	Total Calories	Empty Calories (added sugar)
Pepsi/ Coca Cola	**12 ounces**	**136**	**126**
Fanta soft drink	**12 ounces**	**165**	**NA**
Orchard juice drink	**250mL**	**130**	**92**
Trinidad Fresh	**330mL**	**170**	**NA**
Fruta	**330mL**	**160-187**	**NA**
Fruta Kool Kidz	**200 mL**	**100**	**100**
Nesquik	**250mL**	**240**	**84**
Silk Pure Almond Milk	**240mL**	**100**	**68**
Monster Energy Drink	**16 ounces**	**202**	**206**
Caribbean Cool	**8 ounces**	**120-140**	**NA**
Fruit juice drink (Minute Maid)	**8 ounces**	**116**	**70**
Iced Tea (lemon flavour)	**8 ounces**	**70**	**68**

Many studies, including those of a cross-sectional nature have been carried out in an attempt to find the association between sweetened beverage consumption and obesity but still the association remains controversial (Hu and Malik 2012). Malik and colleagues reviewed the literature until 2006. Of the 13 studies conducted among children and adolescents, the majority found significant positive associations or trends towards a positive association. Larger studies tended to show stronger more consistent results. For example, findings from the 'Growing Up Today study' (GUTs) which included > 10,000 children and adolescents from the US showed that in girls consumption of SSBs was associated with a 0.06 unit increase in BMI per serving (p=0.04) (Malik et al. 2006). These findings are supported by those from combined NHANES surveys which showed that consumption of SSBs contributed a higher proportion of total energy in overweight compared to normal weight individuals. Among studies conducted in adults, one found a greater probability of being overweight in subjects with higher SSB intake levels and the other observed that women who consumed SSBs regularly were 0.47 pounds heavier than non-consumers (Hu and Malik 2012).

In studies among adults, Liebman et al. (2003) found a significantly greater probability of overweight in subjects who drank ≥1 soft drink/week than in those who drank<1 soft drink/week (70% compared with 47% of women; 77% compared with 58% of men, $P < 0.05$). The probability of obesity was also significantly greater in subjects who drank ≥ 1 soft drink/week than in those who drank <1 soft drink/week (32% compared with 18% of women; 33% compared with 18% of women; 26% compared with 17% of men, $P < 0.05$). Similarly, the findings of French et al. (1994) indicate that women who

consumed 1 soft drink/week were 0.47 pounds (0.21 kg) heavier than those who reported no soft drink consumption (P = 0.03). Men consuming 1 soft drink/week were 0.33 pounds (0.15 kg) heavier than those who reported no soft drink consumption, although this difference was not significant (P = 0.13).

When humans ingest energy-containing beverages, energy compensation is less precise than when solid foods are ingested (Bray et al. 2004). DiMeglio and Mattes (2000) found that when 15 healthy men and women were given a carbohydrate load of 1880 kJ/d (450 kcal/d) as a calorically sweetened soda for 4 weeks, they gained significantly more weight than when the same carbohydrate load was given in a solid form as jelly beans. In a cross-sectional analysis of 791 non-Hispanic white men and women aged 18–70 Odegaard et al. (2012) examined how beverage consumption habits obtained from a food frequency questionnaire associate with overall and abdominal adiposity measures from MRI. They found that participants with greater sugar-sweetened beverage intake were more likely to be male and with increasing frequency of SSB intake, they observed increases in waist circumference (WC) and the proportion of visceral to subcutaneous abdominal adipose tissue (VAT%), with no change in total body fat (TBF%) or BMI.

The Black Women's Health Study of 59,000 black women examined the association of SSB consumption at the start of the study with weight gain over the ensuing six years (1995 to 2001). 22 Data were analyzed for 43,960 women who did not have diabetes at the time of study enrollment and provided complete dietary intake and weight change data. SSB categories were "sugar-sweetened soft drinks", "orange juice and grapefruit juice" and "other fruit juices, fortified fruit drinks, and Kool-Aid." Daily consumption of at least one glass of soft drinks, fruit drinks, and orange/grapefruit juice at the start of the study was 17 percent, 32 percent, and 22 percent, respectively. The greatest weight gain, 6.8 kg (~15 lbs), was reported by women who changed from one or fewer soft drinks per week to one or more soft drinks per day. Women whose consumption of soft drinks remained stable at one or more per day reported a weight gain of 5.8 kg (~12.2 lbs). Women who maintained their intake of soft drinks at one or less per week or who reduced their intakes from one or more per day to less than one per week gained the least weight: 4.9 kg (~11 lbs) and 4.1 kg (~9 lbs), respectively. A somewhat similar, but weaker, association was observed for other sweetened fruit drinks.

A prospective study of 810 adults was conducted by Chen et al. (2009). Measurements taken were height, weight and a 24hr dietary recall. The objective of their study was to investigate how changes in beverage consumption affect weight gain among adults. Based on the results of the study, only intake of sugar-sweetened beverages were associated with weight gain.
West and colleagues surveyed undergraduate students in an urban university campus about their sweetened beverage consumption (West et al. 2006). Out of two-hundred sixty-five students, 95% reported sweetened beverage intake within the past month and 65% reported daily intake. The findings from this study also showed that more males reported daily intake than females; soft drink being the most common sweetened beverage. Younger students reported significantly higher intake than older students (p=0.025). With respect to the most preferred beverage type, fruit drinks were the most common sweetened beverage among students (West et al. 2006). In this study, men reported significantly greater sweetened beverage consumption than females. Age was another predictor of greater sweetened beverage consumption and therefore greater caloric intake from sweetened beverages. West et al. found that students aged between 19 to 21 years (p=0.025) consumed more calories from sweetened beverages than students older than 21 years of age (West et al. 2006).

A meta-analysis evaluating change in BMI per increase in one 12-oz serving of SSB per day in children conducted by Hu et al. (2010) found a clear positive association between SSB intake and weight-gain.

With respect to SBs and gender, Rankit et al. (2010) found that consumption of SBs and the level of consumption varied according to gender. The prevalence of any consumption of SBs was substantially larger for boys and girls (83% and 78% respectively). Associations of unhealthy foods such as fried foods were also found to be associated with SBC (Ranjit et al 2010).

With respect to the other NCDs, sweetened beverages increase the risk of hypertension as well as overweight and obesity. A study by Dhingra et al. 2007, looked at SSB consumption in relation to individual Metabolic syndrome components found that individuals who consumed ≥1 soft drink per day had a 22% greater risk of developing hypertension (≥ 135/85 mm hg or on treatment). In the International Study of Macro/Micronutrients and Blood Pressure (INTERMAP), for every extra sugar-sweetened beverage drunk per day participants on average had significantly higher systolic blood pressure by 1.6 millimeters of mercury (mm Hg) and diastolic blood pressure higher by 0.8 mm Hg. This remained statistically significant even after adjusting for differences in body mass index (American Heart Association 2011).The evidence between sweetened beverage consumption and the development of hypertension however seems limited.

Methodology

Participants: The inclusion criteria for this study were students enrolled at the University of the West Indies campus, St. Augustine in the academic year of 2013/2014. Students who were ill or pregnant were excluded from this study.

Research Design

A cross-sectional study design was used, with a non-probability sampling, which is a convenient sampling method due to the short period of time to conduct the study. The target population were the students of the University of the West Indies, St Augustine ≥18 years of age.

Sampling Procedure

The sample size of the study was determined based on the precision of the study:

$n = Z^2 pxq/e^2$

n = sample size

z = standard normal value of Z-Score which has a value of 1.96 and 2.58 at the 95% and 99% confidence level respectively.

p = the proportion of the population with the attribute of interest (expressed as a decimal)

e = level of precision or confidence interval

The sample size which was calculated with a margin of error of 5% totalled to 322 students as the target population.

Data Collection and Procedure

Data collection was conducted throughout the months of October to November 2013. The research data were collected through the distribution of a self-administered questionnaire to be completed by each participant and anthropometric and clinical measurements to be completed by the researcher. The questionnaire was pre-tested, where 15 questionnaires were distributed to students of The University of the West Indies, St Augustine to gain feedback and improve on the study design where necessary. After the pre-test, adjustments were made to the structure of the questions and a total of 161 questionnaires were distributed to the students of The University of the West Indies St. Augustine. Out of 161 questionnaires distributed, 137 questionnaires were collected. Out of 137 collected, 133 were fully completed. The study had a response rate of 83%. The questionnaires were distributed to students who were willing to complete the questionnaire, and the anthropometric and clinical measurements. The research purpose was explained to the willing participants and they were advised that the questionnaire would have taken 10 to 15 minutes to complete and an additional 10 minutes for the anthropometric and clinical measurements to be completed.

Instrument

Food frequency questionnaires (FFQ) were used in this study as they are an acceptable method for assessing habitual dietary intake. The availability of a brief, self-administered quantitative beverage intake questionnaire could greatly enhance research targeting habitual beverage intake patterns in adults (Hedrick et al. 2012). Food consumption was estimated in 2 ways: as energy intake in kilocalories and amount consumed in ounces (0.035 oz = 1.0 g)

The questionnaire comprised of twenty-six (26) questions the majority of which were in close-ended format. The questions were categorized into five (5) sections: Section 1-Demographics, Section 2- Behaviours/Habits, Section 3- Access, Section 4- Frequency and Section 5- 24-Hour Recall. The respondents were asked to place a tick in the circle next to the option which best corresponded to them. Questions on the respondents' gender, age group, ethnicity and faculty made up Section 1.

Section 2 focused on beverage preferences and sweetened beverage drinking patterns during a usual day. In this section, the respondents were first asked whether or not they consumed sweetened beverages where they had the option of choosing 'yes' or 'no'. The respondents who chose 'no' as an option were allowed to continue the questionnaire, in attempt to compare their results to the other respondents who answered 'yes'. Respondents were then asked 'when they consume sweetened beverages' and 'which type of foods usually accompany their sweetened beverage consumption' in order to get an idea of their consumption habits. Question 8 asked respondents about their general beverage preference, where they were given the option to rank beverages based on the one they preferred the most to the one they preferred the least and the reason for the one they prefer the most. Question 9 asked them to choose 'which beverage they prefer to drink when thirsty' and to give 'their reason why'. This was asked to determine whether their beverage choice when thirsty was the same as for their general preference. Question 10 asked the respondents to state if 'their sweetened beverage consumption had increased over the past 12 months' and if they answered yes, they were asked to give a reason.

Availability refers to whether foods (or beverages) of interest are present in an environment (Cullen et al., 2003). To assess availability of sweetened beverages at home and on campus, Section 3 consisted of questions which asked respondents about their sweetened beverage access and purchasing patterns with respect to 'the places in which they get the most sweetened beverages to the least' and 'where they consume sweetened beverages the most'. Question (13) which ended the 'Access' section asked "do you find these beverages easily available'. This was a factor used to determine if access contributed significantly to sweetened beverage consumption patterns among the UWI, St. Augustine students.

In Section 4, questions were asked pertaining to the students' usual sweetened beverage consumption pattern each week, in a beverage frequency table. Two (2) questions were asked about consumption: The frequency of beverage consumption in one column labelled as 'How often' and the amount of beverage consumed at each time, labelled in another column as 'How much each time'. These two columns were used for correlation to determine students who were frequent consumers of sweetened beverages and students who regularly consumed more than one (1) serving each time. They were given the beverage options of water, soft drink, 100% fruit juice, energy drink, flavoured water, juice drink, juice mix, sweetened iced tea, flavoured milk, beer/stout and mixed alcohol drinks. Under the "How often" column, the response

categories were ‘rarely or never’, ‘1 time per week’, ‘2-3 times per week’, ‘4-5 times per week’, ‘1 time per day’, and ‘2 times or more per day’. For the amount they drank each time, response categories were ‘8oz’, ‘12oz’ and ‘20oz’. Therefore for each beverage, respondents had to tick each column: one (1) tick for “How much” and one (1) tick for “How often”.

Section 5 asked the respondents to list in detail the beverages they consumed within the last 24 hours, prior to answering the questionnaire. This included the serving size, the amount of added sugar or sweetener if any, the brand of beverage and the average time each beverage was consumed. This was to observe the periods in the day in which sweetened beverages were consumed the most and to evaluate the amount of calories coming from sweetened beverages for each student.

After the questionnaire was completed, the anthropometric and clinical measurements were taken by the researcher. Respondents were asked if they had anything to eat or drink within the last 3 hours. For the respondents who answered “yes”, they were asked to give a list of the items, which were recorded on their questionnaire as an undigested stomach could have affected the BIA readings as well as the blood pressure readings, depending on what items they may have had. Respondents were also asked to empty their bladder if they felt the need to do so, to avoid inaccuracy of BIA readings also.

For blood pressure measurements, each student was asked to sit with their feet flat, in an upright relaxed position for about 5-10 minutes before their blood pressure readings were taken. Using an automated machine (Omron HEM-712 BP machine), the cuff was placed snugly on the left arm of each respondent and the monitor was switched on. Readings of systolic, diastolic blood pressure (hhmG) and heart beats per minute were displayed and recorded. This procedure was repeated twice for each participant so that an average for a greater representation of actual blood pressure (BP) was maintained.

The height of each student was taken using a stadiometer. Students were asked to remove their shoes and socks (if any was worn). With their heels together, they were asked to keep their back straight and go as far back as possible on the stadiometer, to ensure that their heels, buttocks, shoulders and head was touching the measuring rule of the stadiometer, with their heads in a Frankfurt Plane (looking straight ahead). After the student took a deep breath, their height was read off to the nearest 0.05 inch.

After height was recorded, the students were asked to keep their shoes and or socks off and were directed to the Biological impedance analysis (BIA) machine. The machine was switched on and the demographics such as gender, age and height of the student was entered. Within a few seconds of stepping onto the scale, readings of weight, BMI and VF % was displayed and recorded.

WC was measured to the nearest 0.5inch with a stretch resistant cloth tape measure. A standardization protocol was used; observing waist as the midpoint between the lowest rib and the top of the iliac crest (WHO, 2008). This procedure was repeated for all participants. The ‘adult’ cut-offs for high WC circumference based on classifications were 35 inches for females and 44 inches for males.

Data analysis

Analyses were conducted using IBM SPSS Statistics 19.0 (IBM Corporation, Chicago, IL, USA). Descriptive statistics such as ANOVA were used to calculate the frequencies, percentages and mean values of data collected. Chi-squared tests, independent t-tests and regression analysis were used to compare variables and to find associations between variables. The statistical significance for all tests was $p<0.05$.

Results

This section reports the main results from the questionnaires administered to students of the University of the West Indies, St Augustine campus. Usable responses were received from 137 of the 161 students to whom self-administered questionnaires were distributed; resulting in an 85% response rate.

Table 3: Frequency distribution of demographics of participants

Variable	**n**	**%**
Gender		
Male	37	27
Female	100	73
Age Group		
17-19	23	16.8
20-22	72	52.6
23-25	23	16.8
>25	19	13.9
Ethnicity		
African	64	46.7
East Indian	28	20.4
Other*	45	32.8

**Includes non-Afro Trinidadian, non-Indo Trinidadian and non-Trinidadian students*

Table 3 shows the frequency distribution of selected demographic characteristics of the participants by gender, age and ethnicity. As seen participants were predominantly female (n = 100; 73%); aged between 20-22 years (n = 72; 52.6%) of Afro-Trinidadian (n = 64; 46.7%) descent.

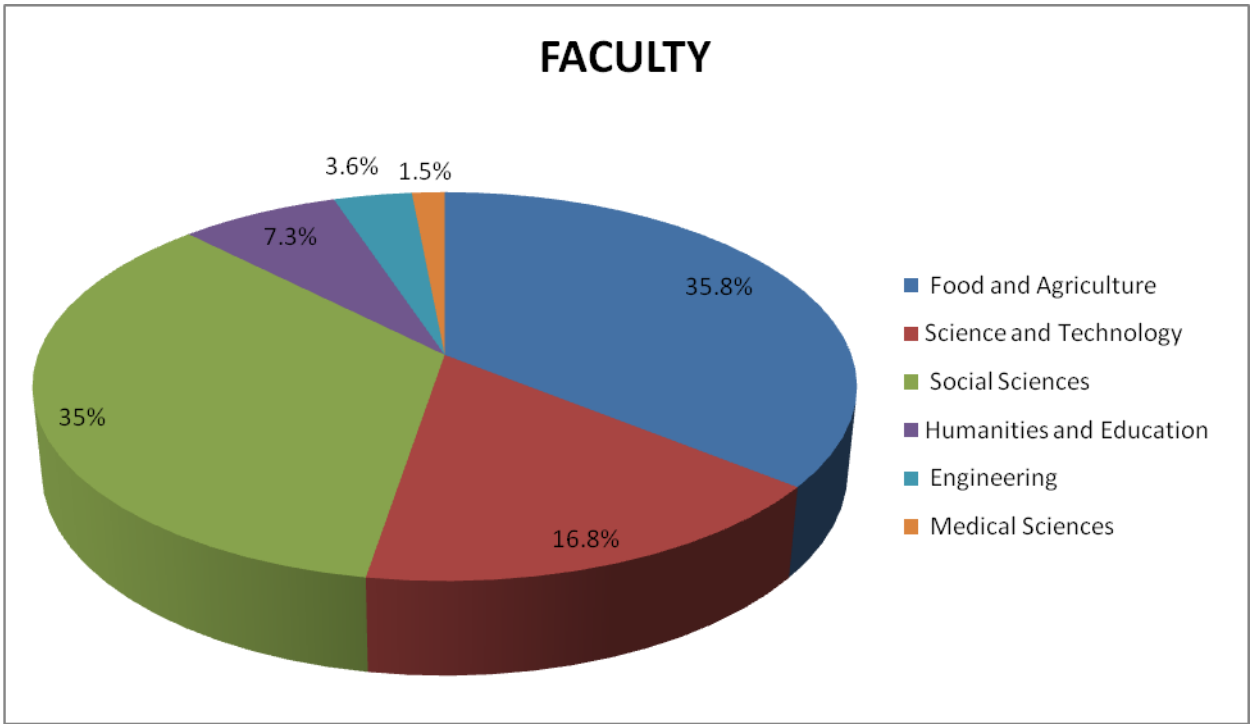

Figure 1: Pie chart showing the distribution of participants by faculty

As depicted in figure 1, the majority of participants were enrolled in the Faculty of Food and Agriculture (FFA; n = 49; 35.8%), whilst the minority was enrolled in the Faculty of Medical Sciences (FMS; n=2; 1.5%).

Overall Beverage Consumption

A total of 133 students (97.1 %) said that they consumed sweetened beverages and 2.9 % (n=4) said that they did not, compared to 130 (94.9%) who said that they drank water at least '*Once per Week*"; 6 (4.1%) who '*Rarely or Never'* drank water and 1 student (0.7 %) who did not respond.

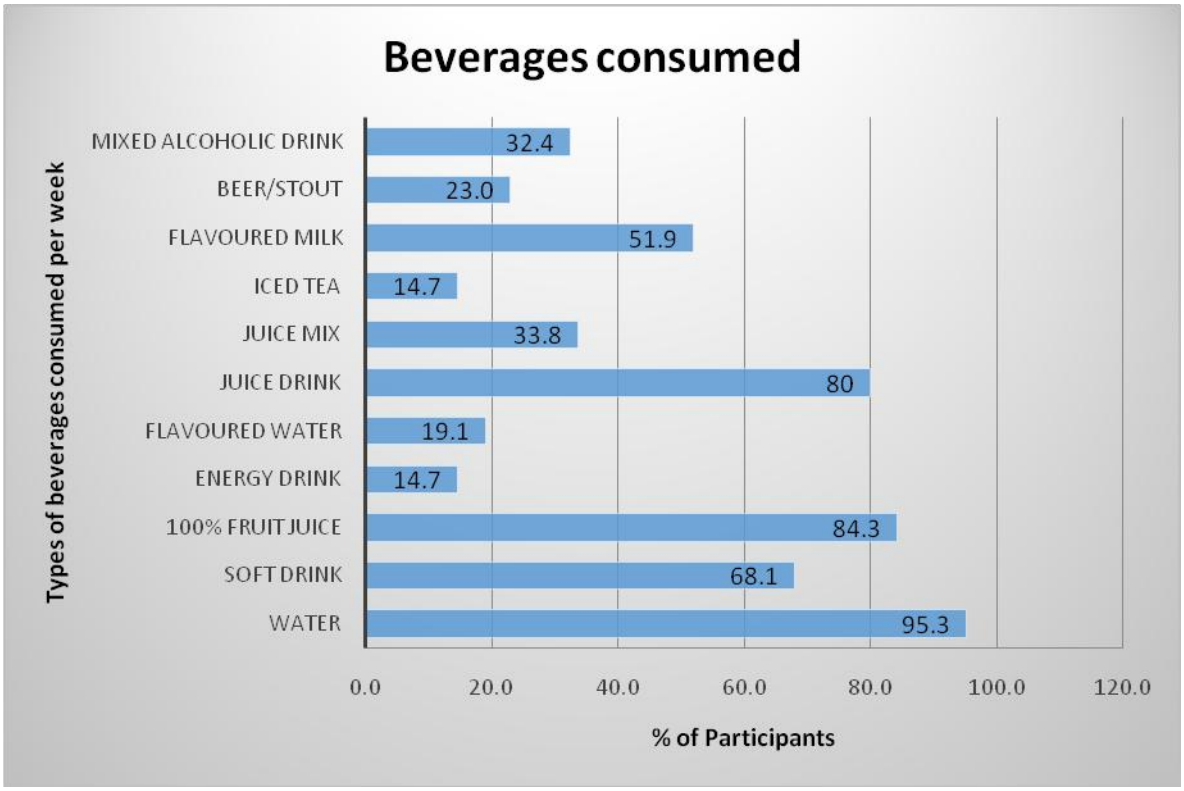

Figure 2: Prevalence of water and sweetened beverage consumption among the participants

Figure 2 shows the prevalence of water and sweetened beverage consumption among students. As seen with respect to the sweetened beverages, the prevalence was highest for 100% Fruit Juice (n = 113; 84.3%) while the consumption of energy drinks had the smallest prevalence (n = 20; 14.7%).

A test of comparison of two proportions showed that the prevalence of sweetened beverage consumption among students was not significantly different from the prevalence of water consumption among them (p = 0.54).

Sweetened Beverage Consumption by Demographic variables

A one way ANOVA test showed the prevalence of sweetened beverage consumption for males (n=37; 100%) compared to females (n=96; 96.0%). Statistically, there were no differences (p=0.217) in the consumption of sweetened beverages observed when gender was compared.

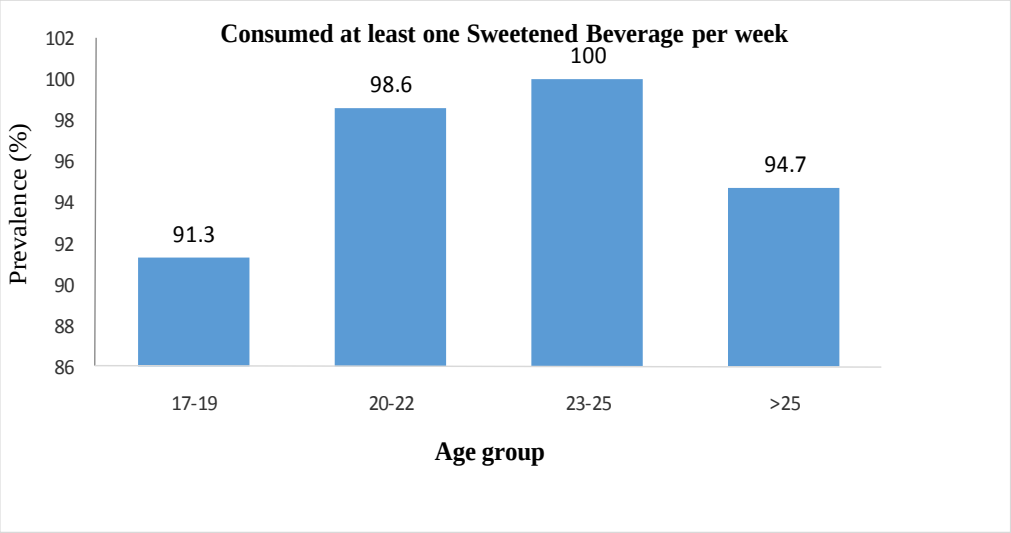

Figure 3: Prevalence of sweetened beverage consumption by age group

Figure 3 displays the comparison of the prevalence of sweetened beverage consumption by age group. There was no significant difference in the prevalence of consumption among the age groups (p=0.225).

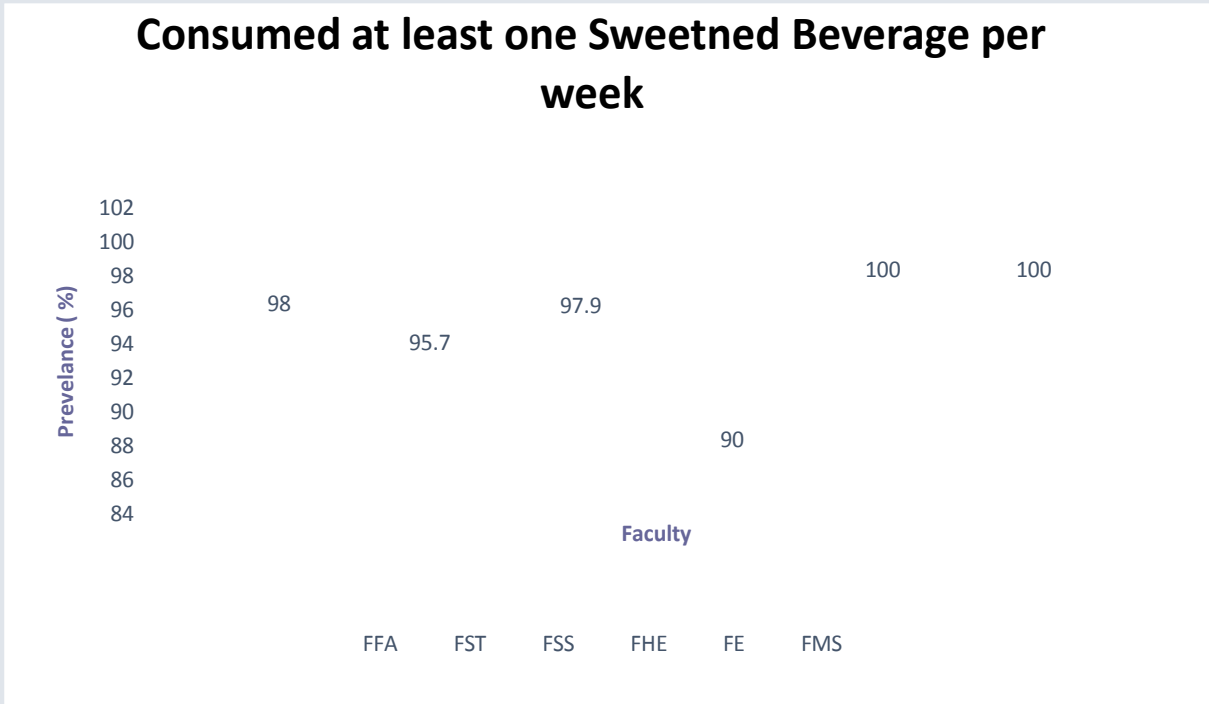

Figure 4: Prevalence of sweetened beverage consumption by faculty

Figure 4 displays the comparison of the prevalence of SB consumption by faculty. There was no significant difference in the prevalence of consumption among the faculties (p=0.792).

Consumption Amounts

Table 4: Pattern of beverage consumption by serving sizes

Beverages	**8-ounces**	**12-ounces**	**20-ounces**	**p-value**
Water	41.8	14.7	43.4	≤ 0.001
Soft Drink	68.8	14.6	16.5	≤ 0.001
100% Fruit Juice	59.5	19.8	20.7	≤ 0.001
Energy Drink	84.6	7.7	7.7	≤ 0.001
Flavoured Water	82.1	10.7	7.1	≤ 0.001
Juice Drink	73.9	16.5	9.5	≤ 0.001
Juice Mix	69	15.5	15.5	≤ 0.001
Sweetened Iced Tea	85.7	8.2	6.1	≤ 0.001
Flavoured Milk	80.7	14.8	4.5	≤ 0.001
Beer/Stout	51.6	17.7	30.6	0.002
Mixed Alcoholic Drinks	52.1	17.8	30.1	0.001

Table 4 shows that participants generally consumed 8-oz beverages significantly more than the other serving sizes, with the exception of water.

Table 5: Frequency and amount of sweetened beverage consumed by gender

			p-values	
Variable	**Gender**	**n**	**Frequency**	**Amount**
Water	Male Female	36 100	0.397	0.409
Soft drink	Male Female	36 98	0.002	0.025
100% Fruit juice	Male Female	36 100	0.019	0.269
Energy drinks	Male Female	36 100	0.188	0.647
Flavoured water	Male Female	36 100	0.312	0.823
Juice drinks	Male Female	36 100	0.108	0.755
Juice mix	Male Female	36 100	0.255	0.986
Sweetened ice-tea	Male Female	36 100	0.758	0.977
Flavoured milk	Male Female	36 100	0.278	0.844
Beer/Stout	Male Female	36 100	0.01	0.476
Mixed alcoholic drinks	Male Female	36 100	0.009	0.093

Table 5 shows the p-values associated with comparisons of male-female frequency and amount of sweetened beverages consumed. A series of tests of association between amounts and frequency of consumption and gender showed that males consumed soft drinks (p=0.002), 100% fruit juices (p=0.019), beer or stout (p=0.01) and mixed alcoholic drinks (p=0.009) more often than females. Also, male students consumed more ounces of soft drinks than females students on any given occasion (p = 0.025). There were no significant differences between the frequency and amount of sweetened beverages consumed by males and female students on any given occasion.

Preferences

Table 6: Ranked beverage preferences by gender

Beverage		
Rank	**Male**	**Female**
1	Water/ 100% Fruit Juice	100% Fruit Juice/Water
2	Fruit Drink	Fruit Drink
3	Soft Drink	Soft Drink
4	Alcohol	Flavoured Milk
5	Flavoured Water	Flavoured Water
6	Flavoured Milk	Alcohol
7	Energy Drinks	Energy Drinks

Table 6 shows the comparison of the ranked beverage preferences by gender. Water and 100% fruit juice were the number 1 preference and the least preferred sweetened beverage was energy drinks by both genders.

Consumption Habits

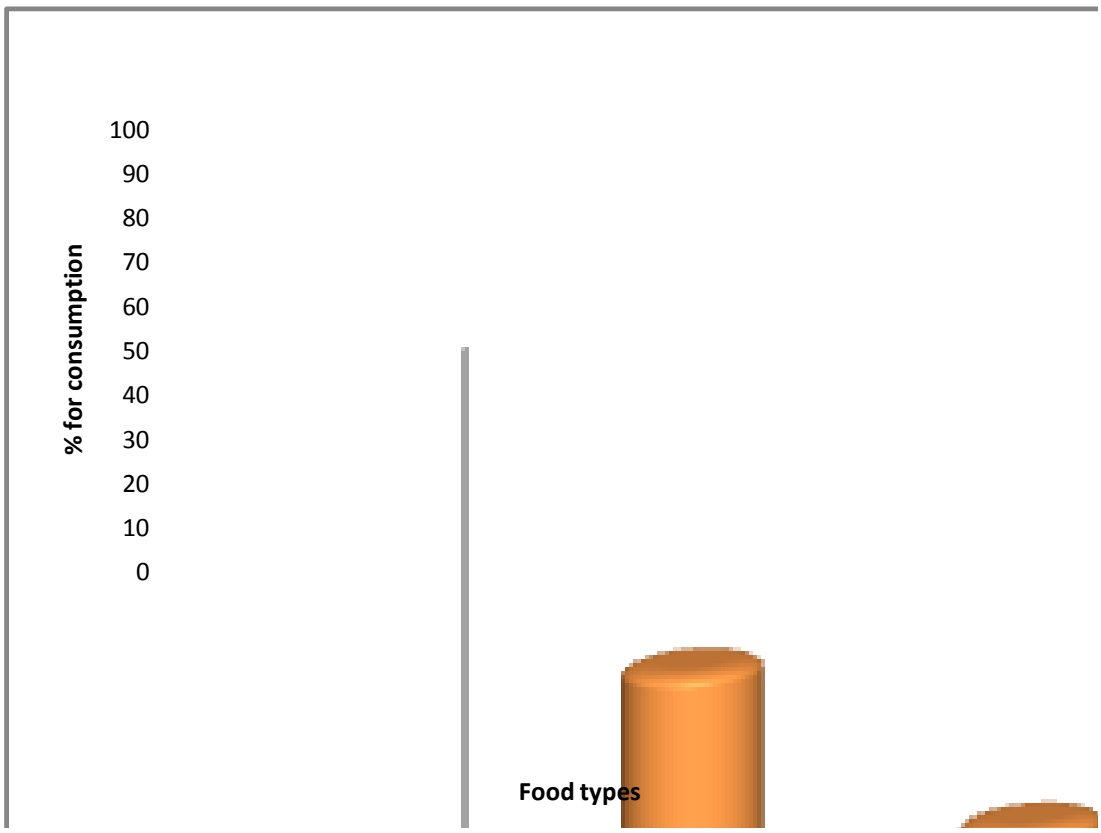

Figure 5: Foods usually consumed together with Sweetened Beverages

Figure 5 presents the meals that usually accompany sweetened beverages consumed among students. From the options given, the majority of students, (n = 95; 72.0%) stated that they drank sweetened beverages while they ate home-cooked meals at home. The minority of students, 9.8%, (n=13) and 9.2%, (n=12) ate fresh salad and candy while they consumed sweetened beverages, respectively.

Table 7: The five leading purchase and consumption locations/settings

Setting/Location		
Rank	**Purchase**	**Consumption**
1	Cafeteria	Social gatherings
2	On-campus eating places	On-campus eating places
3	Supermarkets	Going to and/or from classes
4	Off campus eating places	In class (as permitted)
5	Minimarts	At place of residence

Table 7 shows the five leading purchase and consumption locations for sweetened beverages among respondents. Cafeterias and social gatherings ranked #1 for purchase and consumption respectively while minimarts and place of residence ranked #5 for location of purchase and consumption and least purchased at vending machines (not shown in table; not among the top 5).

Risk for Disease

Participant Classification

Table 8: Comparison of BMI by Gender

Variable	**Gender: n (%)**		**P**
	Male	**Female**	
BMI			
Underweight	2 (5.9)	9 (9.4)	0.847
Normal	16 (47.1)	49 (51.0)	
Overweight	11 (33.4)	27 (28.1)	
Obese	5 (14.7)	11 (11.5)	

Table 8 shows the BMI classifications between genders. There was no significant difference in the BMI between genders (p=0.847).

Table 9: Comparison of Body fat % by Gender

Variable	**Gender: n (%)**		**P**
	Male	**Female**	
Body Fat %			
Lean	0 (0.0)	6 (7.0)	0.016
Ideal	5 (16.1)	4 (4.7)	
Average	10 (32.3)	14 (16.3)	
High	16 (51.6)	62 (72.1)	

Table 9 shows the classifications of body fat % between genders. There was a statistically significant difference between body fat % and gender (p=0.016).

Table 10: Comparison of Visceral fat by Gender

Variable	Gender: n (%)		P
	Male	Female	
Visceral Fat			
Low	7 (22.6)	27 (31.4)	0.000
Normal	9 (29.0)	49 (57.0)	
High	13 (41.9)	8 (9.3)	
Very High	2 (6.5)	2 (2.3)	

Table 10 shows the classifications of visceral fat % between genders. There was a statistically significant difference between visceral fat % and gender (p=≤0.001).

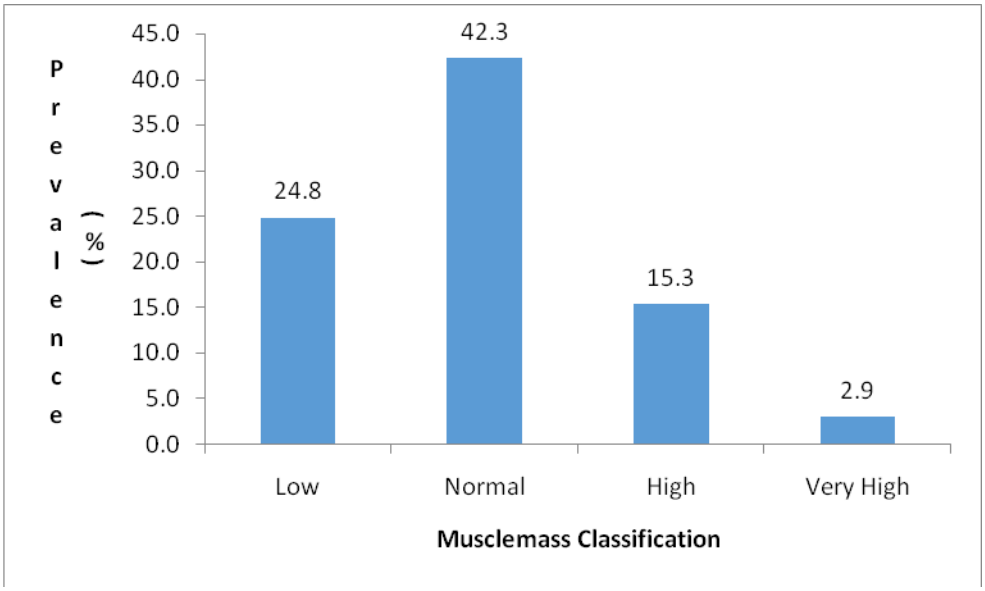

Figure 6: Muscle mass Classification

Figure 6 displays the classification of muscle mass among the participants. It shows that 29.1% (n=34 out of 117) had low muscle mass while that of 21.3 % was *high* to *very high*.

Waist circumference measurements were obtained from 87.6% (n=120) students from which summary statistics were obtained that showed that the majority of participants 93.3% (n =112) had a normal waist circumference while that of 6.6% (n =8) was *high*. There was no significant difference between WC and gender (p=0.106).

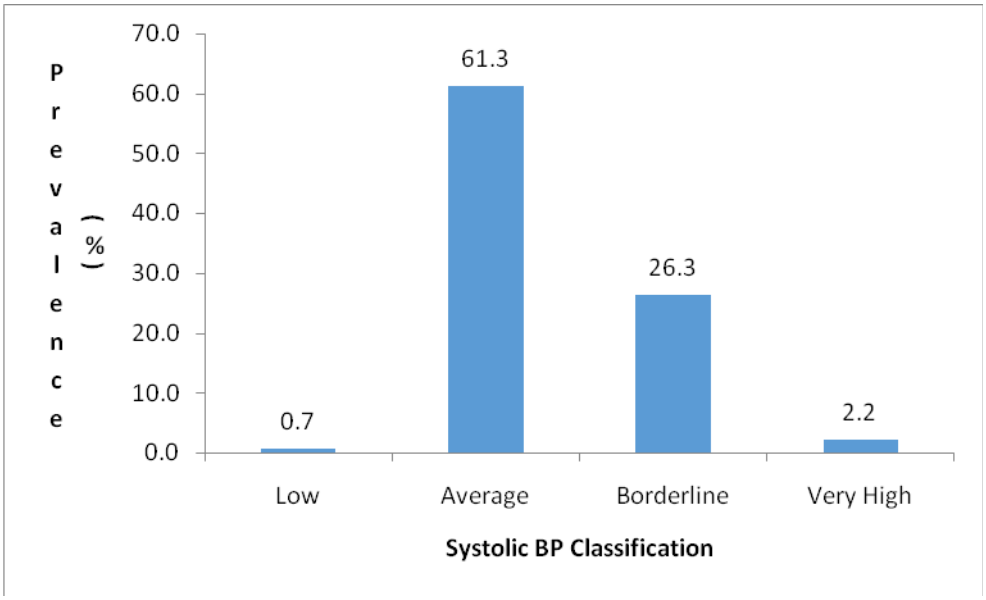

Figure 7: Student Systolic BP Classification

Figure 7 shows the classification of systolic blood pressure (BP) among the participants. A small amount of the participants was found to have low systolic BP (0.7%) and *very high* systolic BP (2.2%).

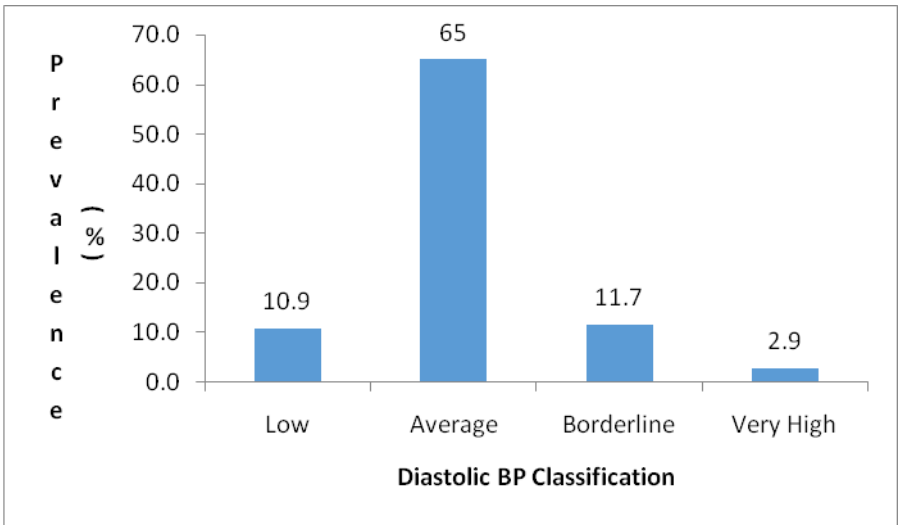

Figure 8: Student Diastolic BP Classification

Figure 8 shows the classification of diastolic BP. Respectively, 10.9% participants had low diastolic BP and 2.9% had very high diastolic BP.

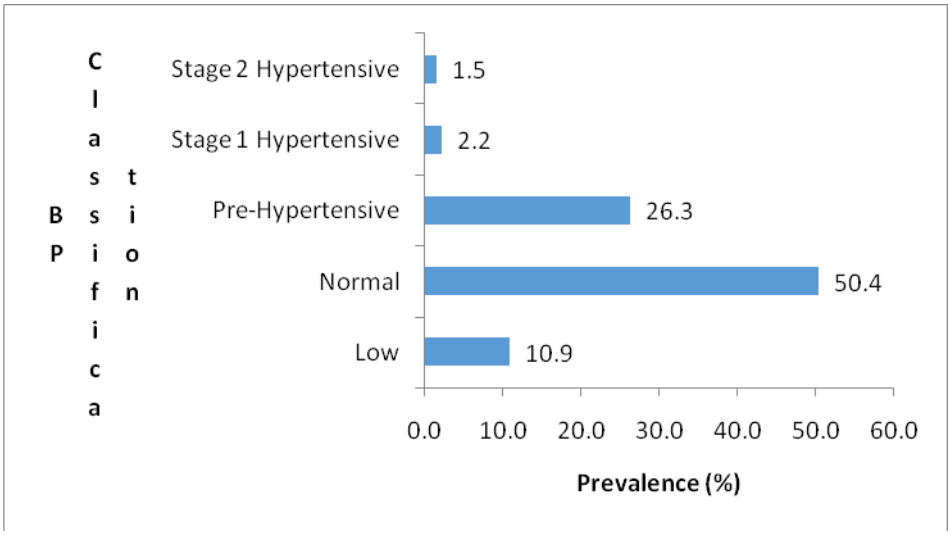

Figure 9: Student BP Classification

Figure 9 shows that the prevalence of high BP and low BP among participants was 3.7% and 10.9% respectively. Also 26.3% participants were classified as pre-hypertensive.

Associated Risk Factors

The following associations were found to be significant:

1. Frequency of consumption of soft drinks and body fat classification ($p = 0.044$)
2. Frequency of energy drink consumption and systolic BP classification ($p = 0.039$)
3. Frequency of flavoured drink consumption and visceral fat classification ($p = 0.016$)
4. Frequency of beer of stout consumption and waist circumference classification ($p = 0.019$); systolic BP classification ($p = 0.009$); and BP classification ($p \leq 0.001$)
5. Frequency of mixed alcoholic drinks consumption and BP classification ($p = 0.004$)

Table 11: Useful Predictors of Selected Students' Measure: *p-value*

Variable	**Body fat%**	**Visceral Fat (%)**	**Muscle mass**	**Systolic BP**	**Diastolic BP**
	**	**	**	**	**
Age	**	**	**	0.026	0.002
Gender	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001	**
Faculty	**	**	**	**	**
Is student from FFA?	**	**	**	**	**
How often do you drink water?	0.022	0.033	0.010	**	**
How often do you drink soft drinks?	**	**	**	**	0.039
How often do you drink fruit juice?	**	**	**	**	**
How often do you drink energy drinks?	**	**	**	**	**
How often do you drink flavoured water?	0.009	0.037	**	**	**
How often do you drink juice drinks?	**	**	**	**	**
How often do you drink sweetened ice tea?	**	**	0.015	**	**
How often do you drink flavoured milk?	**	**	**	**	**
How often do you drink beer or stout?	**	**	**	**	≤ 0.001
How often do you drink mixed alcoholic drinks?	**	**	**	**	**

Not significant at the 5% level

Table 11 shows the useful predictors of selected student anthropometric measures.

None of the variables was found to be a useful predictor of BMI (excluded from the table). Neither was sweetened beverage consumption a predictor of any of the measures. Age was useful for predicting only BP.

Discussion

This study set out to investigate the association between the consumption of sweetened beverages and overweight and obesity among students enrolled at the University of the West Indies, St Augustine campus. The study consisted of 37 males and 100 females students (n=137). Participants were predominantly Afro-Trinidadian, between 20-22yo, enrolled in the FFA. The study revealed that 97.1% of the sample population consumed sweetened beverages (SBs), similar to that found by West et al. (2006), where 95% of the students in that study reported consuming sweetened beverages. A lot of the students drank water at least once per week, 94.9% (n=130) while the remainder 4.1% (n=6) did not because they did not like the taste or refused to purchase water, if they did not bring it from home and 1 student (0.7) who did not respond, which may be due to the fact that they rarely or never drank water. Most students stated that they drank water because it is the most hydrating. Students in another study also reported that they drank water primarily for hydration (Block et al. 2013). Others reported that they drank water because it is nutritive and free of calories

With respect to sweetened beverage consumption (SBC), most students consumed 100% fruit juice, 84.3% (n=113), followed by fruit drinks, 80% (n=108). This result is in agreement West et al. (2006) who surveyed undergraduate students and found that the most common sweetened beverage among them was fruit juice. Both male and female participants stated that they believe both type of beverages are the healthiest, most hydrating and natural, which can be the reason for their preference. This finding was similar to another study where juice had a "health halo" to the students (Block et al. 2013). The least preferred sweetened beverage was unexpectedly energy drinks. This finding may be due to their expensive cost and the fact that energy drinks may be a seasonal beverage among campus students, namely around examination period.

Unlike Hu and Malik (2012) who found a greater probability of being overweight in participants with greater SBC levels, this study found no significance with respect to SBC and overweight or obesity. Soft drinks were among the top three preferred SBs, 68.1% (n=82) mainly because of its taste. Most students did not even care that it was not one of the least healthy beverage options, nor did the cost matter to them, for neither of the SBs. The same findings were also arrived by West and colleagues (2006) where soft drink was reported to be the most common sweetened beverage. Energy drinks and iced tea were drunk the least by students. There was no significant difference between male to female SB consumption, however the prevalence of SBC was larger for males (100%) than for females (96%). With respect to SBs and gender, Rankit and colleagues (2010) also found that consumption of SBs and the level of consumption varied according to gender. The prevalence of any consumption of SBs was larger for males than females (83% and 78% respectively).

With respect to frequency of SBC, males drank soft drink (soda), 100% fruit juice and alcohol more often than did females. This may be due to them socializing more and getting out more, being at sports bars and pubs more often than females. It can also mean that females underreported their alcohol consumption. Alcohol consumption varies considerably depending on the occasion, and so it is difficult to determine a "usual" amount. As well, alcohol consumption is subject to under-reporting as people usually don't keep track of the amount they drink at a time (Garriguet 2008). With respect to the amount, males also drank a greater amount of soft drink than females. Males usually thirst more and have a bigger appetite than females, which may be the best explanation for the findings.

Although, no significant difference was found for SB consumption by age group, participants older than 25yo consumed the least, compared to the other age groups. According to West et al. (2006), younger students reported significantly higher intake than older students (p=0.025). After the mid twenties, it seems as though adults monitor their diet and the calories they consume.

No significant difference in SB consumption was found for comparison of faculties (p=0.792). This finding was also similar to that of West and colleagues (2006) who found that class rank was not a significant predictor of sweetened beverage consumption. This proves that access has an integral part to play in SB consumption. Although the food court on campus is far from FFA and closer to FSS and FHE, SB consumption among FFA students and FSS students were about the same. This can be due to the access to vending machines within the vicinity of the FFA. Results for the faculties of FMS and FE were not representative of the population of the faculties as ≤ 3 participants were investigated from each faculty.

From *table 4*, it can be seen that participants usually consumed 8 ounces of SBs at a time. It can either mean that they misreported, due to the inability to estimate serving sizes or because 8 ounces are a standard serving size, and so recall bias not to seem as though they drink SBs in excess.

Home-cooked meals were the most common meal by the majority of participants to be accompanied by sweetened beverage consumption. The majority of sweetened beverage consumption was at home (West et al. 2006). This can be due to the fact that students generally eat more at home than on campus, because of their daily compact schedule, with numerous classes and group meetings and projects that they hardly find time to eat a meal on campus. As expected the least common meal which was fresh salad followed by candy. Fresh salad is categorized as a "healthy" food. Most individuals usually eat salad when they are on a fitness regime, diet or simply want to lose weight. Therefore once following a healthy eating pattern, a healthy drinking patter is adopted; and that is the consumption of water and the elimination of sweetened beverages. Candy in itself is already sweetened. Although human beings have an innate affinity for sweetness as we grow older that affinity decreases. After the consumption of something sweet, there is usually the urge to cleanse the palate and therefore, as adults candy usually won't be consumed with a sweetened beverage. Also, in the participants of this study may have not been regular consumers of candy, making it the food item least consumed with sweetened beverages. Further research is needed to investigate the reason for these findings.

The leading place of sweetened beverage (SB) purchase was the cafeteria on campus. This may be due to the fact that the majority of the sample population were enrolled in the FFA, and the closest place of purchase to that faculty is the Yvette's cafeteria. The leading place of sweetened beverage consumption however was at social gatherings. University students tend to socialize a lot and party often, especially due to the cheap cost of clubbing due to University discounts. Where there are events, there are a lot of sweetened beverages, especially alcohol and partakers (students) tend to drink a lot, justifying the reason for social gatherings being the leading place of consumption. The eating places on campus weighed in equally as the second leading place of SB purchase and consumption. Although not ranked at first, it was expected to be in the top three ranked locations since a lot of students enrolled at the UWI St. Augustine campus. Vending machines were ranked last for the location of SB purchase. Though they are located at each faculty, students may prefer to go elsewhere that has a greater variety. Also, though there aren't any long lines at vending machines, they are usually troublesome with bills

which tend to be time consuming, trying to find a bill suited for the machine. An extra cost is also added on to the beverages in the machine sometimes. All these factors may persuade students to purchase elsewhere over a vending machine.

There were no associations found between SB frequency and BMI. No significant difference was found for the BMI between males and females (P=0.847). However, more males (33.4%) were overweight compared to females (28.1%) and more males (14.7%) were obese than females (11.5%). This study is consistent with the findings of Berkey and colleagues (2004) who found no association between SBC and BMI. Therefore, maybe if the population sample had been larger as calculated to be, a significant difference in BMI between male and female may have been found. The null hypothesis is therefore was accepted.

In this study, a significant difference was deduced for the comparison of body fat % between male and female students on the UWI St. Augustine campus (p= 0.016). More females (were found to have a high body fat % compared to males. Unless athletic, females (72.1%) usually have more body fat than males (51.6%). Statistical significant difference was also found for visceral fat % between genders ($p=\leq 0.001$). Women have a higher essential body fat requirement because of gender-specific fat deposits in breast tissue and the area surrounding the uterus (Vella et al. *na*).

The majority of the participants (42.3%) were found to have a normal muscle mass percentage in this study, followed by 24.8% students who had low muscle mass, maybe due to physical inactivity. The minority of students were found to have high (15.3%) and very high (2.9%) muscle mass due to involvement in sporting activities on campus which was mentioned to the researcher during interaction.

The majority (87.6%) of participants had a normal waist circumference and there was no significant difference between WC and gender (p=0.106). This finding was in contradiction to the findings of Odegaard et al. (2012) who reported that as SB consumption increase, so did waist circumference, particularly be males.

From the findings in this study, no associations were found between SBC and BP. This finding was in accordance with Kim et al. (2012) who found that sugar consumption was not associated with the prevalence of hypertension. A significant difference between systolic BP and gender ($p\leq 0.001$) was recorded. Three times more males (51.4%) had borderline systolic BP readings than females (17%), while 5.4% males had high systolic BP readings compared to 1% female. The Physics Factbook (2007) suggests that males have higher blood pressure than females until the age of 55, where the risk of high blood pressure is the same for both sexes. After menopause, levels of estrogen are significantly lower, thereby increasing blood because high to medium testosterone levels are related to high blood pressure. There is also evidence that the systolic BP for males is different from that of females (The Physics Factbook 2007).

Some of the findings of this study were not consistent with the literature mentioned earlier, about sweetened beverage consumption and overweight and obesity. Unlike previous studies, no association was found between sweetened beverage consumption and overweight and obesity. Many of the students may have underestimated their usual serving sizes and may have also misreported how often they actually consume sweetened beverages compared to water. Had this not been the case and the sample size been much larger to allow more variety, more significant values may have been concluded as larger studies show stronger, more consistent results.

Conclusion

The main findings of this study showed that the majority (97.1%) of the sample population consumed sweetened beverages. The most common sweetened beverage was 100% fruit juice (84.3%), followed by fruit drinks (80%). Many participants agreed that 100% fruit juice and fruit drinks tastes good and is nutritive and therefore preferred it over water. However, ignorant to the fact that fruit juice and fruit drinks are loaded with natural sweeteners and artificial sweeteners respectively, which contribute to daily caloric intake and can lead to involuntary weight gain and even diabetes. However, in this study no significant association was found between sweetened beverage consumption and BMI. Males (100%) consumed a greater amount of sweetened beverages than females (96%), but not by a significant difference. A statistical significance was found specifically for soft drink ($p=0.002$), 100% fruit juice ($p=0.019$), beer/stout ($p=0.01$) and mixed alcohol ($p=0.009$) consumption, consumed more by males than females. There was no significant difference for sweetened beverage consumption between the different faculties examined ($p= 0.792$). No significant relationship was noted between body mass index and blood pressure. However a significant relationship was found between (male) gender and systolic blood pressure ($p\leq0.001$). As expected, a statistically positive association was recorded for females and visceral fat ($p\leq0.001$) and body fat percentage ($p=0.016$) due to sex-specific fat. No significance was found for sweetened beverage consumption and overweight and obesity. Therefore, sweetened beverage consumption is not associated with the development of overweight and obesity among the students of the University of the West Indies, St. Augustine campus. Based on the findings of the study, the null hypothesis was accepted.

Limitations

As compared to previous studies which consisted of a large number of participants over a long period of time to get significant results, this study consisted of too little participants over a very short period of time and so this could be a reason for the lack of significance between the hypothesized associations. Had the study been conducted with a larger population sample, a better idea of the student's sweetened beverage consumption habits would have been deduced and more significant findings recorded as a larger studies tend to produce stronger, more consistent results. This study set out mainly to find the association between sweetened beverage consumption and the development of overweight and obesity.

As stated earlier in the report, sweetened beverages contribute excess calories to the diet. Therefore estimates of the caloric intake of sweetened beverages should have been calculated to get a clearer idea of the amount of calories students really consume from sweetened beverages. The results from the caloric intake may have justified the reason for the insignificant BMI results. Although the main focus of this study was the association between sweetened beverages and overweight and obesity, there were also confounding factors in this study, such as physical activity, socioeconomic status and diet; apart from the main focus that were not taking into account. This too could have affected the results.

There is also a strong possibility of recall bias, where respondents misreported their usual intake of sweetened beverages in comparison to water. Recall bias could have also been increased as there were no visual displays of sweetened beverage serving sizes for participants to refer to, and without strong knowledge of different serving sizes they consume, chose the smallest (8oz). Overweight participants may have underreported their usual SBC. This could have led to the null findings even if an association were present (. There was also non-response bias, where some participants did not answer close-ended questions, and the population sample consisted mainly of females (73%) than male (27%) students. This could be a significant reason why no significant findings were established between sweetened beverage consumption and overweight and obesity between genders and overall.

Recommendations

In attempt to improve future studies related to this topic and avoid some of the limitations, some recommendations need to be considered. There should be healthier beverage choices on campus, especially at the fast food restaurants at the campus' food court. Water should accompany combo meals instead soft drinks. Students should have to pay extra if they want soft drink instead of water, which should only come in an 8 ounce serving size. Vending machines and cafeterias on campus should also offer healthy beverage options at a reasonable cost. With their tight, busy class schedules, students tend to eat or drink what they have close and quick access to. Therefore, once they have only healthy options, they will pay for the healthy options.

There should also be regular 'water drives" on campus, promoted in collaboration with clubs on campus, student advisory services and marketing and communications. At least a week in each month or a minimum of three days should be allotted to this where students are encouraged to drink as much water as they can in a week, to see how many bins can be filled with mainly bottled water, with an initiative behind it. Many students preferred to drink a fruit drink or fruit juice over water because to them they were the healthier option and most nutritive, unaware that both beverages contain caloric sweeteners that are just as threatening as soft drink. Therefore a mandatory nutrition course should be implemented for each degree programme, in the first year of study to ensure students have the knowledge to a healthy lifestyle to help improve their consumption choices and habits and thus improve their academic life

Limited studies have been presented in Trinidad and Tobago on this growing epidemic. Other type of studies, such as prospective, longitudinal and experimental, along with cross-sectional should be conducted to compare the findings of each and decide which is best for the topic of study. More studies should be done, under a clinical setting, over a longer data collection period, with follow up to focus on and to better understand the possible relationship between sweetened beverage consumption and its association with excess weight gain and other complications in order to find a solution to eradicate the problem.

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Appendix