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Added Sugar Consumption Among College Students

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ADDED SUGAR CONSUMPTION AMONG COLLEGE STUDENTS

by

MARAM MURAD

A THESIS

Presented to the Faculty of the University of the Incarnate Word
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Maram Murad

DEDICATION

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ADDED SUGAR CONSUMPTION AMONG COLLEGE STUDENTS

Maram Murad, MS

University of the Incarnate Word, 2017

Added sugar consumption has been increasing in all age groups in the United States and worldwide, with the greatest increase in young adults. College-age years are a critical period in the young adult's life where many habits develop, including nutrition and food choices. An understanding of college-age students' attitudes and behaviors toward added sugar consumption might help predict added sugar consumption within this population. This was a quantitative study of traditional-aged college students' added sugar consumption through a convenience sample at a private university in San Antonio, TX. A survey was administered to undergraduate students at different classes. Subjects were 18 to 24 years old, 72% females and 27.7% males. Results indicated that most participating students consumed one sugar-sweetened beverage daily or at least several times per week. Moreover, most participating students rarely/never chose a product based on the type of sweetener used. Only 11% of participating students mentioned that they tried to limit and avoid added sugars, however, 61% of those considered limiting sugar-sweetened beverages to help maintain a healthy weight. Furthermore, 56.5% of participating student declared that they were not aware of the American Heart Association (AHA) added sugar recommendations. Over half, 54.4%, of participating student reported that they were not aware of the 2015-2020 Dietary Guidelines for Americans. Similarly, 58.3% declared that they were not aware of the WHO added sugar limit recommendations and the associated health benefits. In conclusion, many students were not aware of their added sugar intake, and only a small percentage were aware of the added sugar limit recommendations. Variables that influence excess sugar consumption include taste preference, stress, and cost. Most of the students who consider the sugar content of the foods and beverages they buy do so to help maintain a healthy weight.

TABLE OF CONTENTS

Chapter	Page
INTRODUCTION	1
Health Concerns Related to Excess Added Sugar Consumption	1
The World Health Organization Recommendations on Added Sugar	1
The American Heart Association Recommendations on Added Sugar.....	1
The 2015-2020 Dietary Guidelines on Added Sugar	2
The Food and Drug Administration Proposal on Added Sugars	2
The Major Sources of Added Sugars.....	2
Hidden Sugars in Food	2
LITERATURE REVIEW	6
A Worldwide Call to Reduce Added Sugar Consumption	6
Excess Added Sugar Consumption and Health Concerns	9
Attitudes and Behaviors toward Added Sugar Consumption	16
The purpose of the study	18
METHODOLOGY	19
Subjects.....	19
Data Collection	19
Statistical Analyses.....	20
RESULTS	21
Participant Characteristics	21

Table of Contents--Continued

Sugar-Sweetened Beverage Consumption.....	23
Added Sugar Names on Food and Beverages Labels.....	24
Determining General Knowledge about Added Sugar.....	24
DISCUSSION.....	27
Attitudes and Behaviors of College-aged Student Diets.....	27
Lack of Awareness about Added Sugar Consumption.....	27
Exceeding Added Sugar Recommended Limit.....	28
Factors Influencing Added Sugar Consumption.....	28
Lack of Awareness about Added Sugar Recommendations.....	29
Low Use of Non-nutritive Sweeteners.....	30
Limitations to Study.....	31
Future Research Recommendations.....	33
CONCLUSION.....	33
REFERENCES.....	36
APPENDIX.....	46

LIST OF TABLES

Table	Page
1. Calorie Intake From Total Sugar-Sweetened Beverages among Young Adults from 1999–2000 to 2007–2008.	2
2. Different Names of Added Sugar	3
3. Participant Characteristics	24
4. Non-nutritive Sweeteners Examples	30

LIST OF FIGURES

Figure	Page
1. WHO Current and Proposed Recommendations	15
2. Food Category Sources of Added Sugar in U.S. Population (2016)	15
3. Participating Students' Extent of Limiting Added Sugar	25
4. Participating Students' Knowledge About the American Heart Association Added (AHA) Sugar Recommended Limit	25
5. Participating Students' Knowledge About the 2015-2020 Dietary Guidelines Added Sugar Recommended Limit	26
6. Participating Students' Knowledge about the World Health Organization (WHO) Observed Benefits of Reducing Added Sugar	26

INTRODUCTION

There are two types of sugar found in food, naturally occurring sugars and added sugars. Naturally occurring sugars are those found in fruit, vegetables, and milk products. Added sugars, on the other hand, include syrups and all caloric sweeteners that are added to food and beverages. Many health concerns are related to excess added sugar consumption. Among these health concerns are higher risk of obesity¹⁻⁶, cardiovascular disease^{1,2,3}, type 2 diabetes mellitus^{11,12,13}, fructose and nonalcoholic fatty liver^{14,15,16}, and cancer occurrence in the colon^{17,18}, pancreas¹⁹⁻²³, breast^{24,25,26} and ovarian.^{27, 28} Unfortunately, soda is the most heavily consumed sugar-sweetened beverages in all age groups, and the consumption of sport/energy drinks rose in young adults specifically from 1999-2000 to 2007-2008 (see Table 1).²⁹

In response to this issue, in March 2015, the World Health Organization (WHO) called for decreasing added sugar consumption to less than 10% of daily caloric intake, mentioning that further reduction to less than 5% of daily caloric intake would provide additional health benefits. The health benefits include decreasing the prevalence of overweight, obesity and tooth decay³⁰. Furthermore, the American Heart Association (AHA) recommends a 5% daily caloric intake sugar limit. Specifically, women and men should limit their added sugar consumption to no more than 100 calories (25g or approximately six teaspoons) and 150 calories (37.5g or approximately nine teaspoons) respectively.⁸ The 2015-2020 Dietary Guidelines for Americans emphasize shifting to healthier food and beverage choices. For the first time, the guidelines set a limit of added sugar consumption, which is less than 10% of daily calorie intake.³¹ To raise consumer awareness, in July 2015, the Food and Drug Administration (FDA) proposed adding the percent daily values (%DV) for added sugars to the Nutrition Facts label. The %DV would be based on the recommendation that added sugars not exceed 10% of the total daily caloric intake.³²

Beginning July 2018, it will be required by the FDA to show added sugar in grams on food labels.³³

Moreover, added sugars account for almost 270 calories or more than 13% of calories per day in the typical American diet.³² The major source of added sugars is sugar-sweetened beverages, which include soft drinks, fruit drinks, sweetened coffee and tea, energy/sports drinks, and alcoholic beverages.³² Sugar-sweetened beverages account for almost half of all added sugars consumed by Americans.³² Some data suggest that the consumption of total sugar-sweetened beverages is declining. However, current consumption levels among all age groups remain higher than recommended by health experts.^{30,31,32} Furthermore, added sugar can be hidden in food products under different names. Examples of added sugars that can be listed as an ingredient are found in table 2.

Table 1.

Calorie Intake From Total Sugar-Sweetened Beverages Among Young Adults from 1999–2000 to 2007–2008

	Total Sugar-Sweetened Beverages	Regular Soda	Fruit Drinks	Sport/ Energy Drinks
	kcal/day	kcal/day	kcal/day	kcal/day
1999–2000	421	374	279	119
2001–2002	389	322	309	176
2003–2004	391	342	285	223
2005–2006	333	278	265	158
2007–2008	338	295	231	229

Han E., Powell L. M. Consumption patterns of sugar-sweetened beverages in the United States. *JAND*. 2013;113(1),43-53.

Table 2.*Different names of added sugar*

Names for added sugars on food labels
anhydrous dextrose
brown sugar
confectioner's powdered sugar
corn syrup
corn syrup solids
dextrose
fructose
high-fructose corn syrup (HFCS)
honey
invert sugar
lactose
malt syrup
maltose
maple syrup
molasses
nectars (e.g., peach nectar, pear nectar)
pancake syrup
raw sugar
sucrose
sugar
white granulated sugar

USDA. What are added sugars? Nov 2016 <https://www.choosemyplate.gov/what-are-added-sugars>

** Note. Other names can be used for added sugars, but these are not recognized by the FDA as an ingredient name. These include cane juice, evaporated corn sweetener, crystal dextrose, glucose, liquid fructose, sugar cane juice, and fruit nectar.*

LITERATURE REVIEW

A Worldwide Call to Reduce Added Sugar Consumption

Recently, several research studies have observed that excess sugar consumption is related to an excess in calorie accumulation, and may lead to a substantial number of health concerns. Among these health problems are increased risk of risk of obesity¹⁻⁷, cardiovascular disease^{8,9,10}, type 2 diabetes mellitus^{11,12,13}, nonalcoholic fatty liver disease^{14,15,16}, and cancer occurrence in the colon^{17,18}, pancreas¹⁹⁻²³, breast^{24,25,26} and ovaries^{27, 28}. In 2013, Han E. and Powell M. concluded that added sugar intake has increased in the United States and worldwide over the past fifteen years in all age groups, with the most significant increase in young adults.²⁹

With the results of recent research, it is not surprising that in March 2015, the World Health Organization (WHO) called for decreasing added sugar consumption to less than ten percent of daily caloric intake, noting that further reduction to less than 5% of daily caloric intake would provide additional health benefits. These health benefits include decreasing the prevalence of overweight, obesity and tooth decay³⁰. The American Heart Association (AHA) recommends limiting the consumption of added sugar to 5% of the daily caloric intake. Specifically, women and men should limit their added sugar consumption to no more than 100 calories and 150 calories respectively⁸. Also, the 2015-2020 Dietary Guidelines for Americans now recommends limiting added sugar consumption to less than 10% of the daily calorie intake. For a 2000 daily calorie diet, this is approximately 200 calories, which is about the amount of added sugar in just one regular 12 oz. soda beverage.³¹

In July 2015, the Food and Drug Administration (FDA) proposed changes to include the percent daily value (%DV) of added sugars on the Nutrition Facts label. The %DV would be based on the recommendation that daily calorie intake from added sugars dose not exceed 10%

of the total daily energy intake.³² On May 20, 2016, the FDA announced the new Nutrition Facts label for packaged foods, which will show nutrition facts in an easier way to consumers.³³ The FDA published the final rules regarding the Nutrition Facts label update in the Federal Register on May 27, 2016. Beginning in July 2018, the FDA will require manufacturers to show the amount of added sugar per gram on food labels.³³ Thus, allowing consumers to have a better understanding of natural and processed added sugars. Also, the amount of added sugar will be listed in grams; this will help consumers to calculate their added sugar intake and not exceed the recommended limit.³³

The Sugar Association is a trade group founded by the U.S. sugar industry that seeks to educate people about the scientific study of sugar's role in food, and communicate that role to the public. The Sugar Association called the FDA's label ruling “a dangerous precedent that is not grounded in science.”³⁴ Furthermore, the Sugar Association published an article in May 2016 showing their disappointment in the FDA ruling requiring on added sugar gram and a daily reference value (DRV) for added sugar on the Nutrition Facts Label. The Sugar Association group said, “The extraordinary contradictions and irregularities, as well as the lack of scientific justification in this rulemaking process, are unprecedented for the FDA”.³⁴ They claimed that they are concerned that this rule will set a dangerous precedent that is not grounded in solid science and could keep people from buying healthy food options just because of their sugar content.³⁴

In July 2016, Cristin and coworkers distributed proposed that five decades of exploration and research into the role of food and heart disease, including dietary proposals, and numerous nutrition recommendations, may have been greatly influenced by the sugar industry.³⁵ Specifically, in 1960, the sugar industry paid researchers and nutrition experts to point fault at fat

as the fundamental cause of heart disease. The report demonstrates that a trade group, called the Sugar Research Foundation, currently known as The Sugar Association, paid a few Harvard researchers about \$50,000 to publish a 1967 review of research on sugar, fat and heart disease.³⁵ It was determined that the studies utilized in the analysis were picked by the sugar group, and in response to that, an article was published in the *New England Journal of Medicine*, minimizing the connection between sugar and heart health and blaming saturated fat as the primary cause of the problem.³⁵ Today, heart disease is one of the leading causes of death around the world, and it is important when reviewing the scientific literature to consider giving less weight to food industry–funded studies and incorporate more research assessing the impact of added sugars on various heart disease biomarkers.³⁵

It is estimated that adults consume around 300 calories from added sugar per day, while children consumed around 329 calories of added sugar per day in 2009-2010.³⁶ These numbers are much higher than the current recommendations on added sugar consumption.³⁶ Moreover, the AHA published a statement which reviewed and graded the current scientific evidence for studies examining the relationship between cardiovascular health and added sugars consumption in children and adolescents aged 2-18 years old.³⁷ The available literature was divided into five areas: effects on blood pressure, lipids, insulin resistance and diabetes mellitus, nonalcoholic fatty liver disease, and obesity. Substantial evidence supports the association of added sugars with cardiovascular disease risk in children.³⁷ The cardiovascular disease risk is due to an increased energy intake, increased central adiposity, and dyslipidemia. The committee concluded that it is appropriate to set a limit for added sugar consumption in children of ≤ 25 g (100 calories or approximately 6 teaspoons) of added sugars per day, and to strictly avoid added sugars for children below two years old.³⁷ In addition, the report recommended that children and

adolescents limit their intake of sugar-sweetened beverages to one or fewer 8 oz beverages per week.³⁷ This was the first actual scientific statement recommending a particular sugar limits for children and adolescents.

Excess Added Sugar Consumption and Health Concerns

Diets that are high in simple sugars may result in decreased HDL cholesterol³⁸⁻⁴³ and elevated fasting triglycerides⁴⁴⁻⁵⁷ which are established risk factors for cardiovascular disease. In 2013, the AHA claimed that sugar-sweetened beverages including sodas, sports drinks, and fruit drinks might be associated with an approximate 180,000 deaths around the world each year.⁵⁸ The study calculated the quantities of sugar-sweetened beverages consumed by age and sex, the effects of this consumption on obesity and diabetes rates; and the impact of obesity and diabetes-related deaths. By using data collected as part of the 2010 Global Burden of Diseases Study, the researchers linked the intake of sugar-sweetened beverages to 133,000 diabetes deaths, 44,000 deaths from cardiovascular diseases and 6,000 cancer deaths.⁵⁸ Moreover, 78% of these deaths were to over-consuming sugary drinks were in low and middle-income countries, rather than high-income countries.⁵⁸ The study concluded that consumption of sugar-sweetened beverages can significantly contribute to excess body weight, and increase the risk of developing some chronic diseases that eventually lead to death.

Jiantao et al believe that drinking sugar-sweetened beverages every day might affect the risk of developing diabetes and heart disease risk.⁵⁹ Regular sugar-sweetened beverages intake was significantly associated with an adverse change in both visceral adipose tissues quality and quantity, whereas there was no similar association for diet soda.⁵⁹ This finding supports that drinking sugar-sweetened beverages every day is associated with an increase in visceral adipose

tissue fat that may affect diabetes and heart disease risk. Moreover, growing evidence in showing the health hazards associated with added sugar led the AHA to provide added sugar recommendations for adults in 2009, and for children and young adults in 2016.⁵⁹ These findings coincide with current dietary guidelines that suggest limiting the consumption of added sugar to reduce the risk of developing associated health complications.^{5,31}

Added Sugar and Diabetes

The consumption of sugar-sweetened beverages can cause a dramatic increase in the risk of type 2 diabetes mellitus.⁶⁰⁻⁶⁵ Regular consumption of sugar-sweetened drinks is strongly associated with type 2 diabetes independent of obesity status.⁶⁰ Imamura et al analyzed the results of 17 observational studies, design and quality were taken into account to minimize bias, and none of these studies were funded by industry. Frequent consumption of sugar-sweetened beverages was associated with the incidence of type 2 diabetes, regardless of the weight status.⁶⁰ Moreover, consumption of artificially sweetened drinks and fruit juice was positively associated with type 2 diabetes, but the quality of evidence was limited.⁶⁰ In 2013, Romaguera et al used data on consumption of juices, sugar-sweetened soft drinks and artificially sweetened soft drinks collected across eight European cohorts to study the link between sugar-sweetened beverages consumption and type 2 diabetes. The researcher found that drinking at least one 12-ounce serving size of sugar-sweetened soft drink a day was enough to increase the risk of developing type 2 diabetes by 22%.⁶⁵ This increased risk fell slightly to 18% when total energy intake and body-mass index (BMI) were considered. This result could indicate that the effect of sugar-sweetened drinks on diabetes goes beyond its effect on body weight.⁶⁵

In 2016, an epidemiological analysis was done to distinguish the relationship between the consumption of sugar-sweetened beverages with the risk of prediabetes and insulin resistance.⁶⁶

The analysis found that people who regularly consumed sugar-sweetened beverages, about one can of soda per day, had a 46% increased risk of developing prediabetes compared to low or non-consumers over a 14-year period.⁶⁶ Higher sugar-sweetened beverage intake was also associated with increased insulin resistance, which is a risk factor for type 2 diabetes.⁶⁶

Moreover, high consumption of sugar, specifically sugar-sweetened beverages, was found to be linked to overall poor diet and nutrition.⁶⁷ New research presented at the annual meeting of the European Association for the Study of Diabetes (EASD) determined that a high consumption of sugar-sweetened beverages was significantly associated with lower intakes of foods generally considered healthy.⁶⁷ The consumption intake differences between high and low consumers of sugar-sweetened beverages were noted as fruits, vegetables, yogurt, whole wheat and fish. People who consumed more sugar-sweetened beverages tended to eat less of these healthy food choices.⁶⁷ This study was cross-sectional; therefore, no conclusions about the exact effect on health can be drawn. However, the authors concluded that the excessive sugar-sweetened beverages consumption is associated with poor nutrition, which together can cause health concerns leading to chronic diseases such as type 2 diabetes mellitus.⁶⁷

Added Sugar Overweight and Obesity

The increasing consumption of sugar-sweetened beverages has been determined to influence the obesity epidemic.⁶⁸ There are 16 calories in one teaspoon of sugar; a typical 20-ounce soda contains 15 to 18 teaspoons of sugar, which is around 240 Kcal from added sugar.⁶⁹ People who drink sugar in a liquid form do not feel as full as if they had eaten the same calories from solid food, which contribute to drinking high amounts of sugar.⁷⁰ Before the 1950s, regular soda drink bottles were 6.5 ounces. In the 1950s, soda pop drink companies produced larger sizes including the 12-ounce can. In 1990, the 12-ounce can became the new regular size.^{71,72} By

2011, soda beverages were available in even larger sizes, such as the 42-ounce bottle.⁷³

Furthermore, it was found that half of the people in the United States consumed sugar-sweetened beverages; one in four people get at least 200 calories per day from these drinks; and 5% get at least 567 calories, which is equal to five cans of soda.⁷⁴ One of the major concerns is that sugar-sweetened beverages are becoming one of the top calorie sources in the young adults' diets (226 calories per day).⁷⁵

The consumption of sugar-sweetened beverages is associated with an increase in abdominal fat which increases the risk of heart disease and diabetes.⁵⁹ A number of studies demonstrate that an increased consumption of added sugar is significantly associated with total and abdominal obesity.^{1,4,5,6,7} Furthermore, foods containing fructose and high-fructose corn syrup specifically are found to have a greater relationship with obesity risk, as the effects of high intake may have effects that build up over time and lead to accumulating excess fat.^{2,3} According to Lustig “Fructose is like alcohol, fructose is metabolized directly into fat – not cellular energy, like glucose.”⁷⁶ this means that dietary fructose might potentially stimulate the pathways in which the body convert excess carbohydrates into fatty acids, this is known as “lipogenesis”.^{76,77}

Duffey et al. tested the effect of replacing sugar-sweetened beverages with water on energy intake and obesity prevalence.⁷⁸ They replaced one 8-ounce sugar-sweetened beverage with an 8-ounce serving of water, based on the daily dietary intake of American adults aged 19 and older. Among the U.S. adults who consume one serving of sugar-sweetened beverages per day, substituting one drink with water lowered the percent of calories coming from drinks from 17% to 11%.⁷⁸ By using previously published randomized controlled trials (RCT) and meta-analyses of steady weight loss, the researchers also predicted a decrease in obesity and an increase in normal BMI in the population.⁷⁸

Added Sugar and Nonalcoholic Fatty Liver Disease

Nonalcoholic Fatty Liver Disease is characterized by the accumulation of triglycerides in the liver cells that is unrelated to alcohol consumption,⁷⁹ which can lead to liver damage. NAFLD is a silent disease, around 25% of Americans with the disease don't experience any symptoms in the early stages.⁷⁹ Jiantao et al found an existing relationship between excess added sugar consumption and NAFLD. It was indicated that there is a higher prevalence of NAFLD among people who drink more than one sugar-sweetened beverage per day, compared to individuals who drink no sugar-sweetened beverages.⁷⁹

Moreover, obesity and overweight increase the risk for NAFLD, and people with NAFLD tend to be at greater risk of developing chronic diseases such as cardiovascular disease and type 2 diabetes mellitus.⁷⁹ Animal studies provided additional evidence on the role of fructose sugar specifically in developing NAFLD.^{14,15,16,51} The lipogenic and proinflammatory effects of fructose are related to transient ATP depletion by its rapid phosphorylation in the cell, and the ability of fructose to increase intracellular and serum uric acid levels.⁵¹

Added Sugar and Cancer

Some studies found a relationship between excess added sugar consumption and cancer occurrence in the gastrointestinal tract, particularly in the colon and pancreas. Fuchs et al. tested the association between sugar-sweetened beverage consumption on cancer recurrence and mortality in patients who suffered from stage III colon cancer.⁸⁰ The patients completed a food frequency questionnaire as part of a U.S. National Cancer Institute-sponsored adjuvant chemotherapy trial. In this study, a high sugar-sweetened beverage intake was associated with an increased risk of cancer recurrence and mortality in patients with stage III colon cancer.⁸⁰ In addition, a community-based case-control study in Japan found that sugar intake was associated

with increased risk of colorectal cancer among smokers and non-alcohol drinkers in men.⁸¹ Moreover, elevated blood glucose concentrations have been shown to be associated with greater risk of pancreatic cancer; some studies found that high fructose and sucrose intakes may play a role in pancreatic cancer etiology.^{82,83,84} Cancer cells favor metabolizing fructose to increase cell proliferation. Therefore, it appears that reducing refined fructose intake or inhibiting fructose-mediated actions may disrupt and decrease tumor growth in patients with cancer.⁸³ Another study found that there is no overall significant greater risk of pancreatic cancer in men or women with high intake of total added sugar. Bao et al. concluded that results from previous studies were scarce and inconsistent.⁸⁵

Some studies support an existing relationship between added sugar consumption and the occurrence of cancer in breast and ovaries in women.⁸⁶⁻⁸⁸ Wong et al. found that high consumption of sugar-sweetened soft drinks and sugar-sweetened fruit drinks were associated with higher chance of developing breast cancer.⁸⁶ Women who consumed > 0.5 servings per day of regular soft drinks had increased odds of premenopausal breast cancer.⁸⁶ Moreover, high glycemic index diets have been associated with an increased risk of breast cancer. Jiang et al reported that mice which were fed an amount of sucrose and fructose similar to what is found a typical American diet developed breast cancer more than mice fed a low sugar diet.⁸⁷ Furthermore, consuming foods that are high in added sugar raise insulin level in blood, and when consumed in great amounts can lead to hyperinsulinemia which is found to increase endometrial cancer risk.^{88,89} In fact, there is an indication that high added sugar intake might play a major role in ovarian cancer development.^{27,28,89} The implication of these findings suggest that a diet low in sugar may lower the risk of breast, endometrial and ovarian cancer.

Attitudes and Behaviors Toward Added Sugar Consumption

Young adulthood is a critical developmental period during the life cycle, in which many health and nutrition habits are formed.⁹⁰ In the U.S., it is the average consumption of sugar by all age groups and especially adolescent and young adults exceed that recommended by WHO; not only exceeding the proposed 5% limit, but also exceeding the current 10% added sugar limit (see figure 1).³⁰ Between 1999- 2008 the caloric intake from regular soda and fruit drinks decreased in young adults. However, the average energy consumption of sports/energy drinks increased to the largest extent among young adults (119 to 229 kcal/day). Unfortunately, young adults population shows some of the most unhealthy dietary patterns of all age groups, characterized by an inadequate consumption of fruits and vegetables and high consumption of fast food and sugar-sweetened beverages.^{91,92,93} In fact, sugar-sweetened beverages are the leading single source of empty calories in American adolescents' and young adults' diets.²⁹ The most heavily consumed sugar-sweetened beverage in those age groups are soda pop.²⁹ Between 2000 and 2008, the consumption of soda slightly decreased among young adults, however, sports and energy drinks consumption tripled.²⁹ The data indicates that serious steps need to be taken to reduce the consumption of sugar-sweetened beverages among the young generation. Spreading awareness could be the first step to reducing sugar consumption, as college students reported that educational messages could be a helpful tool to reduce consumption of sugar-sweetened beverages.⁹⁴ Also, identifying the top sugar-sweetened beverages sources of added sugars such as sugar-sweetened beverages and sugary snacks could help health professionals target educational programs for healthier food and beverages choices (see figure 2).⁹⁵

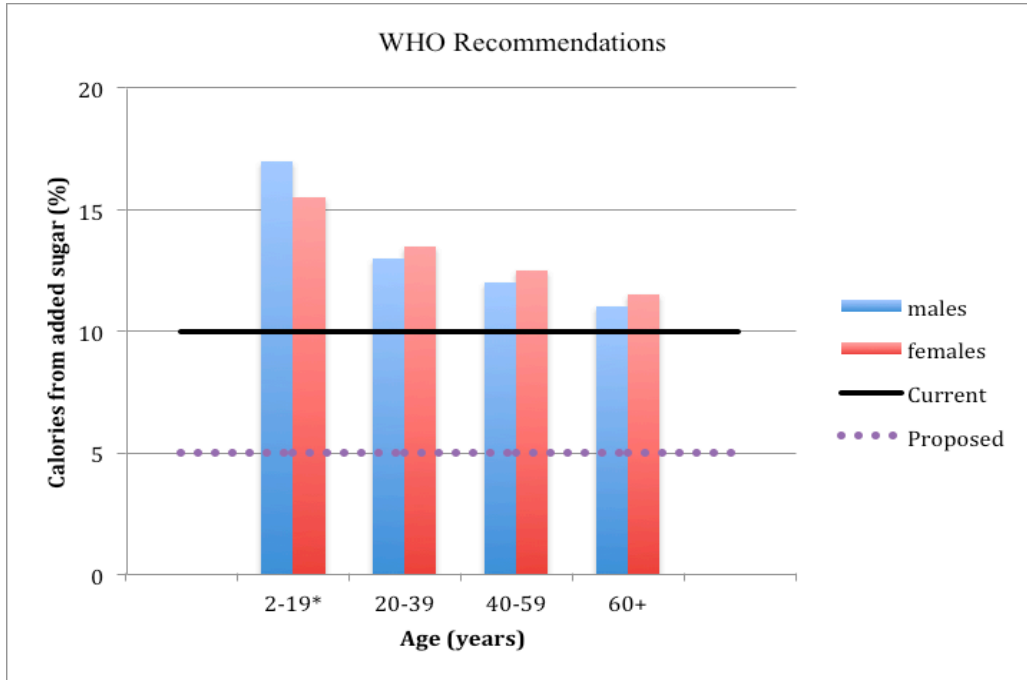


Figure 1. US Calories Consumption From Added Sugar Compared The Current WHO Recommendations. Data for 2-19 from 2005-08; Other Groups From 2005-10.³⁰

Food category sources of added sugar in US population 2 years and older

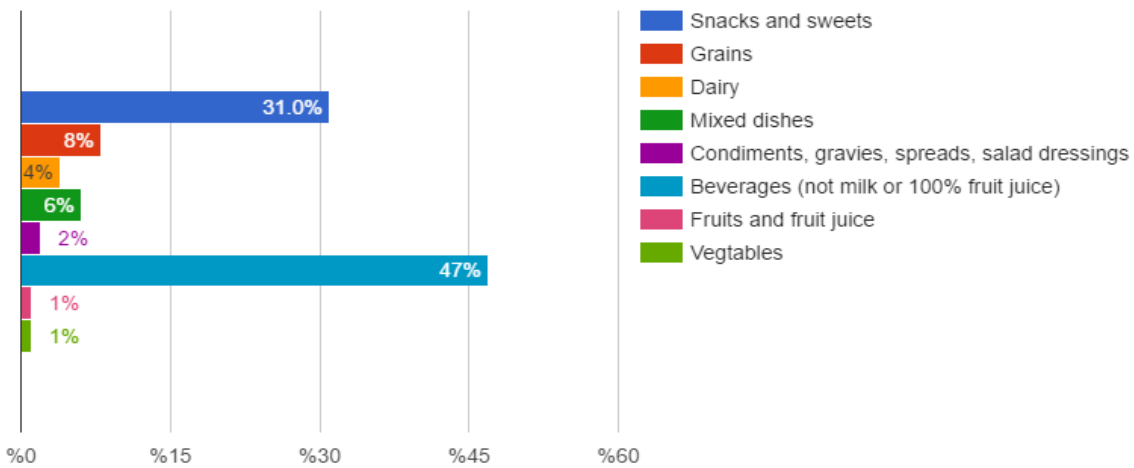


Figure 2. Food Category Sources of Added Sugar in U.S. Population (2016)

Many factors can affect young adults' attitudes and behaviors toward added sugar consumption. Price was a top factor according to a study done at six colleges to distinguish factors influencing sugar-sweetened beverages consumption among college students.⁹⁴ Additionally, lack of awareness was found to be another influencing factor. In the same study, only a few students mentioned that calorie content was important when making food choices, and most declared that they were unaware of how many calories their drinks contain.⁹⁴ Also, there is some recognition of high sugar content in fruit juices, but many students considered it is a healthy choice.⁹⁴ Most of the students' negative perceptions of sugar-sweetened beverages focused predominantly on the negative health effect of sugar and chemical ingredients found in soda.⁹⁴

Presently, social media and social life can have a significant influence on food and beverages choices. In fact, the sugar-sweetened beverage industry targets children and young adults specifically through advertisements and promotions.⁹⁵ In 2013, almost one-third of advertisements for sugar-sweetened beverages and energy drink brands appeared on Facebook, Twitter and YouTube targeting mostly the youth.⁹⁵ In fact, social media marketing has been increasing, and sugar-sweetened soda and energy drink brands represented 84% of these Facebook likes, 86% of Twitter followers, and 95% of YouTube views.⁹⁵ Moreover, young adults' dietary patterns appear to be affected by social norms. Young adults' dietary behaviors and attitudes appear to reflect their perceptions of normative behavior, particularly among friends. However, sugar-sweetened beverages consumption among young adults is significantly associated with the consumption of sugar-sweetened beverages among family and friends.⁹⁵

Young people are particularly susceptible to the consumption of excess added sugar. Thus, it is important to identify attitudes toward added sugar and consumption trends so that

public health educators and awareness campaign can address this issue. It can also help in increasing the awareness of health issues associated with added sugar, and informing the population how added sugar consumption can be controlled.

The purpose of the study

1. To review the association between excess added sugar consumption and associated health concerns.
2. To demonstrate college-aged students' attitudes and behaviors toward added sugar consumption.
3. To investigate the knowledge level of the recommended limit of added sugar consumption.
4. To determine factors influencing excess added sugar consumption.
5. To determine students' intention of using non-nutritive sweeteners.

METHODOLOGY

Subjects

The study took place at a private Catholic university in San Antonio, TX. The study participants were 203 undergraduate students between the ages of 18 and 24 years of age. Students who were less than 18 years of age or greater than 24 years of age were excluded.

Survey development

Survey response rate was 100%, completing the survey was entirely optional and all survey information remained confidential. No names or other identifying information were asked from the students. Additionally, all responses were combined with those of many others and summarized. Participants did not experience any risk other than mild discomfort with trying to remember their eating habits. The survey was approved by UIW Institutional Review Board (IRB) on 08/26/2016. IRB approval number is 16-08-005.

Data collection

Students were selected through a convenience sample of courses whose instructors agreed to the survey. Participating classes were: Dimensions of wellness, euclidean and non-euclidean geometry, geometry and proof, introduction to nutrition, mathematics for elementary teachers II, and religious quest. A paper survey was administered to distinguish undergraduate student knowledge, attitudes, and beliefs toward added sugar consumption (Appendix). A brief educational presentation about added sugar consumption was offered to participating classes after data collection. It was in an infographic video that could be viewed on Blackboard[®], used by the professor, or could be presented to the class if requested by the instructor.

Statistical analyses

Data analysis was completed by December 2016. Data from the survey was entered manually into SPSS. Descriptive statistics were performed.

RESULTS

Participant characteristics

The sample (n=203 at baseline; 72% females, and 28% males) included undergraduate students 18 to 24 years old. The students self-identified as the following: 32.5% sophomores, 28% juniors, 26% freshmen, and 13.5% seniors. More than half of the participants (60.5%) lived within driving distance of the institution. More than half of the students who participated in the study either lived with their parents (36%) or with other students (30%). Only a small percentage of the participants were athletes (15.8%) or members of an athletic club (3%). Fifty-five percent of the students took a nutrition course in high school or college. The majority of the participants (90.9%) were US students whereas 9.1% were foreign students. The Hispanic/Latino students constituted 65%; 31.3% were white; 9.1% were African-American; 6.1% were Middle Eastern; 5.6% were Asian/Asian American; 1.5% were American Indian/Alaskan Native; 0.5% were Pacific Islanders, and 1% identified as “other” (see Table 3).

Table 3.*Participant Characteristics Table*

Variable	Total (n=203)
Sex	
Male	27.7%
Female	72.3%
Age in years	
18-20	67.3%
21-24	32.7%
Classification in college	
Freshman	25.6%
Sophomore	33%
Junior	28.1%
Senior	13.3%
Living Distance	
Dormitory or other campus housing.	34%
Residence (house, apartment, etc.) within driving distance of the Institution.	61.1%
Residence (house, apartment, etc.) within Walking distance of the institution.	4.9%
Athlete	
UIW college athlete	15.8%
UIW club athlete	3%
Knowledge	
Took a nutrition class in high school or college	55%
Student Status	
U.S. student	90%
Foreign student	9%
Ethnic identification	
African American/Black	9%
American Indian/ Alaskan Native	1.5%
Asian/Asian American	5.5%
Hispanic/Latino	65.5%
Pacific Islander	0.5%
Middle Eastern/North African	6%
White	31%
Other	1%

Sugar-Sweetened Beverages Consumption

A small percentage (7.5%) of the students who participated responded that they did not consume sugar-sweetened soda pop/soft drinks on a regular basis. The most common serving sizes for the majority who consumed soda pop/soft drinks were 8oz, followed by 12 oz. Moreover, 19.3% opted to drink sugar-sweetened beverages (other than soda pop/soft drinks) at least one time per day, while 35.4% responded to drink sugar-sweetened beverages several times per week. The most consumed serving size of these sugar-sweetened beverages was 12 oz.

Attitudes Toward Added Sugar Consumption

Students who participated in the study rarely/never chose a product based on the type of sweetener in the product. Only 11% of the participating students mentioned that they tried to limit and/or avoid added sugars; 16.5% of respondents selected that they did not pay attention to added sugar consumption; and 10% indicated that they were not sure. Moreover, over half (61%) of the students considered the sugars, carbohydrate content of a food in order to help maintain a healthy weight. Almost half (48.5%) responded that it was to prevent future health conditions, and 40.5% indicated that it was to help provide energy for physical activities. A small percentage of the students (20%) said they did not think about sugar and carbohydrate content when making food and beverages purchases, as shown in Figure 3. The results of the study indicated that only 2% of the students used artificial sweeteners and none claimed to use sugar alcohols, and novel sweeteners (e.g. Stevia). Students were asked about factors influencing their consumption of sugar-sweetened food or beverages. Almost three-quarters (73%) of respondents indicated that appetite and/or taste often affect their consumption. Mood or stress caused 74% of the students to alter their food and beverages choices. Nearly 74% stated that attitudes, beliefs, or

knowledge were rarely/never factors in food and beverages choices. Cost was a factor for 65% of the students, meanwhile, 78% selected that access time or skills (e.g. cooking) can sometimes play a role in choosing food and beverages. Moreover, most participants reported that they don't use sugar substitutes. However, the most non-nutritive sweeteners mentioned to be used were artificial sweeteners (29.9%), followed by novel sweeteners (10.7%).

Added Sugar Names on Food and Beverages Labels

Some students identified different names of added sugars on food and beverages labels. In fact, corn syrup was found to be the most well-known type of added sugars on food labels (81.1%), more than fructose (71.1%), sucrose (54.2%), and maltose (33.7%). A little over a quarter of the students (29.5 %) knew dextrose was an added sugar, roughly the same amount identified nectar as an added sugar, meanwhile, only 23.7% were aware that cane crystals are considered added sugar. The least selected name for added sugar (14.2%) was evaporated cane sugar. Surprisingly, 11.2% thought that monosodium glutamate (MSG) salt is a name of an added sugar on food and beverages labels.

Determining General Knowledge About Added Sugar

Nearly half (43.4%) of the participating students were aware that 4g of sugar is equal to 16 calories (1 teaspoon). An overwhelming majority of students who participated in the survey (78.5%), knew that fruit flavored drinks contain very little fruit and are high in added sugar. Fourteen percent thought that fresh fruit juices contain a high amount of fiber; yet 52% knew that fresh fruit juices are a more concentrated source of simple sugars than whole fruits.

The questionnaire asked students about their current knowledge about added sugar recommendations. Slightly over half (56.5%) stated they were unaware of the AHA added sugar recommendations. Although, 20.5% were aware of the AHA maximum limit for added sugar consumption per day, as shown in Figure 3. A little over half (54.4%) of the participating students declared that they were not aware of the 2015-2020 Dietary Guidelines for Americans; a mere 17.2% were aware of the 2015-2020 Dietary Guidelines recommended daily added sugar limit, as shown in Figure 4. However, 58.3% indicated that they were not aware of the WHO added sugar limit recommendations and the associated health benefits. A small percentage of students, 19.1%, thought that the associated health benefits included reducing type 1 and type 2 diabetes mellitus, while only 15.1% were aware that the significant associated health benefits included reducing the prevalence of overweight, obesity, and tooth decay, as shown in Figure 5.

Students' Extent of Limiting Added Sugar

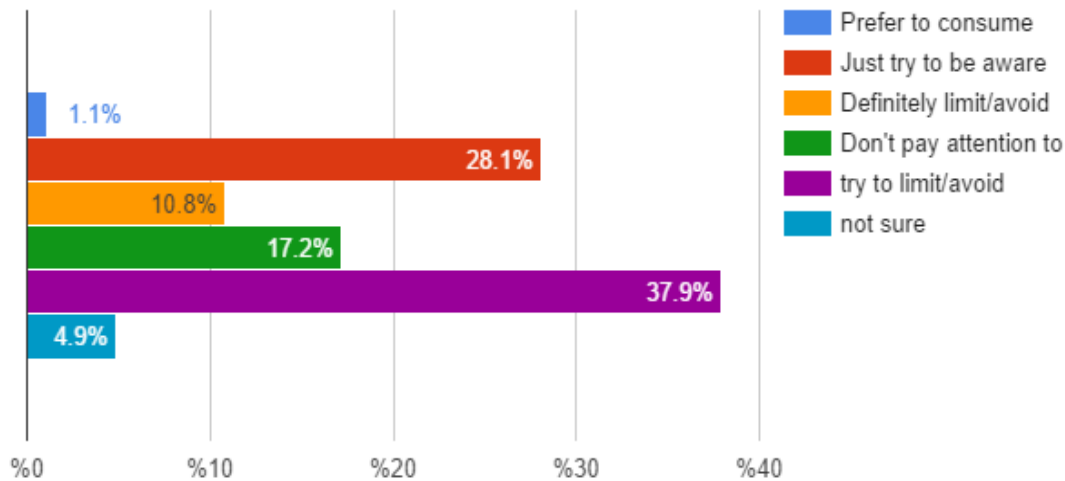


Figure 3. Participating students' extent of limiting added sugar.

Student knowledge about the AHA added sugar recommended limit

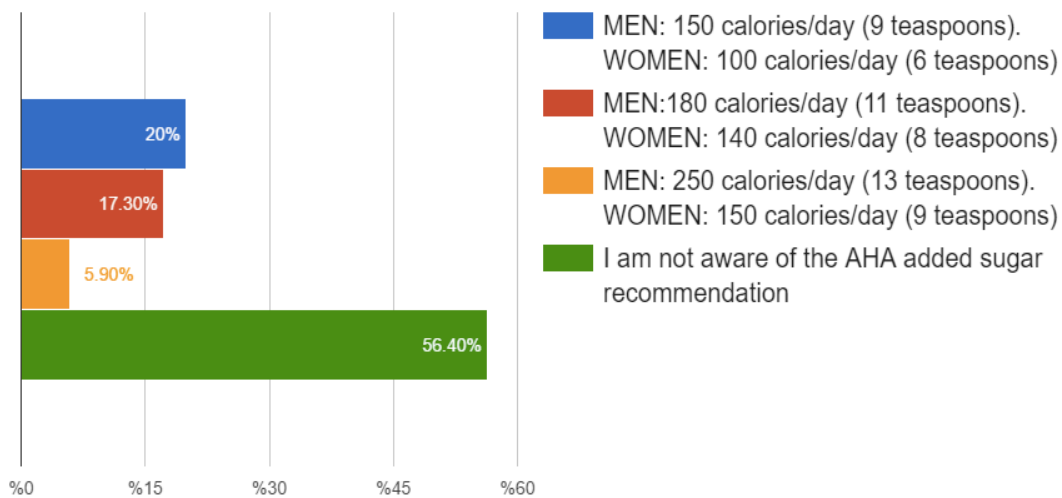


Figure 4. Participating students' knowledge about the American Heart Association (AHA) added sugar recommended limit.

Student knowledge about the 2015-2020 Dietary Guidelines added sugar recommended limit

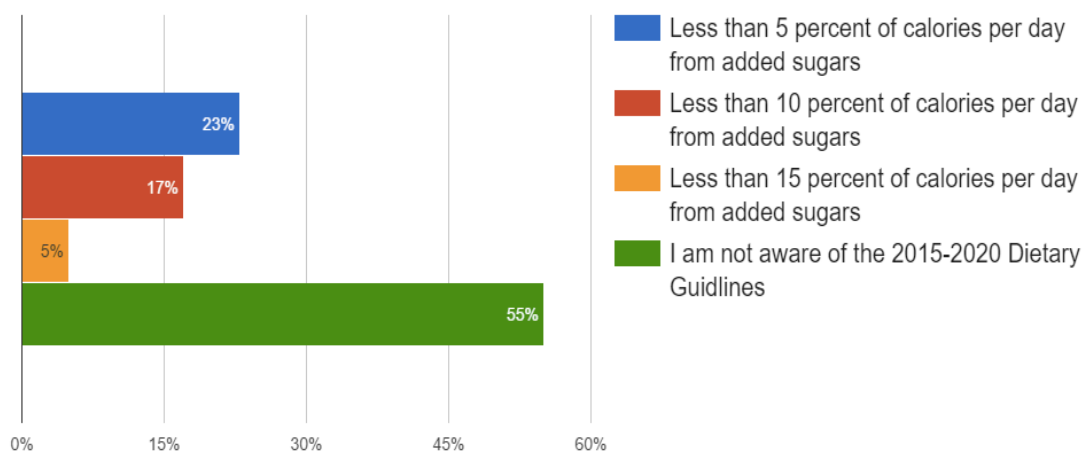


Figure 5. Participating students' knowledge about the 2015-2020 Dietary Guidelines added sugar recommended limit.

Student knowledge about the WHO observed benefits of reducing added sugar

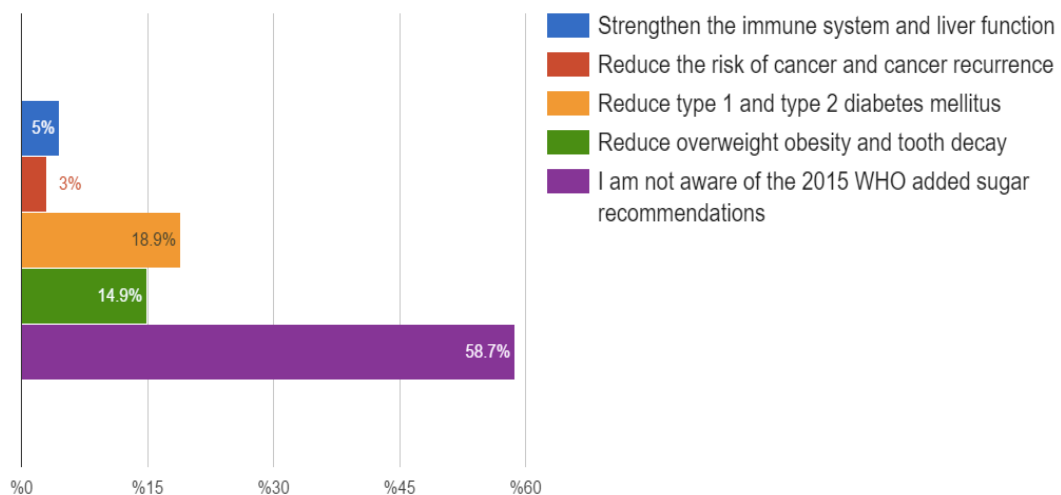


Figure 6. Participating students' knowledge about the World Health Organization (WHO) proposal limit and associated health benefits.

DISCUSSION

This study focused on investigating college student attitudes and behaviors toward added sugar consumption. Most of the students drank one or more sugar-sweetened beverages daily or at least several times per week. The common serving sizes of sugar-sweetened beverages consumed were (8 oz, and 12 oz); it is common that these serving sizes contain an amount of added sugar near or exceeding the recommended maximum limit for daily added sugar. For example, a 12 oz can of a regular Coca-Cola drink contains 39 grams of added sugar, this exceeds the maximum daily recommended by both AHA and WHO proposed limit. The results of the study indicated that most students do not pay much attention to their daily added sugar consumption. For instance, the majority of students mentioned that they do not pay attention to the sugar content or the type of sweetener used in the products they consume. Moreover, weight maintenance or weight loss are among the top reasons for students to consider the sugars and carbohydrate content of the foods and beverages they buy, followed by prevention of future health conditions. This is similar to the results of a qualitative study of beverage consumption among college students. In 2013, Block JP et al. found that for the minority of students who did report calorie and added sugar content as important considerations when making beverages choices, they identified reasons such as: trying to lose weight, balancing calories intake, or avoiding high intake of added sugar to avoid negative health consequences.⁹³

Additionally, the students lacked awareness of added sugar names on food and beverages labels; some students thought that monosodium glutamate (MSG) is considered an added sugar. Also, High Fructose Corn Syrup (HFCS) was found to be the most well-known name of added sugars among participating students. In the United States, HFCS constitutes a major source of

dietary fructose. It is a major source of caloric sweeteners in soft drinks and many other sugar-sweetened beverages.^{96,97}

Similar to previous studies, among college students, appetite taste and price were among the top factors when choosing food and beverages.⁹³ Additionally, peer pressure can also influence food and beverage selection⁹⁴; in this study almost half of the students mentioned that social life including family and friends on occasion had a great influence on their selections. However, most participants believe that knowledge and beliefs were not found greatly influence their selection of food and beverages.

It is alarming that a large percent of students declared that they are not aware of the AHA, WHO, and 2015-2020 Dietary Guidelines recommendations on added sugar. There is a lack of studies discussing the knowledge and awareness of college students or the general adult population has about added sugar recommendations. However, in 2017, the *AHA News* shared a survey from a leading health website which asked over 3,000 Americans about their attitudes, habits and knowledge on the health effects of added sugar.⁹⁸ The survey revealed that most Americans are not aware of AHA's recommended daily allowances for sugar consumption. Yet, most people are aware of the added sugar health risks but do not know how to reduce added sugar intake.⁹⁸ Moreover, the WHO reported that by reducing added sugar consumption overweight, obesity and tooth decay rates would decrease. However, many participants thought that the reason for the WHO proposed recommendation is to reduce type 1 and type 2 diabetes mellitus, which is not accurate. Unfortunately, these results show that there is certainly a lack of knowledge about the current recommendations on added sugar. However, there was some knowledge about added sugar in general. Around half of the students were aware of the number of grams of sugar or calories in one teaspoon of sugar. Most students knew that fruit flavored

drinks were usually high in added sugar. In a similar study, the researchers concluded that not all students were aware that while whole fruit can be a healthy choice and a good source of dietary fiber, fruit juice is basically fruit sugar and contains little to no fiber.⁹³

This study revealed that there is a low use of non-nutritive sweeteners. Non-nutritive sweeteners are sweeteners that provide fewer calories per gram than sugar because they are not completely absorbed by the digestive system (see Table 4). The most used type of sugar substitute among students was artificial sweeteners. There are six artificial sweeteners approved by the FDA; each one is far sweeter than regular sugar and has no calories. However, the health effects of artificial sweeteners are inconclusive. Long-term studies show that regular consumption of artificial sweeteners may lead to adverse health effects including weight gain⁹⁹, induced glucose intolerance¹⁰⁰, and increased sugar craving.¹⁰¹ Recently, Pase et al. found that high consumption of artificially sweetened soft drinks may be associated with increased risk of both stroke and dementia.¹⁰² In fact, it is the first study to reveal that artificially sweetened beverages, but not sugar-sweetened beverages, can increase the risk of stroke and dementia, including Alzheimer's disease.¹⁰²

Table 4.
Non-nutritive Sweeteners Examples

Types	Names
Artificial Sweeteners	Acesulfame potassium (Sunett, Sweet One) Aspartame (Equal, NutraSweet) Neotame Saccharin (SugarTwin, Sweet'N Low) Sucralose (Splenda) Advantame
Sugar Alcohols	Erythritol Hydrogenated starch hydrolysate Isomalt Lactitol Maltitol Mannitol Sorbitol Xylitol
Noval Sweeteners	Stevia extracts (Pure Via, Truvia) Tagatose (Naturlose) Trehalose Monk fruit
Natural Sweeteners	Honey Agave nectar Date sugar Coconut sugar Fruit juice concentrate Pure maple syrup Molasses Brown rice syrup

Future investigation into the health effects of routine use of artificial sweeteners in the diets of young adults is needed. Moreover, sugar alcohols are considered a common alternative, however, in this study, none of the students mentioned the use of sugar alcohols. Sugar alcohols have a taste similar to sucrose but increase blood glucose levels much less. Unlike sugar, sugar alcohols do not cause cavities.^{103,104} The structures of sugar alcohols are similar to sugar but are either poorly digested like maltitol, or poorly metabolized like erythritol.¹⁰⁵ Sugar alcohols, except erythritol, may also cause bloating and diarrhea when consumed in excessive amounts.¹⁰⁵ However, when consumed regularly, most people develop a degree of tolerance and no longer experience these undesirable symptoms. Moreover, in order to hydrogenate xylitol nickel is used, which is a powdered nickel-aluminum alloy. This might pose the risk of heavy metal residue and contamination.¹⁰⁶ Also, there is currently a lack of literature on determining the health effects of consuming hydrogenated sugar. Future investigation into the health effect of adding sugar alcohol gradually to daily diet is needed.

Students did not identify using novel sweeteners such as stevia. Novel sweeteners are the most recent sugar alternative addition to the diet. They are zero-calorie sweeteners, and they do not raise blood glucose levels. The FDA has approved highly refined stevia preparations as a novel sweetener. The WHO and UN's Joint Expert Committee on Food Additives also have ruled stevia to be safe in moderation. Whole stevia leaves contain a number of active components.¹⁰⁷ Steviol glycosides are described as having a sweet, clean taste at usual amounts but are bitter at higher amounts.^{107, 108} Another novel sweetener, monk fruit extract, was recently approved as a generally recognized as safe sweetener.¹⁰⁹ It is 150 to 300 times sweeter than table sugar, and contains zero calories per serving.¹⁰⁹ Monk fruit extract has beneficial antioxidant properties. However, it can have a mildly bitter taste when consumed in large amounts.¹⁰⁹ Novel sweeteners

are less commonly used and may not have the negative health outcomes of other nonnutritive sweeteners. Thus, more studies are needed to guide the young adult generation on the use of novel sweeteners as a staple sugar substitute.

Moreover, participating students showed some interest in using natural sugar substitutes. Natural sweeteners like honey are sweeter than sugar; therefore, less is needed to achieve the same level of sweetness. The vitamins present in honey are B6, thiamin, niacin, riboflavin, pantothenic acid and certain amino acids. The minerals found in honey include calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium and zinc.¹¹⁰ The composition of honey varies depending on the plants on which the bee feeds and richness of honey. However, almost all natural honey contains a wide range of compounds including flavonoids, phenolics, peptides, organic acids and enzymes.¹¹⁰ Many of those compounds work together to provide synergistic antioxidant^{111,112} and antibacterial effects.^{113,114} However, moderation is important when using natural sweeteners, because consuming excess amounts of natural sweeteners can lead to an increase in energy intake, blood glucose and dental cavities. Therefore, excess consumption of natural sweeteners can lead to weight gain and/or increased triglycerides.¹⁰ Future research into the health benefits of routine use of natural sugars instead of processed sugar and/or artificial sweeteners is needed.

Limitations to the Study

This study has some limitations. First, as mentioned previously this is a convenience sample, it was done at one university in one location in the country, and therefore, it cannot be generalized to the population of college-aged students. Second, the time frame which the students had to finish the survey was limited during the class period. Indeed, some surveys were

distributed at the end of the class, so some students had to rush answering to leave the class. However, many students seemed interested in the study and willing to participate, some students even asked for extra time to complete the questionnaire. Third, answering in a classroom setting may have affected the answers selected.

Future Research

A few recommendations for future research can be made based on the present study. More studies are needed to determine the knowledge and behaviors young adults have regarding added sugar recommendations. Further studies could examine the knowledge, attitudes, and behaviors regarding the use of different types of non-nutritive sweeteners.

Conclusion for Added Sugar Consumption among College-Aged Students

This study found that among the college-aged students surveyed there is a lack of knowledge about added sugar limit recommendations by AHA, WHO, and the 2010-2020 Dietary Guidelines for Americans. Factors found to influence excess added sugar consumption were: taste, price and peer pressure. Most of the students try to avoid added sugar consumption for weight management goals, followed by prevention from diseases associated with excess sugar consumption. Furthermore, artificial sweeteners were the most non-nutritive sweeteners used by students. However, there is a low intention of using other non-nutritive sweeteners such as natural sweeteners, sugar alcohols, and novel sweeteners. This study indicates that added sugar consumption is common in college-aged students, which may justify the need for expanded efforts in the aim of reducing added sugar intake and emphasizing a healthy style eating pattern. More studies are important to determine the knowledge and behaviors young adults have

regarding added sugar recommendations. Additionally, because of the lack of research for or against the long term of using non-nutritive sweeteners recommendations is hard to be done. Thus, further research is needed for the safety of routine use of non-nutritive sweeteners.

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Appendix

Questionnaire for Participants of the Study

1. **What is your classification in college?**(203 responses)
 - a. Freshman 25.6%
 - b. Sophomore 33%
 - c. Junior 28.1%
 - d. Senior 13.3 %
 - e. Graduate student 0%
 - f. Unclassified 0%

2. **Where do you now live during the school year?**(203 responses)
 - a. Dormitory or other campus housing 34%
 - b. Residence within walking distance of the institution 0%
 - c. Residence within driving distance of the institution 1.5%
 - d. Residence (house, apartment, etc.)within driving distance of the institution 59.6%
 - e. Residence (house, apartment, etc.)within walking distance of the institution 4.9%

3. **With whom do you live during the school year?**(203 responses)
 - a. no one I live alone 1%
 - b. one or more students 29.6%
 - c. my spouse or partner 3.4%
 - d. my child or children and partner or parents 3.4%
 - e. my parents 36.5%
 - f. other relatives 10.3%
 - g. host family 1%
 - h. Other 23.2%

4. **Are you a UIW athlete?** (203 responses)
 - a. Yes I am a club athlete. 3%
 - b. Yes I am a college athlete. 15.8%
 - c. No I am not. 81.3%

5. **Did you take a nutrition class in high school or college?** (203 responses)
 - a. Yes 55%
 - b. No 45%

6. **Over the past 12 months how often did you have sugar-sweetened soft drinks or soda-pops?**
(203 responses)
 - a. Less than once per month 13.8%
 - b. 1-3 times per month 24.6%
 - c. 1-2 times per week 20.7%
 - d. 3-4 times per week 7.4%
 - e. 5-6 times per week 2.5%

- f. 1 time per day 5.9%
- g. 2 or more times per day 9.9%
- h. Never 7.4%
- i. I only drink diet soft drinks or soda-pops 1%

7. If any what serving size did you usually consume of the drink? (203 responses)

- a. 8 oz can 38.9%
- b. 12 oz bottle 24%
- c. 16 oz (Small fast food cup) 17.7%
- d. 24 oz (Medium fast food cup) 12.3%
- e. 32 oz (Large fast food cup) 3%
- f. none 1%

8. Over the past 12 months how often did you have sugar-sweetened beverages other than soft drinks or soda-pops? (Including fruit juices-sweet tea- vitamin water-energy drinks-chocolate milk- milk shakes-sweetened handcrafted coffee beverages-alcoholic drinks-etc) (203 responses)

- a. Less than one per month 5.9%
- b. 1-3 times per month 16.3%
- c. 1-2 times per week 21.7%
- d. 3-4 times per week 24.1%
- e. 5-6 times per week 11.3%
- f. 1 time per day 9.9%
- g. 2 or more times per day 9.4%
- h. Never 1.5

9. If any what serving size did you usually consume of the drinks? (203 responses)

- a. 8 oz (1 cup) 29.1%
- b. 12 oz (1.5 cup) 52.2%
- c. 24 oz (Medium fast food cup) 15.3%
- d. 32 oz (Large fast food cup) 2.5%
- e. none 1%

10. How often do these factors influence your consumption of sugar-sweetened food or beverages?
(203 responses)

	OFTEN	ALWAYS	SOMETIMES	RARELY/NEVER
Appetite and/or taste	73%	47%	63%	19%
Mood and/or stress	45%	27%	74%	55%
Attitudes beliefs and/or knowledge about food	31%	32%	64%	74%
Cost	42%	30%	65%	62%
Access time and/or skills (e.g. cooking)	35%	39%	78%	47%
Family and/or peers	29%	17%	76%	78%

11. Over the past 12 months have you added solid caloric sweeteners to your food or beverages? (Oatmeal- cereal- coffee- tea-etc) (200 responses)

- a. White sugar 49%
- b. Brown sugar 19.5%
- c. Coconut sugar 3%
- d. Date sugar 0.5%
- e. Turbinado or demerara sugar 0%
- f. Jaggery sugar 0%
- g. No I didn't use any 1%
- h. Other 41%

12. **If any what is the total amount of the selected solid caloric sweeteners was used?** (202 responses)

- a. 1 packet per day (1 teaspoon) 7.9%
- b. 2 packets per day (2 teaspoons) 15.8%
- c. 3 packets per day (3 teaspoons) 3%
- d. 4 packets per day (4 teaspoons) 3%
- e. 5 packets per day (5 teaspoons) 0.5%
- f. More than 5 packets per day (5+ teaspoons) 0.5%
- g. 1-2 packets per week 12.4%
- h. 3-4 packets per week 8.9%
- i. None 41%
- j. Other 6.9%

13. **Over the past 12 months have you added liquid caloric sweeteners to your food or beverages?** (Pancakes- oatmeal-smoothies-coffee-tea-etc) (200 responses)

- a. Agave 4%
- b. Brown rice syrup 0.5%
- c. Honey 23%
- d. Pancake syrup 38%
- e. Pure maple syrup 8%
- f. Molasses 0.5%
- g. No i didn't use any 1%
- h. Other 40.5%

14. **If any what is the total amount of the selected liquid caloric sweeteners was used?** (200 responses)

- a. Less than 1 Tablespoon per day 18.3%
- b. 1 Tablespoon per day 18.3%
- c. 2 Tablespoons per day 6.9%
- d. 3 Tablespoons per day 2%
- e. 4 Tablespoons per day (equals 1/4 cup) 2.5%
- f. 5+ Tablespoons per day 1%
- g. 1-2 Tablespoons per week 17.3%
- h. 3-4 Tablespoons per week 5%
- i. None 39.6%

15. Over the past 12 months have you add solid and/or liquid low-caloric sweeteners to your food or beverages? (198 responses)

- a. Stevia-Truvia-Purevia. 0%
- b. Artificial sweeteners (Splenda-Sweet'nLow-Equal-NutraSweet). 1%
- c. Sugar alcohols (Xylitol-Erythritol-Sorbitol- Mannitol). 0%
- d. No I didn't use any. 1%
- e. Other. 106%

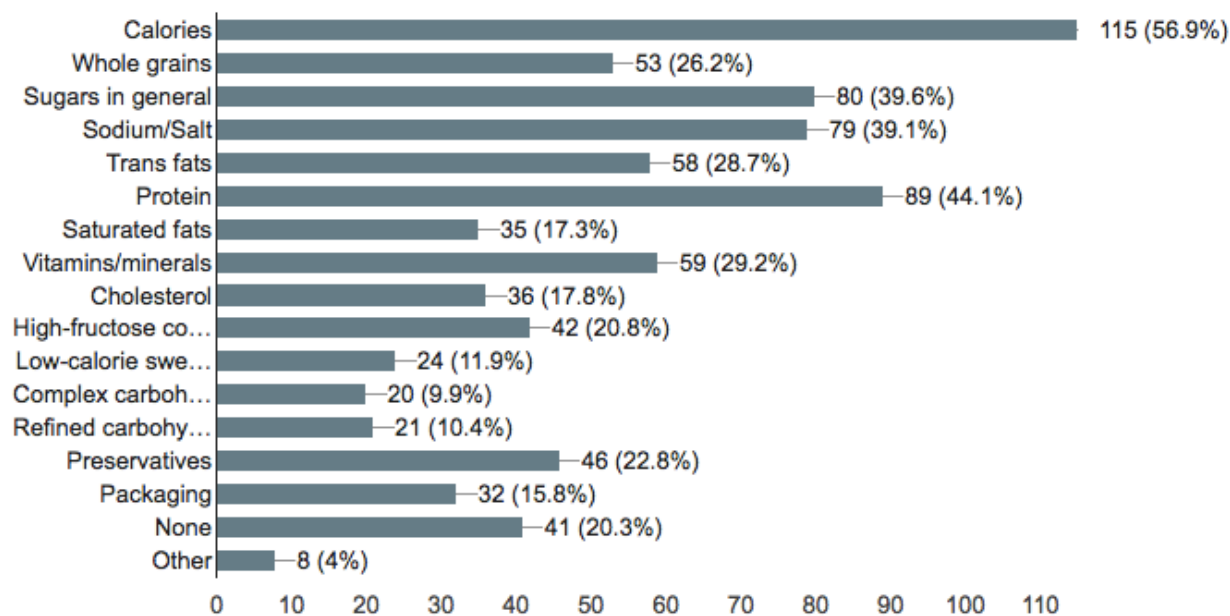
16. If any what is the total amount of the selected low caloric sweeteners was used? (200 responses)

- a. Less than 1 packet per day (< 1 teaspoon) or (< 2-4 drops) 59.5%
- b. 1 packet per day (1 teaspoon) or (2-4 drops) 9%
- c. 2 packets per day (2 teaspoons) or (4-8 drops) 7%
- d. 3 packets per day (3 teaspoons) or (6-12 drops) 1%
- e. 4 packets per day (4 teaspoons) or (8-16 drops) 0.5%
- f. 5 packets per day (5 teaspoons) or (20 drops) 0.5%
- g. More than 5 packets per day (5+ teaspoons) or (> 20 drops) 0.5%
- h. 3-4 packets per week (6-16 drops) 6%
- i. 1-2 packets per week (2-8 drops) 9%
- j. None 59.5%
- k. Other 0.5%

17. If any what are your reasons for adding low caloric sweeteners or consuming foods and/or beverages that contain low-calorie sweeteners? (202 responses)

- a. To help reduce the total number of calories I consume 16.3%
- b. To prevent a future health condition 9.9%
- c. To manage an existing health condition 7.4%
- d. Taste preference 33.7%
- e. None 50.5%
- f. Other 1.5%

18. **Over the past 12 months when making decisions about buying packaged food or beverages have you considered whether or not they contain the following?** (202 responses)

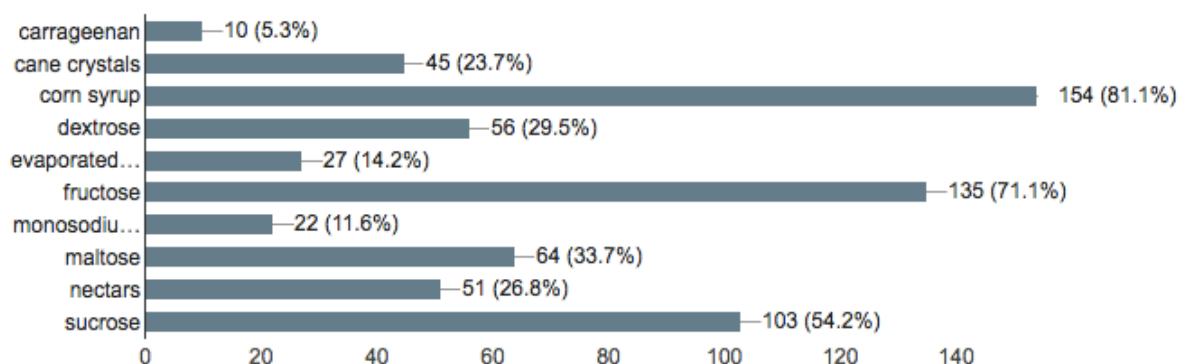


20. **To what extent do you try to consume or avoid added sugars?** (203 responses)

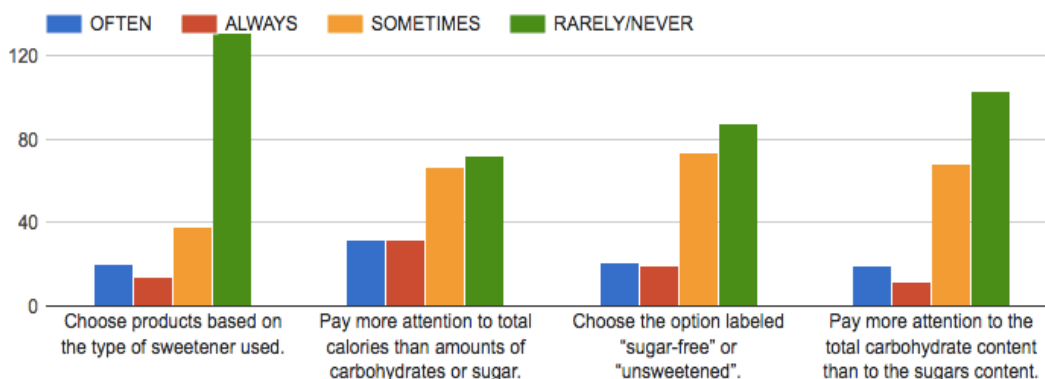
- Prefer to consume 1%
- Just try to be aware 28.1%
- Try to limit/avoid 37.9%
- Definitely limit/avoid 10.8%
- Don't pay attention to 17.2%
- Not sure 4.9%

21. **Names for added sugars on food labels include:** (190 response)

(carrageenan cane crystals, corn syrup, dextrose, evaporated cane juice, fructose, monosodium glutamate, maltose, nectars, sucrose)



22. How often do you do each of the following? (203 responses)



23. Which of the following are reasons why you consider the sugars and/or carbohydrate content of the foods and beverages you buy? (203 responses)

- To help maintain a healthy weight 60.6%
- To help provide energy/fuel for my physical activities 39.9%
- To prevent a future health condition To manage an existing health condition 48.8%
- Because I've heard that people should pay attention to the amount of sugar they consume 19.7%
- Because I've heard that people should pay attention to the types of sugar they consume 26.1%
- Another reason 6.4%
- I don't think about 19.2%
- Other 0.5%

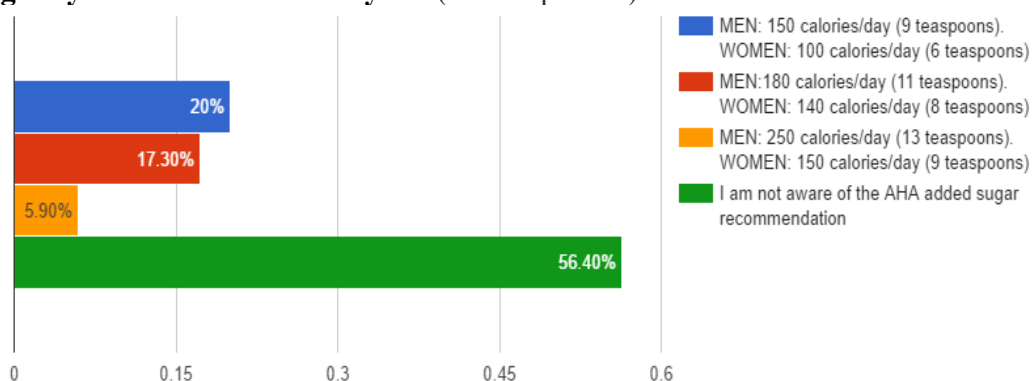
24. Check the statements you believe are TRUE regarding fruit juice. (196 responses)

- a. Fruit-flavored drinks usually have very little fruit and are high in added sugar. 2%
- b. 100% fruit juices contain a high amount of fiber. 13.8%
- c. 100% fruit juices are a more concentrated source of simple sugars than whole fruits. 54.6%

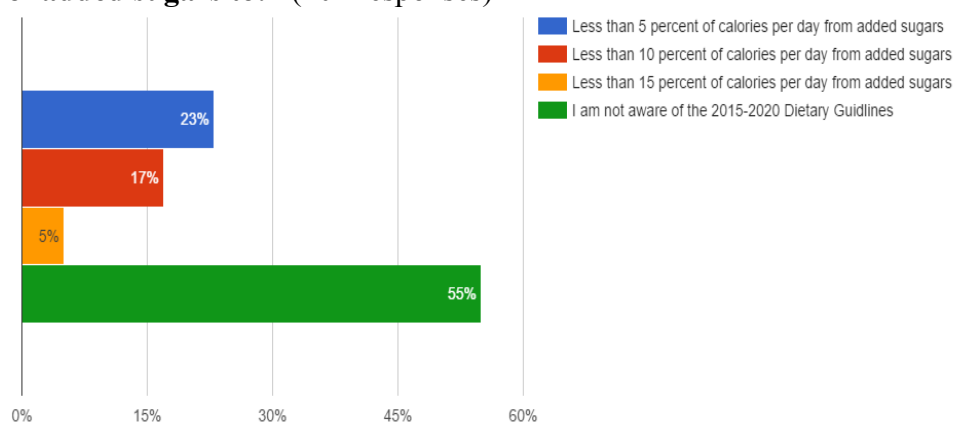
25. **On food labels the amount of sugar is listed in grams. How much is 4g of sugar?** (200 responses)

- a. 8 calories (1/2 teaspoon) 18.5%
- b. 16 calories (1 teaspoon) 44%
- c. 32 calories (2 teaspoons) 28%
- d. 64 calories (4 teaspoons) 9.5%

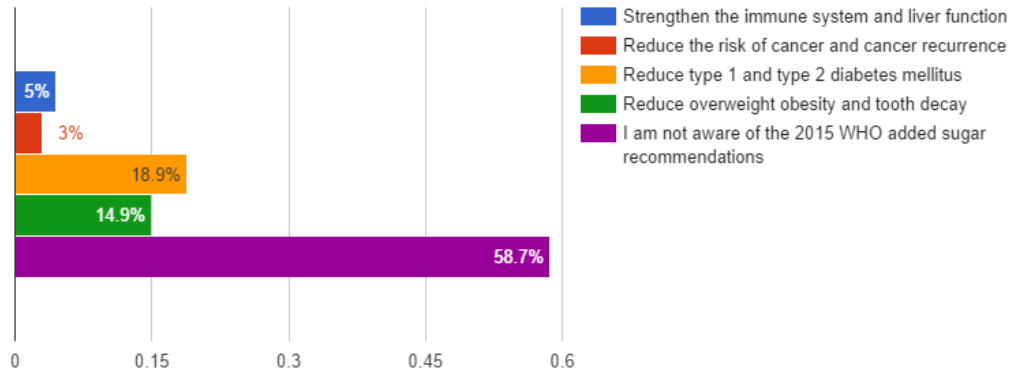
26. **The American Heart Association (AHA) declares that the maximum amount of added sugars you should eat in a day is:** (202 responses)



27. **According to the 2015-2020 Dietary Guidelines we should limit our total daily consumption of added sugars to:** (202 responses)



28. **In 2015 The World Health Organization (WHO) guidelines recommend limiting the amount of added sugar to less than 5 percent of calories per day this was found to:** (202 responses)



29. **Age** (202 responses)

- a. 17 or younger 0%
- b. 18-20 67.3%
- c. 21-24 32.7%
- d. 25-29 0%
- e. 30+ 0%

30. **Sex** (202 responses)

- a. male 27.7%
- b. female 72.3%

31. **What is your student status?** (202 responses)

- a. US student. 91%
- b. Foreign student (exchange student). 9%

32. **What is your racial or ethnic identification?** (202 responses)

- a. African American/Black 9%
- b. American Indian/ Alaskan 1.5%
- c. Native Asian/Asian American 5.5%
- d. Hispanic/Latino 65.5%
- e. Pacific Islander 0.5%
- f. Middle Eastern/North African 6%
- g. White 31%
- h. Other 1%