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The Acute Effects of Artificially-Sweetened Beverages on Cardiovascular Health

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The Acute Effects of Artificially-Sweetened Beverages on Cardiovascular Health

by

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Abstract

Consuming artificially-sweetened beverages instead of sugar-sweetened beverages is becoming increasingly popular among those who want to lose weight, have medical conditions that prohibit intake of sugar, or want to improve overall health. However, little research has been conducted on the repercussions of the intake of these diet drinks, specifically on how they affect the cardiovascular system. The purpose of this study was to examine the acute effects of artificially-sweetened beverages on cardiovascular health. Eight participants with no pre-existing heart conditions underwent two separate appointments, one where they consumed a 12 oz. water and one where they consumed a 12 oz. diet cola. Pulse wave analysis (PWA), including systolic blood pressure, diastolic blood pressure, mean arterial pressure, and heart rate; and pulse wave velocity (PWV), which measures arterial stiffness, were examined at baseline, 30, 60, 90, and 120 minutes post water and diet cola consumption. No significant changes to PWA or PWV measurements were observed for either beverage. This analysis demonstrates that artificially-sweetened beverages have no acute effects on cardiovascular health, in regards to PWA and PWV. More studies are needed to fully examine the risks of diet drinks on heart health.

Keywords: artificial sweeteners, cardiovascular disease, pulse wave analysis, pulse wave velocity, diet cola, arterial stiffness

Dedication

To my parents, Voloria and Philip Mulligan, for always pushing me to be the best student and person that I can be.

To Amy Miller, for mentoring me throughout my entire life and dedicating your time to my success as a student.

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List of Abbreviations

BMI	Body Mass Index
CDC	Center for Disease Control
CVD	Cardiovascular Disease
DBP	Diastolic Blood Pressure
FDA	Food and Drug Administration
FMD	Flow-Mediated Dilation
HR	Heart Rate
MAP	Mean Arterial Pressure
PWA	Pulse Wave Analysis
PWV	Pulse Wave Velocity
SBP	Systolic Blood Pressure
SSN	Suprasternal Notch

Chapter 1: Introduction

The use of artificial sweeteners, or nonnutritive sweeteners, as a substitute for sugar (sucrose) has become a global phenomenon due to their sweet taste and lack of calories. Commonly found in diet soft drinks, artificial sweeteners are advertised to promote weight loss as well as an alternative to those who cannot have sugar, such as individuals with diabetes mellitus. Aspartame, the artificial sweetener in Diet Coke, has very few calories while imitating the taste of sugar (Tandel, 2011). Most other nonnutritive sweeteners have zero calories and are believed to be healthier than regular soft drinks. However, as more research is conducted, the negative effects of artificial sweeteners are being exposed. Increased intake of artificial sweeteners is associated with obesity, hypertension, metabolic syndrome, type 2 diabetes, stroke and cardiovascular disease events (Azad et. al, 2017). All of which are risk factors for the development of cardiovascular disease (CVD), which affects more than 28.1 million people in the United States (CDC 2017).

The purpose of this thesis project was to determine the acute effect of consuming an artificially sweetened beverage (diet cola) on cardiovascular health. The effects of sugar and high fructose corn syrup on cardiovascular health have been heavily researched and are known to have negative effects on heart health. According to Stanhope, extensive epidemiological research has shown that consumption of added sugars or sugar-sweetened beverages can lead to cardiovascular disease, metabolic syndrome, and type 2 diabetes (2016). Consequently, artificial sweeteners were produced to lessen some of the ramifications that come with consuming added sugars, which theoretically would decrease the prevalence of cardiovascular disease risk factors. However, recent studies

have shown a correlation between artificial sweeteners and cardiovascular disease (Gardener et al., 2012; Vyas et al., 2014). While there is supporting evidence of this claim, no current research has examined the mechanisms by which artificial sweeteners cause this increased risk for CVD. This study will evaluate those mechanisms by determining how the arteries respond to caffeine-free Diet Coke when compared to how they respond to water. We will specifically assess arterial stiffness, which determines how well the arteries compress and contract due to pressure of blood from the heart (Stoner et al., 2015). Previous research has shown that determining one's arterial stiffness can be an indicator of the presence of CVD; high stiffness can cause higher blood pressures, resulting in possible growth of the muscles of the left ventricle and myocardial ischemia (Zhang et al., 2018). This study focuses on the way that artificial sweeteners affect the cardiovascular system, by investigating how the arteries respond to short-term exposure to artificial sweeteners.

Chapter 2: Literature Review

Cardiovascular Disease

Cardiovascular disease (CVD) is the leading cause of death in the United States and in the world, contributing to approximately 2,220 deaths every day (Mainous III et al. 2018). Although the mortality rate has slowly decreased in the U.S., approximately 635,260 deaths were attributed to CVD and 28.1 million individuals were diagnosed with CVD in 2016 (CDC 2017). According to Mainous III and colleagues (2018), a considerable amount of adults in the United States are at risk for CVD, especially individuals who are African American or Hispanic. In addition to the extensive number of individuals that are affected, heart disease contributes approximately $200 billion dollars to our health care system each year from cost of health care services, medications, and lost productivity. (DHDSP|CDC, 2017). While efforts are constantly being made to educate people about the dangers and prevalence of CVD, more strategies to reduce the mortality rate and costs of heart disease are necessary.

CVD consists of a large group of diseases that affect the heart, as well as central and peripheral blood vessels. Examples of CVD include coronary heart disease, stroke, myocardial infarction, hypertension, and peripheral artery disease (Zeb et al. 2016). Risk factors that lead to the development of CVD include hypertension, obesity, diabetes mellitus (Type I and Type II), smoking, age, hyperlipidemia, and race (Zeb et al. 2016 & Mainous III, 2018). Some of these risk factors, including type 1 diabetes, family history, age and race, cannot be prevented or modified. However, risk factors such as obesity, type 2 diabetes, hypertension, and physical inactivity are heavily dependent upon the lifestyle choices of an individual. Specifically, obesity and type 2 diabetes have been

linked to a high intake of added sugars in the diet, such as those in sodas, energy drinks, candies, and some desserts (Bach 2018). According to McEwen and colleagues (2018), the diets of many Americans consist of high amounts of sugars and soft drinks, which have extremely negative effects on heart health. In response, artificial sweeteners were developed.

Artificial Sweeteners

In recent decades, people have made greater efforts to live healthier lifestyles and lower their caloric and sugar intake. In attempts to decrease the amount of sugars in diets, the use of artificial sweeteners has become increasingly popular (McEwen 2018). An estimated 30% of people in the U.S. consume artificial sweeteners daily, and this rate continues to rise (Azad et al. 2017). In the U.S., six artificial sweeteners can be legally produced and consumed: acesulfame-K, aspartame, neotame, saccharin, sucralose, and advantame (Lohner et al., 2017). Each of these is used as substitutes for sugar, although they each have different mechanisms of absorption, metabolic processes, and excretion (Magnuson et al. 2016). They also are all hundreds of times sweeter than sugar, which allows them to be added to substances in very small amounts while still obtaining the sweetness of sugar (Magnuson et al. 2016). Of the six approved artificial sweeteners, saccharin was the first to be produced in 1878 and is 300-500 times sweeter than sucrose (Magnuson et al. 2016). According to Tandel (2011), it is used in foods, drinks, and toothpastes to enhance their sweetness. Acesulfame Potassium, or Acesulfame-K, was synthesized in 1967 and is about 200 times sweeter than sucrose (Magnuson et al. 2016). Acesulfame-K is commonly found in soft drinks, gelatins, chewing gum, frozen desserts, candies, and pharmaceutical products and can be used for baking due to its stability in

extreme temperatures (Yadav et al., 2014). Aspartame is a popular artificial sweetener created in 1965 (Tandel 2011) that is found in over 6000 products, including diet beverages, and is reported to be 180-200 times sweeter than pure sugar (Choudhary & Lee, 2018). Aspartame is a key ingredient in Diet Coke, contributing to its appealing zero calorie content unlike regular Coca-Cola. Neotame is a less popular sweetener, but it has zero calories and is approximately 8,000 times sweeter than sugar (Tandel 2011). Neotame is commonly used in drinks, canned goods, low carb breads, tea mixes, stored juices, candies (Yadev et al., 2014). Sucralose, the only non-caloric sweetener that is developed from sucrose, was created in 1976 and is 600 times sweeter than sugar (Tandel 2011). It is used in over 4,000 foods and is the most versatile considering its stability in extreme temperatures (Tandel 2011). Sucralose is commonly used in Fruit drinks, canned fruit, syrups, baked products (Yadev et al., 2014). Lastly, advantame was recently approved by FDA in 2014 and is about 20,000 sweeter than sucrose (FDA 2018). It is currently used to enhance sweet flavors and as a general sweetener (FDA 2018). Extensive testing on each artificial sweetener was conducted on both animals and humans in order to make sure they were safe for consumption.

Artificial sweeteners were originally created to replace added sugars in foods and beverages, in order to provide a sweet taste to those who cannot consume normal amounts of sucrose (Magnuson 2016). These now appeal to the general public because of their low or no calorie content and reduced energy intake. Previous studies have shown that those who consumed food and beverages containing sucrose and high fructose corn syrup gained more weight than those who consumed food and beverages containing nonnutritive sweeteners (Stanhope 2015). Other benefits are that they can be consumed

by those with diabetes without substantially altering blood glucose levels, are healthier for teeth, and are less costly (Tandel 2011). However, newer studies have shown that artificial sweeteners have adverse affects and can lead to CVD. According to Vyas et al. in a study of approximately 60,000 women, the women who consumed 2 or more diet drinks per day reported higher rates of diabetes mellitus and hypertension, had greater body mass indexes, increased energy intake, and included more smokers–all of which lead to CVD (2014). Some of the mechanisms that may contribute to the negative effects of artificial sweeteners include their interference with the normal response of the body to glucose and energy, as well as their interference with the healthy bacteria in the digestive system (Pepino, 2015). The purpose of this study was to explore how an artificial sweetened beverage, Diet Coke, can affect the heart and blood vessels by measuring arterial stiffness of the body after consuming the diet soda.

Chapter 3: Methodology

Participants

This study consisted of eight volunteer subjects, ranging from ages 18-39. The volunteers were required to be healthy, have no pre-existing cardiometabolic conditions (heart disease, diabetes, hypertension, etc.) and were instructed to fast for 24 hours before their scheduled appointment. Before the subjects participated in the testing, they completed an informed consent, a demographics questionnaire, the Godin Leisure-Time Exercise Questionnaire, a medical health history form, and a soft drink questionnaire. The soft drink questionnaire asked participants about how often they consume regular soft drinks, diet soft drinks, and artificial sweeteners. Additionally, it inquired how often they look at a soft drink's ingredient list, how familiar they are with health concerns regarding regular soft drinks, and if they think that diet soft drinks are healthier than regular soft drinks (see Appendix). This study required two separate visits, three hours each, in which they were randomly assigned to either consume a 12 oz caffeine free diet cola or a 12 oz bottle of water. After the subjects completed both of their visits, they were compensated by a choice of a $50 gift card to either Wal-Mart or Target. The testing took place at the University of Southern Mississippi's School of Kinesiology and Nutrition. Our team received approval to work with human subjects from the Institutional Review Board at the University of Southern Mississippi.

Experimental Methods

Our research team consisted of Dr. Stephanie McCoy, graduate assistant Raymond Jones, and myself. After completion of all required forms and questionnaires, our team collected the participant's height, weight, date of birth, and age. The subject was

then instructed to lie flat in supine position on an adjustable examination table. We then instrumented the participants: SphygmaCor Cuffs on the arm and thigh (for blood pressure and pulse wave velocity measurements), and then measured the distance from the carotid artery to the suprasternal notch (SSN), the dip at the base of the neck and above the sternum, as well as the SSN to the cuff on the thigh to prepare for the pulse wave velocity measurements. Since our testing required the participant to be rested, we waited 15 minutes before completing our baseline measurements. Our baseline measurements included pulse wave analysis (central and brachial blood pressure) and pulse wave velocity. After completing the baseline measures, the examination table was raised so that the participant was in a semi-recumbent position. They then had five minutes to drink either a 12 oz. diet cola or bottle of water. After they finished consuming their assigned beverage, they were laid back down to their starting position. Pulse wave analysis and pulse wave velocity were then measured at 30, 60, 90, and 120 minutes post beverage consumption. Each participant visit was identical except for the beverage the participant consumed.

Pulse Wave Analysis (PWA)

Pulse wave analysis determines measurements that can identify the condition of one's cardiovascular health. PWA not only measures peripheral systolic and diastolic pressures via the brachial artery, but also measures central aortic pressures. Central blood pressure is a better indicator for cardiovascular events (myocardial infarction, etc.) as that it accounts for the true exertion among other organs such as the heart, brain, and kidneys (Debowska et al., 2018). According to Debowska and colleagues (2018), measuring PWA can estimate the efficiency of myocardial blood

flow (Debowska et al., 2018). Examining these functions of the heart after diet cola consumption compared to water consumption will show how the acute effects on central hemodynamics in the presence of an artificial sweetener.

Pulse Wave Velocity (PWV)

Pulse wave velocity is considered the 'gold-standard' for measuring arterial stiffness (Debowska et al., 2018). PWV determines how fast an arterial waveform travels from one artery to another (Stoner et al., 2015). A tonometric device (measures pitch of a sound; in this case, the pulse) was used to measure the speed of an arterial waveform from the carotid artery to the femoral artery. The difference between the pulse wave velocity post water consumption and post diet cola consumption was evaluated to determine the acute effects on the velocity of blood flow through the body in the presence of an artificial sweetener.

Data Analysis

All laboratory information was de-identified (participants received a unique study ID to preserve confidentiality). All data was collected and tracked using Microsoft Excel spreadsheets compiled from software in the lab as well as paper questionnaires.

Statistical Analysis

To examine the acute impact of artificial sweetener on cardiovascular health (dependent variables PWA and PWV), and two-way repeated measures analysis of variance was performed. Normality of data was evaluated using a Shapiro-Wilk test and in the event of non-normal data distribution, and non-parametric analysis of variance was used. All statistical analyses were performed using STATA (Version 15.1) statistical

software. All data are presented as either proportions or mean ± standard error, and statistical significance was set at $p<0.05$.

Chapter 4: Results

Description of demographics

Table 1 presents the characteristics of demographics among the subjects. The average age of participants was 21.6 ± 3.1 years old. Out of the eight participants, 62.5% were male. The average height and weight were 1.7 ± 0.1 m and 72.8 ± 12.5 kg, respectively. The average BMI was 24.7 ± 2.8 kg/ m^2. Regarding race, 62.5% of subjects were White non-Hispanic. Most of the participants had an associate degree or some college (50%), followed by college graduates (37.5%), and high school graduates (12.5%).

Table 1. Demographic Characteristics

Variable	Participants (n=8)
Age, years: M ± SD	21.6 ± 3.1
Sex, male (%)	62.5
Height, meters ± SD	1.7 ± 0.1
Weight, kg ± SD	72.8 ± 12.5
BMI, kg/m^2 ± SD	24.7 ± 2.8
Race, White non-Hispanic (%)	62.5
Highest education (%)	
High school graduate or G.E.D.	12.5
Some college or Associate degree	50.0
College graduate or Baccalaureate degree	37.5

Note. M=means, SD=standard deviation

Description of soft drink consumption

Table 2 presents the characteristics of soft drink consumption among the participants. Most of the participants consumed regular soft drinks once a month (50%), followed by daily (12.5%), and multiple times a week (12.5%). None of the participants reported consuming regular soft drinks once a week. However, 25% of participants expressed that they never drink regular soft drinks. In regard to diet soft drink consumption, participants consumed either none at all (50%), one drink a month (37.5%), or a few drinks a week (12.5%). None of the participants consume diet soft drinks daily or once a week. Concerning artificial-sweetener consumption, participants either consumed them never (62.5), a few times a week (25%), or daily (12.5%). Majority of the participants read the ingredients labels on soft drinks (75%) and know the health concerns related to soft drink consumption (87.5%). Few of the participants believe that diet soft drinks are healthier than regular soft drinks (25%).

Table 2. Soft Drink Consumption

Variable	Participants (n=8)
Regular (non-diet) soft drink consumption (%)	
Daily	12.5
Few times a week	12.5
Once a week	0.0
Once a month	50.0
Never	25.0
Diet soft drink consumption (%)	
Daily	0.0
Few times a week	12.5
Once a week	0.0
Once a month	37.5
Never	50.0
Artificial sweetener consumption (%)	
Daily	12.5
Few times a week	25.0
Once a week	0.0
Once a month	0.0
Never	62.5
Reading Ingredient list: yes (%)	75.0

Familiar with health concerns of soft drink consumption: yes (%)	87.5
Diet soft drinks are healthier than regular soft drinks: yes (%)	25.0

Pulse wave velocity

The results from the PWV analysis post water consumption are shown in Table 3. After water consumption, there was no significant increase or decrease in pulse wave velocity. PWV at baseline was 4.7 ± 0.9, increased slightly at 30 minutes (5.0 ± 1.0), decreased slightly at 60 minutes (4.5 ± 0.8) and then returned to baseline at 90 minutes (4.7 ± 0.9) and 120 minutes (4.7 ± 0.8). A graph showing the changes in PWV over the 120 minutes post water consumption is shown in Figure 1. The results from the PWV analysis post diet cola consumption are shown in Table 4. No significant changes to PWV were observed post diet cola consumption (p>0.05). PWV at baseline was 4.8 ± 0.8, stayed constant at 30 minutes (4.8 ± 0.9), decreased slightly at 60 minutes (4.7 ± 0.8), increased slightly at 90 minutes (4.9 ± 0.9) and then increased again at 120 minutes (4.7 ± 0.8). A graph showing the changes in PWV over the 120 post diet cola consumption can be observed in Figure 2.

Table 3. Hemodynamic Response (Water Consumption)

		Post Beverage Consumption			
	Baseline	**30 mins**	**60 mins**	**90 mins**	**120 mins**
SBP (mmHg)	121.6 ± 14.8	118.9 ± 13.8	120 ± 11.0	118.0 ± 10.8	119.1 ± 13.3
DBP (mmHg)	68.6 ± 5.3	69.4 ± 6.9	68.1 ± 4.4	71.6 ± 4.9	70 ± 6.5
MAP (mmHg)	86.3 ± 7.7	85.9 ± 8.5	85.4 ± 5.8	87.1 ± 6.6	86 ± 8.5
HR (bpm)	55 ± 7.5	52.3 ± 8.7	53.9 ± 6.6	53.3 ± 8.5	55.9 ± 5.5
PWV (m/s)	4.7 ± 0.9	5.0 ± 1.0	4.5 ± 0.8	4.7 ± 0.9	4.7 ± 0.8

Note. All variables presented as mean ± standard deviation.

Figure 1. Pulse Wave Velocity Following Water Consumption

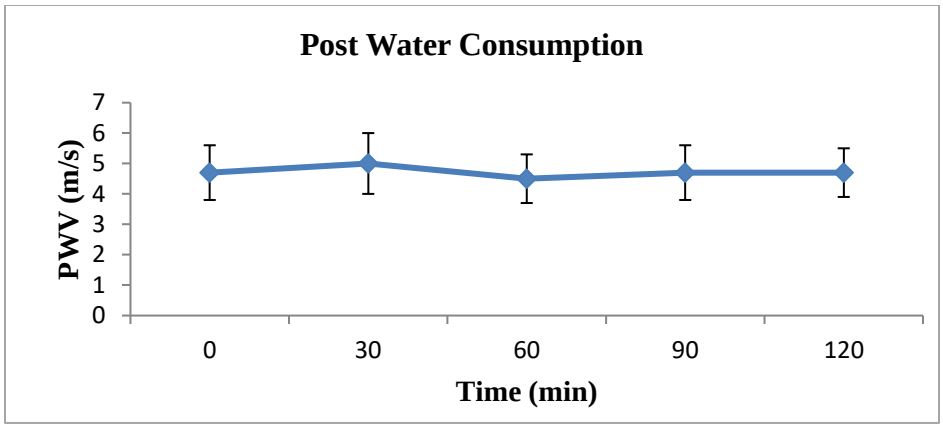
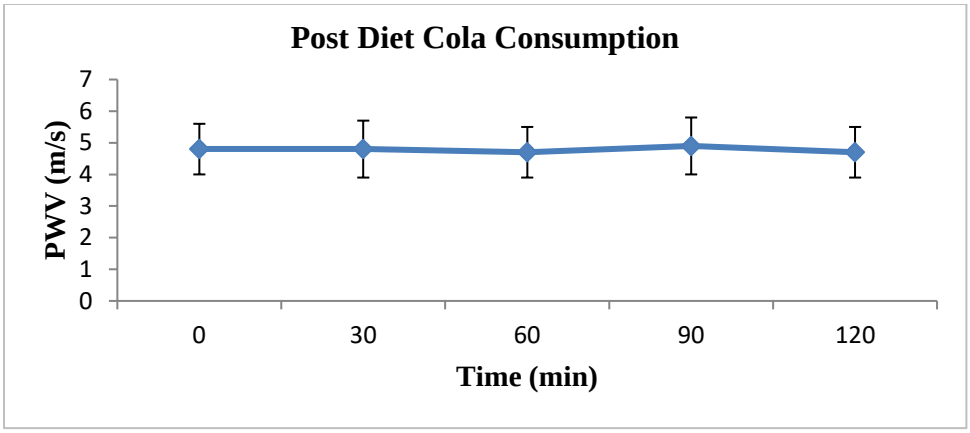


Table 4. Hemodynamic Response (Diet Cola Consumption)

		Post Beverage Consumption			
	Baseline	**30 mins**	**60 mins**	**90 mins**	**120 mins**
SBP (mmHg)	121.5 ± 10.5	119.5 ± 9.0	122.3 ± 8.7	120.6 ± 9.4	118.1 ± 10.0
DBP (mmHg)	67.9 ± 5.6	70.8 ± 8.7	67.25 ± 8.4	70.3 ± 5.9	71.3 ± 8.0
MAP (mmHg)	85.8 ± 6.9	87 ± 8.0	85.6 ± 7.7	87.0 ± 6.6	86.9 ± 7.8
HR (bpm)	54.8 ± 8.7	54.3 ± 7.1	54.1 ± 5.7	57.5 ± 10.2	55.6 ± 8.2
PWV (m/s)	4.8 ± 0.8	4.8 ± 0.9	4.7 ± 0.8	4.9 ± 0.9	4.7 ± 0.8

Note. All variables presented as mean ± standard deviation.

Figure 2. Pulse Wave Velocity Following Diet Cola Consumption



Chapter 5: Discussion

The purpose of this study was to determine the acute effect of consuming an artificially sweetened beverage (diet cola) on cardiovascular health. We found that there was no significant difference between PWV post water consumption and PWV post diet cola consumption. According to Stoner and colleagues, a PWV increase of one m/s would increase the risk of future cardiovascular events by 14%, cardiovascular mortality by 15%, and all-cause mortality by 15% (Stoner et al., 2015). Our results did not show an average increase higher than 0.3m/s over the 120 minutes. There were also no changes in systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate. All of the participants had optimal measurements of those variables. The consistency in the measurements over 120 minutes conveys that the consumption of a single diet cola has no effects on cardiovascular health. This study additionally calculated flow mediated dilation (FMD) tests every 30, 60, 90, and 120 minutes; however, the results of this examination was not included in this thesis. According to Stoner and colleagues, an FMD test expresses the percentage of arterial dilation, which would determine how the shape of the arteries are affected (Stoner et al., 2015). Evaluating the results of the FMD test could

possibly be a better indicator of how the cardiovascular system is acutely affected by diet cola. A study conducted by Vyas and colleagues analyzed the relationship between diet drink intake and CVD outcomes such as coronary heart disease, heart failure, myocardial infarction, coronary revascularization procedure, ischemic stroke, peripheral arterial disease and CVD death (Vyas et al., 2014). They surveyed approximately 60,000 post-menopausal women and found that women who consumed the most diet drinks had a significantly higher risk for CVD events and overall mortality. This may suggest that long term use of diet drinks can have more of an effect on CVD health than short term use. However, the study did not explain why the diet drinks have those effects. In addition, a study by Gardener and colleagues examined 2,564 participants from the Northern Manhattan Study, which was composed to evaluate prognosis, risk factors, and stroke incidences in a diverse population (Gardener et al., 2012). Through surveys evaluating soft drink and diet soft drink consumption, in person interviews, and physician examinations determining previous cardiovascular events, the study sought to determine the association between regular and diet soft drinks with vascular events. They determined that those who reported diet soft drink consumption had a 43% increased risk of vascular events such as diabetes, peripheral vascular disease, metabolic syndrome, hypertension, and previous cardiac disease. The results of this study could be due to the fact that those with risks of CVD drink diet drinks more often, in order to avoid the negative effects of sugar sweetened beverages on cardiovascular health.

Limitations

This study did not address how the demographics, previous regular and diet soft drink consumption, or physical activity levels affect the cardiovascular health of the

participants. Evaluating and comparing these variables between participants and their cardiovascular health would show which groups are more at risk for CVD. Additionally, our sample size included eight participants, five being male and three being female. A larger sample size would have provided more accurate results and could show a wider variety of outcomes. Also, the participants were mostly male, and this could have an effect on the results considering that gender is a risk factor for CVD. Future studies should compare PWA, PWV, and FMD between those who do not ever consume diet drinks with those who often consume diet drinks. This would provide researchers with the mechanisms by which the amount of diet soda consumption can affect cardiovascular functioning and show the long term effects of drinking diet soda.

Chapter 6: Conclusion

The present study found that there were no acute affects of artificially-sweetened beverages on cardiovascular health. Participants showed no difference in PWA or PWV after water consumption and diet cola consumption. Further research is needed to determine why there are associations between diet drink usage and cardiovascular events in order to decrease the prevalence of CVD. Future studies should evaluate the affects of long term artificially-sweetened beverage consumption on cardiovascular health.

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Appendix A

Medical History Form

All of the information provided in this form is voluntary.

Date: | Biographical information:

Last Name | First | MI

Occupation: | Email:

Home Phone( ) | Work ( ) | Cell/Pager ( )

Address:

DOB: / / | Age: | Gender M / F | Height: | Weight:

Highest Education Achieved:

Race: What race do you consider yourself to be? Select one or more of the following:

- ☐ ***Hispanic or Latino*** - A person of Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race. The term "Spanish origin," can be used in addition to "Hispanic or Latino."
- ☐ **American Indian or Alaska Native.** A person having origins in any of the original peoples of North, South, or Central America, and who maintains a tribal affiliation or community attachment.
- ☐ **Asian.** A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent, including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam. (Note: Individuals from the Philippine Islands have been recorded as Pacific Islanders in the previous data collection strategies.)
- ☐ **Black or African American.** A person having either origins in any of the black racial groups of Africa. Terms such as "Haitian" or "Negro" can be used in addition to "Black" or "African American."
- ☐ **Native Hawaiian or Pacific Islander.** A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific islands.
- ☐ **White.** A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

Primary Care Physician:

Name: | Office Phone:

Address:

Emergency Contact:

Name: | Relationship: | Phone #

Medications: include over the counter drugs/oral contraceptives/dietary supplements

Name/Dosage/How often taken:

Allergies:

Smoking History:

Do you smoke | Cigarettes? Pipe/ Cigar? Other? If you quit, what year did you quit _____

# of packs smoked per day _____ For how many years _____

Medical History Form Page 2

Alcohol Consumption History:

Do you currently drink alcohol?	If you drank alcohol previously , when did you stop?
If you ever did drink alcohol, what is (was) the volume consumed? _____ # ounces / day for _____ # of years	

Exercise History:

Do you currently exercise aerobically?	How many years?	Duration:
	Types of Exercise:	Frequency:
Do you compete in endurance events?	How many years?	Frequency:
	What events?	
If you are currently sedentary, when did you last exercise?	How many years?	Duration:
	Types of Exercise:	Frequency:

Medical History:

NO	YES	Please explain any "YES" answers
		high blood pressure
		chest pain / history of heart attack
		extra heart beats or racing
		abnormal electrocardiogram (ECG)
		other heart trouble (eg murmur, valve problems)
		high cholesterol
		diabetes
		seizures
		stroke
		fainting spells
		anxiety (diagnosed)
		depression (diagnosed)
		recurrent fatigue
		insomnia
		thyroid problems
		difficulty breathing
		emphysema/ asthma/ chronic bronchitis
		tuberculosis
		chronic infection
		stomach/GI problems
		hepatitis
		bleeding disorder
		kidney/ urinary problems
		joint injuries/ joint pain
		arthritis (rheumatoid or osteoarthritis)
		migraine headaches
		vision problems (exclude corrected near/far sightedness)
		surgical procedures

Please sign and date.

Signature: _____ **Date:** _____

Appendix B

Godin Leisure-Time Exercise Questionnaire

INSTRUCTIONS

In this excerpt from the Godin Leisure-Time Exercise Questionnaire, the individual is asked to complete a self-explanatory, brief four-item query of usual leisure-time exercise habits.

CALCULATIONS

For the first question, weekly frequencies of strenuous, moderate, and light activities are multiplied by nine, five, and three, respectively. Total weekly leisure activity is calculated in arbitrary units by summing the products of the separate components, as shown in the following formula:

Weekly leisure activity score = (9 × Strenuous) + (5 × Moderate) + (3 × Light)

The second question is used to calculate the frequency of weekly leisure-time activities pursued "long enough to work up a sweat" (see questionnaire).

EXAMPLE

Strenuous = 3 times/wk

Moderate = 6 times/wk

Light = 14 times/wk

Total leisure activity score = (9 × 3) + (5 × 6) + (3 × 14) = 27 + 30 + 42 = 99

Godin, G., Shephard, R. J.. (1997) Godin Leisure-Time Exercise Questionnaire. Medicine and Science in Sports and Exercise. 29 June Supplement: S36-S38.

Godin Leisure-Time Exercise Questionnaire

1. During a typical **7-Day period** (a week), how many times on the average do you do the following kinds of exercise for **more than 15 minutes** during your free time (write on each line the appropriate number).

	Times Per Week
a) **STRENUOUS EXERCISE** **(HEART BEATS RAPIDLY)** (e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)	_____
b) **MODERATE EXERCISE** **(NOT EXHAUSTING)** (e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)	_____
c) **MILD EXERCISE** **(MINIMAL EFFORT)** (e.g., yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking)	_____

2. During a typical **7-Day period** (a week), in your leisure time, how often do you engage in any regular activity **long enough to work up a sweat** (heart beats rapidly)?

OFTEN	SOMETIMES	NEVER/RARELY
1. ☐	2. ☐	3. ☐

Appendix C

Soft Drink Questionnaire

1. **How often do you consume regular (non-diet) soft drinks?**

: Daily
: Few times a week
: Once a week
: Once a month
: Never

2. **How often do you consume diet soft drinks?**

: Daily
: Few times a week
: Once a week
: Once a month
: Never

3. **How often do you consume artificial sweeteners (Splenda, Sweet-n-Low, Zero-Calorie Drinks)?**

: Daily
: Few times a week
: Once a week
: Once a month
: Never

4. **Do you ever read the ingredient list on the back of the soft drink?**

: Yes
: No

5. **Are you familiar with the health concerns of consuming too much soft drinks?**

: Yes
: No

6. **Do you think so called diet soft drinks are healthier than the non-diet soft drinks?**

: Yes
: No

7. **Why do you consume diet soft drinks?**

_____

_____

Appendix D

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 18061201
PROJECT TITLE: Acute Impact of Artificial Sweetner on Vascular Endothelial Health
PROJECT TYPE: New Project
RESEARCHER(S): Stephanie McCoy, Ph.D.
COLLEGE/DIVISION: College of Health
DEPARTMENT: Kinesiology
FUNDING AGENCY/SPONSOR: Aubrey Keith Lucas & Ella Ginn Lucas Endowment for Faculty Excellence
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 06/20/2018 to 06/19/2019
Edward L. Goshorn, Ph.D.
Institutional Review Board