NUTRITION KNOWLEDGE, ATTITUDES AND CONSUMPTION OF SUGAR-SWEETENED BEVERAGES AMONG HIGH SCHOOL STUDENTS IN KAKAMEGA COUNTY, KENYA

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DECLARATION

I declare that this thesis is my original work and has not been presented for a degree in any other institution.

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DEDICATION

I dedicate this Thesis to my family for their support

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OPERATIONAL DEFINITION OF TERMS

Added sugar	Refers to sugars and other sweeteners added to foods and beverages during processing or preparation to improve the taste.
Sweetened Beverages	Refers to beverages with added sugars which could either be natural such as the table sugar added to beverages or chemical sweeteners like high fructose syrup added to processed foods.
Soft drinks	Refer to beverages that do not contain alcohol which may either be carbonated or not.
Fruit drinks	Refer to beverages made by diluting fruit juices and adding sugars to improve the taste.
Sports drinks	Refer to Rehydration drinks for athletes to boost glucose levels.
Energy drink	Refers to Beverages meant to give extra strength to the body due to the presence of caffeine and sugar.
Sweeteners	Refers to substances added to foods or drinks to give a sweet taste. Examples include High fructose corn syrup, aspartame, and saccharin

ABBREVIATIONS AND ACRONYMS

AHA	America Heart Association
CDC	Centre for Disease Control and Prevention
HFCS	High Fructose Corn syrup
MoEST	Ministry of Education Science and Technology
NCHS	National Centre Health Statistics
SPSS	Statistical Package for Social Scientists
SSBs	Sugar-Sweetened Beverages
SCDE	Sub County Director of Education
T2D	Type 2 Diabetes
TPB	Theory of Planned Behaviour
W.H.O	World Health Organization

ABSTRACT

Diet-related health problems are on the rise as a result of high consumption of sugar-sweetened beverages (SSBs) among the general population most especially young adults and adolescents in developed countries. Consumers' choices and consumption of food are determined by several factors such as attitude towards food and nutrition knowledge which enable them to make informed decisions on the choice of food to eat. There is a paucity of data on the relationship between attitudes and nutrition knowledge of Kenyan secondary school students and their SSBs consumption behavior. Therefore, the study sought to establish the type and frequencies of SSBs consumed by students. It further sought to establish nutritional knowledge and attitudes of students on and towards SSBs consumption. It hypothesized that sociodemographic factors, nutritional knowledge, and attitude were not associated with SSBs consumption. This study employed a descriptive cross-sectional study design among 249randomly selected students in form three and four respectively. Likuyani Sub-county was purposively selected due to the availability of different types of schools. Probability proportion to size sampling technique was utilized to establish the number of respondents in the various schools. Students were randomly selected in each class till the sample size was achieved. A structured questionnaire with a food-frequency sub-section was utilized to collect data in the selected schools. Data collected were coded and analyzed using Statistics Package for Social Sciences version 21. Frequencies and percentages were utilized to describe data. Chi-square analysis and binary logistic regression analysis were used to process data on food frequency and presented using frequency tables and cross-tabulations. Associations were considered significant at $p<0.05$. Descriptive statistics show that a high level of sugar-consumption was observed among 53.8% percent of respondents. On nutritional knowledge, 73.9% of respondents had moderate knowledge on SSB consumption while 57% expressed positive attitudes towards SSB consumption. Bivariate analysis indicated that only gender χ^2 *(df)* (1.401, N =249) $p=0.03$. and age χ^2 *(df)* (9.038 N=249), $p=0.029$ were significantly associated with the level of SSB consumption. Regression analysis validates age, (A.O.R= 0.622, p=0.03) attitude (AOR= 0.622, p=0.045).The study established that despite the moderate level of nutritional l knowledge by majority of the students, consumption of SSBs was found to be high. To decrease SSB consumption, novel nutritional awareness is needed to change attitudes of high school students. Concerted effort between the school and parents are needed with a view to strengthen nutritional advocacy for healthy diet and nutritional knowledge. The government, other organisations and the community should work together to help restrict the sale and provision of SSBs in schools and other Public places, and help to implement initiatives to support healthy drink choices.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter gives the background to the topic under investigation, the problem statement, and justification of the study, the significance of the study, general objective and specific objectives of the study, limitations, delimitations and conceptual framework.

1.2. Background

According to the Centre for Disease Control and Prevention (CDC), Sugar-sweetened beverages (SSBs) are defined as water- based beverages to which sugar has been added and include soft drinks, fruit drinks, sports drinks, tea and coffee drinks, energy drinks, sweetened milk or milk alternatives (CDC, 2013). They contain caloric sweeteners mainly high fructose corn syrup (HFC). Despite recommendations by medical experts and health organizations to limit consumption of SSBs, their sales have been increasing worldwide especially in low and middle-income countries (WHO, 2015). According to WHO's recommendation, a person should not take more than 10 teaspoons of sugar per day. The average amount of sugar in a 330ml soft drink can is eight teaspoons (WHO, 2015). The American Heart Association (AHA) recommends that added sugars in the diet should not exceed 100 calories (25g) per day for women or 150 calories (37.5g) for men, which is an equivalent of 5-6% of dietary energy. This is emphasized by Nita, *et al* (2014), who expressed that daily intake of SSBs should be less than 5% of our total energy intake, whereby children between 4-7yrs should not take more than 19g (5teaspoons) of sugar daily. Those who are 11years to adults should not exceed 30g (7teaspoons) of sugar.

Previous studies have shown that the rate of consumption of SSBs is increasing among the general population most especially young adults and adolescents in developing and developed countries (Fadupin and colleagues 2014). Renata (2012) in his study among the youths in Nigeria found that adolescents aged 13-19 are the highest consumers of SSBs.

Consumption of SSBs is associated with many health conditions such as Type2 diabetes, cardiovascular diseases, elevated uric acid levels, gout, and dental caries overweight and obesity (CDC, 2013). These negative health and life consequences associated with excessive calories and sugars have made SSBs attract increasing scholarly attention both in developed and in the developing world including Africa. For example, studies carried out both in Sudan and South Africa found a strong relationship between SSBs consumption and development of dental caries (Stelyn and Temple, 2012*).*

A cross-sectional study by Avery and others (2015) among the adolescents in Europe revealed that SSBs provided more daily energy intake (30.4% of total beverage intake) than any other beverage. In another study conducted in South Africa, the consumption of SSBs was found to be very high among the adolescents and the sales and availability of these beverages was projected to grow at an annual rate of 2.4% between 2012 and 2017 if no preventive measures were taken to curb the high consumption (Tugendhafta *et al.,* 2015).

A study carried out in Kenya found that SSB consumption is high among school going children and could lead to overweight and that Vitamin C is not present in many of the

SSBs although nutritional information on the packages indicates its presence (Ombongi, 2013). In another study conducted among primary school children in Nairobi, it was found that even though the study children had some level of knowledge on the effects of unhealthy diet like SSBs, they still consumed them (Mbithe, *et al.,* 2015). The two studies focused on primary school children in Nairobi between age 7 and 13 years. Little is known about those attending secondary schools in Kenya pertaining their consumption characteristics of SSBs. There is a paucity of data on the nutrition knowledge, attitude and consumption of SSBs among students attending secondary schools in Kenya.

To develop interventions discouraging youths from consumption of SSBs, an insight is needed about their attitude towards these drinks and the level of nutritional knowledge. This study will, therefore, assess nutrition knowledge, attitude, and consumption of SSBs among high school students in Likuyani Sub County, Kakamega County.

1.3. Problem statement

Sugar-Sweetened Beverages are considered to be the cause of energy intakes above the individual requirements and this has been associated with various diet-related health problems such as obesity and overweight, Type2 diabetes, gout, dental caries, mental health problems cardiovascular diseases, cancers and blood pressure (Nita *et al*,.2014). In Kenya, the prevalence rate of diabetes is estimated to be 4.2% nationally (Republic of Kenya 2012b). Hypertension is estimated at 13% of the population and obesity affects 25% of all Kenyans (Republic of Kenya 2012a). According to the District Health Records Information System (DHRIS) in Likuyani Sub-County the prevalence of

Diabetes stands at 4.3% which is slightly above the National prevalence (DHRIS, 2016). The prevalence rate of High blood pressure was 10% of the population.

Most of the studies on SSBs have been carried out in developed countries. In Kenya, studies on SSBs consumption have been done among school going and Primary school pupils. The scarcity of data limits explanation of the nutrition knowledge, attitude and the consumption level of SSBs by Kenyan high school students hence the need for this research in Kenya. This study will, therefore, assess the nutritional knowledge, attitude, and consumption of SSBs among high school students in Likuyani Sub-County.

1.4 Research questions

1. What are the types and frequency of sugar-sweetened beverages consumption among high school students in Likuyani Sub County?
2. What is the nutritional knowledge of sugar-sweetened beverages by high school students in Likuyani Sub County?
3. What is the attitude of high school students towards consumption of Sugar-Sweetened Beverages in Likuyani Sub County?
4. What is the relationship between demographic factors and consumption of SSBs in Likuyani Sub County?

1.5. Null hypothesis

1. There is no association between demographic factors and level of sugar-sweetened beverages consumption among high school students in Likuyani Sub-county.

2. There is no association between nutritional knowledge and frequency of sugar-sweetened beverages consumption among high school students in Likuyani Sub-County.
3. There is no association between attitude and level of sugar-sweetened beverages consumption among high school students in Likuyani Sub-County.

1.6. Main objective

The main objective of this study was to assess the nutritional knowledge, attitude, and the level of SSBs consumption among secondary school students in Likuyani Sub-County, Kakamega County.

1.6.1 Specific objectives

1. To determine the types and frequency of SSBs consumption among high school students.
2. To assess nutritional knowledge of SSBs by high school students.
3. To assess attitudes towards consumption of SSBs by high school students.
4. To establish the relationship between demographic factors and consumption of SSBs by high school students.

1.7 Justification

About 80% of the schools in Likuyani Sub County are day schools with only four boarding schools. Day scholar students' eating behaviors in regard to SSBs may not be controlled because SSBs are found in all selling outlets through the shops along the roads and around schools, kiosks and vendors in open air markets. It was therefore,

necessary to find their knowledge on the recommended amounts and the consequences of consumption of these drinks.

In Kenya, researches on SSBs have been only carried out among school going and Primary school pupils. Scanty data exists in Kenya to show a relationship between the nutrition knowledge and attitudes of high school students and the level of consumption of the SSBs. Therefore, there was a need for research on Kenyan high school students about their attitudes towards and nutritional knowledge of SSBs.

1.8 Significance

It is anticipated that the findings of this study will help to generate preventive measures to rescue youths from adverse effects of SSBs.

If established that students have high nutrition knowledge on SSBs, then they will act as tools to guide and influence the behavioral change of the youths towards consumption of the SSBs and therefore lessen diet-related problems and promote their health.

The findings obtained from the study will be useful for food industries and manufacturers in developing new products and to modify existing products of SSBs based on consumers' preference.

The study will also provide data important for health educators when implementing health-related programmes in institutions.

It will provide data for healthcare providers for planning health education for schools. The data will also help the society as a whole to be aware of the health risks of consuming added sugars so as to reduce their intake.

Policy makers will use the data to develop interventions discouraging youths from consumption of SSBs, and the manufacturers will utilize the data to produce healthier drinks. Study findings will add to the existing literature on SSBs consumption.

1.9 Limitations of the study

This study was only limited to SSBs, attitude, and knowledge regarding other dense foods (such as high-fat foods) was not taken into account.

There is scarcity of data on consumption of SSBs by high school students in Kenya, hence further compounds the finding of relevant literature to compare with.

Since food Frequency Questionnaires were self-reported the responses may not have been honest.

1.10 Delimitation

The study was focused on secondary school students aged between 16-19 years in Likuyani Sub-County.

1.11 Conceptual framework

The conceptual framework in figure 1.1 below was adapted and modified from the Theory of Planned Behaviour (TPB) by Ajzen (1991). It presents the independent and dependent variables and the aspects to be studied under every variable.

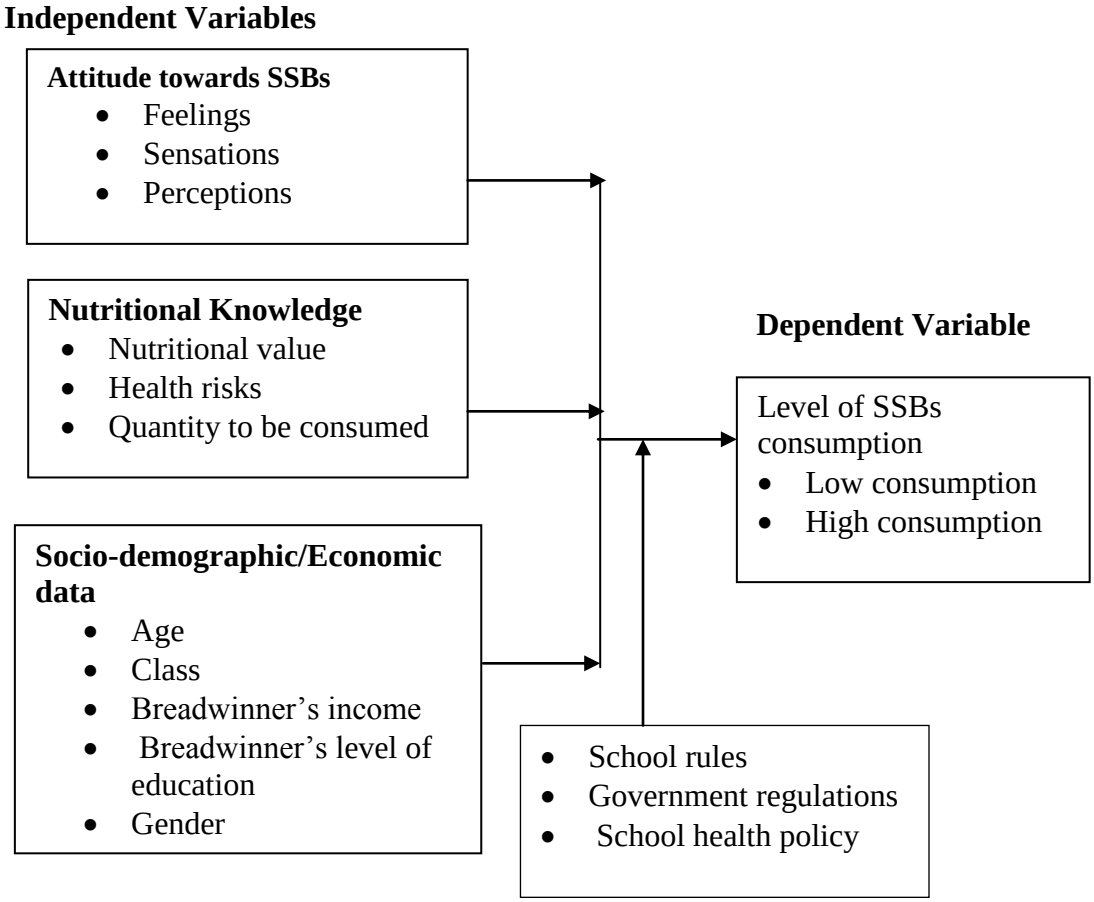

Figure 1.1: Conceptual Framework

Source: Adapted from Ajzen, (1991) and modified according to the objectives of the study.

According to this theory, an individual's behavior is driven by behavioral intentions. These intentions are a function of an individual's attitude towards the behavior, the subjective norms surrounding the behavior, and the perceived behaviour control. It's one of the most widely used models in studying potential determinants of health behavior, including dietary behaviors.

In the present study, some of the constructs of the TPB were adapted and modified to suit the objectives of the study. TPB model was used to examine whether attitude and nutritional knowledge were significantly related to change in SSBs intake. The attitude

was assessed in terms of the subjects' feelings towards consumption of SSBs, perceived behavioral control which was assessed by asking the respondents what they thought about drinking fewer SSBs. Behavior intention was measured by asking the subjects whether they intended to drink less SSBs in the future. The sensation was assessed by asking the participants if SSBs have a good taste. Nutrition knowledge was included in the model in order to find out whether the subjects could evaluate the nutritive value, health risks and the quantity of SSBs to be consumed to minimize the health hazards.

Demographic data (age, gender class, education level and income of breadwinner) was used to investigate whether these factors were associated with a change in intake of SSBs. Socio-demographic information was included in order to categorize adolescents in the study. Behavior was assessed by the frequencies and the amounts of SSBs consumption.

Attitude and nutrition knowledge influence food choices leading to either low or high consumption of SSBs. Consumption level may also vary with the socio-demographic factors like age, gender, and parental influence. Nutrition knowledge is important in enhancing positive attitudes with a focus to reduce consumption of SSBs. TPB was employed in this study to provide guidance when designing, implementing and evaluating interventions for prevention of health dangers caused by consumption of SSBs.

CHAPTER TWO: LITERATURE REVIEW

2.0. Introduction

This chapter reviews the existing literature on consumption of sugar-sweetened beverages. It has been structured to be consistent with the objectives of the study and the conceptual framework.The literature review focuses on the research objectives and research questions as follows; consumption of SSBs in Kenya, consumers' nutrition knowledge about SSBs, consumers' attitude towards various SSBs and socio-demographic characteristics of the consumers.

Consumption of SSBs is a major public health concern because it is associated with many health conditions like overweight and obesity, diabetes, some cancers, dental caries and cardiovascular diseases (Malik, et *al.*, 2013). Dietary behaviors learned in early life are maintained in adulthood thus the risk factor for major chronic diseases. Poor food choices made by adolescents while snacking tend to be high in sugar, sodium, and fat and this calls for scholarly attention (Mbithe *et al*., 2015).

2.1 Sweeteners used in SSBs

Sweeteners are classified as caloric sweeteners and non-energy sweeteners. Caloric sweeteners are those that provide energy and include High Fructose Corn Syrup (HFCS), sucrose/ table sugar and fruit juice concentrates (Malik, *et al*., 2013). Non-energy sweeteners include saccharin, cyclamate, acesulfame, aspartame and traumatic. HFCS is the main sweetener used in soft drinks. Non-energy sweeteners/artificial sweaters are much sweeter than the caloric/nutritive sweeteners. Because of the intense sweetening powers, these sweeteners can be used in very small amounts and thus add

only a negligible amount of calories to foods and beverages. They can, therefore, be consumed by people with diabetes, pregnant women and children although they don't have the same taste of pure natural sugar (Gunnars, 2015).

HFCS contains fructose and glucose from processed corn syrup. It is cheaper than sucrose and gives products a longer shelf life hence the most common sweetener used in soft drinks. It is believed that beverages sweetened with HFCS contribute to obesity more than sucrose. For example; 300mls Coca-Cola and Pepsi contains 186calories (40g of teaspoons) of sugar and the same amount of apple juice contains 165calories 39g or 9.8 teaspoons) of sugar (Gunnars, 2015).

Many of the sugars in the diet come from 'added sugars'. These are sugars added to food prior to consumption or during preparation or processing. They are used to enhance the flavor and texture of foods and increase shelf-life. Fructose is more risky than glucose and the human body is not designed to process this form of sugar at high levels (Barclay and colleagues, 2017). Glucose serves as fuel for the body, but fructose is processed in the liver where it is converted to fat (Gunnars, 2015). According to Barclay and colleagues (2017), on average fruit juice has a fructose concentration of about 45.5g per litre while soda has an average concentration of 50g per litre. The sweetest juice is minute maid with nearly 66g of fructose per litre higher than 62.5g per litre in coca cola as shown in Table2.1.

Table 2.1: Fructose concentrations in popular sodas and juices (grams per litre)

Type of juice /soda	Grams per litre
Minute maid 100% apple	65.8
Pepsi	65.7
Coca-Cola	62.5
Cranberry juice	55.4
Tropicana(orange juice)	28.3
Lemon-lime	23.2

Source: Barclay and colleagues (2017).

2.2. Consumption of sugar-sweetened beverages in Kenya

Sugar-Sweetened Beverages are water-based beverages which may either be carbonated or non-carbonated containing added sugar. They include soda, fruit drinks, sports drinks, energy drinks, sweetened tea and coffee drinks (Tungendhaft *et al.,* 2015). They are liquid carbohydrates which lead to an increase in the total energy intake since liquid sugar may have less capacity to induce satiety and their consumption may not be compensated by reduced caloric ingestion from other sources (Carmen *et al.,* 2015).

The consumption of SSBs has been increasing globally, according to a study conducted in the United States by Han and colleagues (2014). According to the study, the black children and adolescents showed higher odds of heavy SSBs consumption (odds ratio 1.71 and 1.67) than whites. Low-income children and adolescents had a heavy total SSBs consumption (odds ratio1.93) and a higher energy intake of SSBs (27kcal/day) than high-income children and adolescents. Soda was reported to be the most heavily consumed (>500kcal/day) SSB among the adolescents. Venturaand colleagues (2010) reported high daily consumption of sugar-sweetened beverages in U.S.A in both adults

and children to about 175kcal and 172 kcal respectively leading to increased energy intake from 50kcal to above 200kcal between 2005 and 2006.

A cross-sectional study by Avery and others (2015) among the adolescents in Europe revealed that SSBs provided more daily energy intake (30.4% of total beverage intake) than any other beverage. In another study conducted in South Africa, the consumption of SSBs was found to be very high, the sales and availability of these beverages was projected to grow at an annual rate of 2.4% between 2012 and 2017 if no preventive measures were taken to curb the high consumption (Tugendhafta *et al.,* 2015).Kenya is one of the socioeconomically less developed countries, the level of sugar consumption has been increasing, which is seen to be due to the change to a Western-style diet (Kinyua, 2013).

Mbithe *et al.*, (2015) in a study on the dietary practices of school going children in four urban schools in Nairobi found that over 70% of the pupils had consumed sugar-sweetened beverages. 28% of them consumed sweetened drinks between 4-7 days in a week. The sweetened drinks consumed by the study children were sodas and fruit juices like Afia, Quencher and Minute Maid. In a comparative study conducted in Kenya and India, it was found that in India, peer groups are more powerful in influencing potential consumers to take soft drinks while inKenya,parents play a crucial role (Mise, *et al.*,2012). Fruit juices which are mainly flavoured water are easily accessed across the country and at the gates of most schools.

Del Monte Kenya has introduced an economy pack which is affordable for all consumer income groups. Mini- Coca-Cola brand costing fifteen Kenya shillings has been introduced by coca-cola East and Central Africa. These attract more customers because of their lower prices. Production of soda is increasing and this is a sign of a rise in consumption, with customers now enjoying lower prices. Advertisements and vigorous marketing strategies have made soft drinks very popular hence making children to prefer them compared to the nutritious drinks (Mise *et a*l, 2012).

2.3 Consumers' nutrition knowledge about SSBs

The level of SSBs consumption is determined by nutrition knowledge one has, among other factors. Awareness on how to meet nutritional needs enables one to make informed decisions about food choices that enhance health and wellness by preventing excess intake of nutrients that could be associated with ill health, such as those low in fats and sugars (Pieniak *et al*, 2010). Increased knowledge of food value improves dietary practices whereby people understand how to utilize a healthy diet for greater benefits to their health. Nutrition knowledge is important in promoting healthier eating habits because it enables people to make proper food choices despite advertisements that are tempting (Mbithe *et al*., 2015).

Mbithe *et al.,* (2015), further explored the nutrition knowledge, attitude,and practices among urban primary school children in Nairobi. The study found out that almost half of the respondents had moderate nutrition knowledge (49.5%) and that 28% of the children consumed sweetened drinks 4-7 times in a week. Most of the respondents knew that sugars sweets and sweet foods are not good for body healththerefore, there

was no significant relationship between nutrition knowledge ($p>0.05$) with practices on consumption of sweetened beverages because despite majority of the respondents having moderate knowledge on the health risks of sugary drinks they still continued to consume them.

Consumers also need to know what to look for on labels and ingredient lists so that they make the best choices (Rampersaud, 2014). Rampersaud, (2014) also found out that there was a lack of knowledge among consumers regarding the healthiness of various categories of SSBs. Many of the participants believed other drinks that have comparable amounts of added sugars such as fruit drinks, sports drinks, and energy drinks were healthier than soda. Only a few reported correctly that all these drinks contain added sugars and so are less healthy.

Consumption of SSBs is associated with many health problems and therefore consumer nutritional knowledge on the effects of these beverages on their health is required for them to make healthy food choices (Gase*, et al.*, 2014*).* According to Gase,*et al.,(2014),* knowledge on the recommended amounts of added sugars in our diets and even the amount of sugar in the SSBs consumed may be lacking. The American Heart Association (AHA) recommends that added sugars intake should not exceed one serving per day.

2.4. Consumer attitude towards the various SSBs

Attitude is a preferential way of behaving or reacting in a specific circumstance or a liking or dislike for an item (Sarto *et al,* 2011). They can be positive, negative or neutral views of an object. Attitude is one of the key determinants of food choices and

consumption. It is determined through an assessment of one's beliefs regarding the consequences arising from behavior and an evaluation of the desirability of these consequences. Some of the known attitudes associated with food are seen when food choices are triggered by sight, leading to the purchase of attractively packaged foods without considering health implications (Kinyua, 2013). Factors such as aesthetic values of food or health benefits of food, influence the intention of an individual towards consumption of certain foods and sensations towards foods differ from one individual to another, for example, one may find a food to be too sweet, while another may not perceive it the same (Sartor *et al.*, 2011).

Consumer attitudes towards SSBs, therefore, influence their purchasing and consumption behavior. Positive attitudes towards healthy food choices have been influenced by the nature of the environment. School setups to provide a conducive environment to promote a positive attitude and lifestyle choices in enhancing society health for students are viewed as change agents (Kinyua, 2013). In another study carried out at a Nigerian University, it was found that many of the youths perceived SSBs as social drinks and majority had a positive attitude towards SSBs consumption (83.5%) and consumed them regularly despite their awareness of health implications of excessive consumption (Fadupin and colleagues, 2014).

Wrong perceptions towards food may lead to wrong food choices because the food is mainly changed from a means of nourishment to a marker of lifestyle and a source of pleasure as portrayed by the media (Mbithe and colleagues, 2015).

2.5. Effects of SSBs on health

Sugar-sweetened beverages are consumed globally and contribute to many diet-related diseases in high, middle and low-income countries. Their consumption has become a major public health concern. They have high amounts of energy from sugars that are easily absorbed by the body. They contain added sugars especially fructose which does not lower the hunger hormone called ghrelin, the way glucose does. Fructose does not stimulate the satiety centers in the brain that regulate the calorie intake. These liquid sugars provide less satiety and so deliver calories without a sensation of being full. This induces hunger which causes increased consumption of other foods, making the consumer take in a lot of calories in a day without compensating for excess liquid calories from solid food. Therefore regular consumption of SSBs greatly contributes to weight gain (Leech, 2015).

SSBs contain caloric sweeteners mainly high fructose corn syrup and sucrose. Fructose can only be metabolized by the liver. Therefore excessive intake may lead to non-alcoholic fatty liver disease and accumulation of visceral (belly) fat that contributes to metabolic diseases (Leech, 2015). Observational studies have also associated SSBs consumption with a high frequency of gallstones, higher waist circumference and low-density lipoprotein cholesterol, and triglyceride deposition in the liver and insulin resistance. Increased consumption of SSBs is linked to the rising prevalence of Type2 diabetes (T2D) worldwide. Studies carried out in the U.S, show that T2D prevalence has doubled from 5.3% during 1976-1980 to 11.3% in 2010, and currently it is affecting 300 million people worldwide (CDC, 2013). The International Diabetes Federation (IDF) estimates that by 2030, the number of individuals with diabetes will rise by

almost 43% to 552 million. Globalization and Westernization of the developing world continue to contribute to the rapid worldwide growth of T2D (Malik, *et al*., 2013).

T2D is characterized by elevated blood sugars due to insulin resistance. Sugary drinks make the body cells resistant to the effects of insulin a condition called insulin resistance which is the main drive behind metabolic syndrome that leads to type2 diabetes and heart disease. In a study that explored sugar consumption and diabetes in 175 countries, it was found that each 150calories of sugar was linked to a 1.1% increase in T2D (Sanjay *et al.,* 2014). In another study following over 50,000 women for 8 years in the U.S, it was found that SSB consumption of >1 SSB per day was associated with an 83% greater risk of developing type2 diabetes compared with consumption of <1 SSB per day (Malik**,** *et al.,* 2013).

Consumption of SSBs provides no nutritional values and fiber except excessive amounts of added sugar. Instead they can affect the quality of the diet, for example, they may displace milk consumption, thus reducing calcium intake from milk which is the main source of calcium, especially in growing children (Ombongi, 2013). Studies have indicated that daily consumption of SSBs may lead to increased secretion of the protein in the urine causing kidney dysfunction (Singh *et al.,* 2015).

Sugar feeds tumors and encourages the growth of cancer cells and because it is highly acidic provides a conducive environment for cancer growth causing several cancers such as esophageal, adenocarcinoma and renal cancers in men, gallbladder and endometrial cancers in women and about 180,000 deaths annually worldwide (Singh *et al*., 2015).

Fructose is known to increase serum uric acid levels, a condition called hyperuricemia which increases the chances of gout development and hypertension .Gout is a medical condition characterized by inflammation and pain in the joints particularly the large toes. This happens when the uric acid in the blood become crystallized (Leech, 2015).

SSBs are high-carbohydrate and processed drinks. Their consumption makes the body to produce too much insulin and leptin causing a rise in the blood pressure eventually leading to insulin/leptin resistance. Insulin carries magnesium which relaxes muscles. When body cells become resistant to insulin, there will be low magnesium levels in the blood because most of it will be passed out through urination. Consequently, the blood vessels will not relax fully and this constriction causes blood pressure. Uric acid also drives up blood pressure by inhibiting nitric oxide which helps the blood vessels to maintain elasticity; hence its suppression increases blood pressure (Mercola, 2015).

High consumption of SSBs is also linked to the increase of coronary heart disease.When sugary drinks are taken in, the body responds by producing triglycerides (fat globules) some of which are stored in the liver and others exported into the bloodstream, where they may end up lining up the arteries and may cause heart attack (Yang, *et al*., 2014). Sweetened beverages are also reported to increase the risk for dental caries, especially in children because of their high sugar content leading to acidic conditions causing dental plaque. Soda contains acids like phosphoric acid and carbonic acid creating a highly acidic environment in the mouth, which makes the teeth vulnerable to decay. Sugar provides easily digestible energy for the bad bacteria in the mouth which combined with the acids affects dental health with time (Leech, 2015).

2.6 Demographic factors and consumption of SSBs

Age, gender and parenting style (permissiveness or strictness) may influence consumption behavior of consumers. Parents influence the availability of SSBs at home. Both the availability of SSBs and the family food rules for consumption of the beverages provide conditions that might influence their intake at home and this makes home food environment of great importance because youths consume a lot of SSBs at home. Parents are finding it difficult to control their school-going children's thirst for squash, sodas, Coca-Cola and other artificially flavored drinks. They are giving into their children's demand for these drinks instead of milk or tea as preferred foods. A widespread taste for carbonated drinks, French fries, burgers, pizzas, and other fast foods is the manufacturers focus on producing mass brands to target majority of the population. In a study conducted among secondary school students in Tanzania, it was found that an adolescent having a parent with a high education level and wealthy was positively associated with increased consumption of sugary drinks at the frequency of 53.2% weekly soda drinking (Kasusu and Nyamurye, 2012). In another study carried out in the U.S consumption was lower among children with high-income parents and lower in parents with high education levels (Zoellner *et al*., 2012).

Kasusu and Nyamurye (2012) also found out that female respondents consumed more sugary drinks than the male in Tanzania. A study conducted in the U.S by Nesheim and Nestle, (2012), found that the male consumed nearly twice as many sodas as women (14 ounces as compared to 8 ounces a day). The study also indicated that, older youths drunk more SSBs than younger ones. Children aged 2-5 years drunk on average 6 ounces a day while adolescents aged 12-19 drunk 22ounces per day on average**.**

2.7 Summary of literature review and identification of gaps

In this chapter, systematic review of existing literature has been done. The following have been covered in this section, which is in line with the research objectives and research question; health problems due to SSBs consumption, consumer knowledge and attitude towards SSBs, consumption of SSBs in Kenya and how socio-demographic factors may influence SSBs consumption.

From the reviewed literature, studies on SSBs had examined environmental factors and the consequences of SSBs. Studies also showed that many people lack knowledge of the safe amounts of SSBs to be consumed, their nutritive contents and the health problems emanating from their consumption.

A lot of the studies on SSBs have been carried out in developed countries like the U.S.A. In Kenya, few studies have been carried out among primary school children. There is scarcity of literature about students in secondary schools in Kenya pertaining their knowledge on the health risks of SSBs consumption and their attitudes towards these drinks.

This study sought to fill the gap by carrying out a cross-section survey on nutritional knowledge attitudes and the consumption of SSBs among high school students and make recommendations on how to promote nutrition and health education in order to improve the nutrition knowledge and attitude of secondary school students in Kenya, which will consequently influence their consumption of SSBs.

CHAPTER THREE: MATERIALS AND METHODS

3.1. Introduction

This chapter describes the methods used in the study that includes; the study design, study site population, sampling techniques and sample size, data collection, data analysis, ethical and logistical considerations.

3.2. Study design

The research was carried out using descriptive cross-sectional survey design, to provide information on the attitudes, nutritional knowledge, and consumption of sugar-sweetened beverages among secondary school students in Likuyani Sub-County, Kakamega County. A descriptive cross-sectional study design enabled the collection of information at a one point in time. This method was also preferred since the study involved the collection of data from people with different variables of interest like socio-demographic factors.

3.3 Variables

3.3.1: Dependent variable

The dependent variable in this study is the level of respondents' consumption of the Sugar-Sweetened Beverages. The level of SSB consumption was measured as a binary variable of low and high consumption.

3.3.2: Independent variable

3.3.2.1 Demographic characteristics

This comprised of information on age, parental/breadwinner's level of education and occupation, class and gender of the participants and this provided background information of the participants.

3.3.3.2 Nutrition knowledge about SSBs

This section collected information on student's general knowledge of nutritional value, the quantity of SSBs to be consumed and the health risks due to consumption of SSBs**.** Nutritional knowledge was measured using a composite score derived from calculating theme an response from each respondent. Mean scores were re-coded to a three variable measure of poor, moderate and good nutritional knowledge as displayed in Table 3.1

Table 3.1: Nutritional knowledge level composite score

Knowledge Assessment Categories	Mean Range
Poor Knowledge	0-1.9
Moderate	2-2.9
Good Knowledge	3.0 & Above

3.3.3.3 Attitude towards consumption of SSBs

This collected information on the feelings, perceptions, and sensations towards SSBs by the respondents. The attitude was measured as a binary variable of negative and positive. This was derived by recoding the mean scores from all attitude-related questions from each respondent into a binary variable as shown in Table 3.2

Table 3.2: Attitude composite score

Attitude	Attitude Composite Score
Negative	0-2.5
Positive	2.6 & Above

3.4 Study location

This study was conducted in Likuyani Sub-county, Kakamega County. Likuyani Sub-county has an area of 301.90squarekilometers. It is a cosmopolitan settlement scheme with migrants from different communities. The main economic activity in the area is crop farming.

There are four locations in the Sub-County, namely; Sinoko, Nzioa, Likuyani and Kongoni. Total secondary schools are 35, most of which are mixed and day schools. There are four girls' boarding schools and two boys' boarding schools. According to the statistics at the Likuyani Sub-County Director of education (SCDE), (2017), the total population of students in secondary schools is 9431(4780 girls and 4651 boys).

3.5. Target population

The study targeted Form 3 and 4 high school students in Likuyani Sub County, Kakamega County. The population of form three and four students in the sub county was 3932. The study population consisted of 700 (SCDE, 2017) boys and girls attending private and public secondary schools as well as mixed/day boarding in Likuyani Sub-County.

3.6 Sample size estimation

The sample was determined using the standard formula, Fisher *et al.,* (1991) as below

$$n = \frac{Z^2 p \times q}{d^2}$$

Where;

n The desired sample size

Z The normal deviation at the required confidence level (1.96)

P The proportion in the target population estimated to have characteristics of interest (0.5)

q 1-p

d The degree of accuracy desired set at 0.05 which corresponds to the normal deviate.

$$\frac{1.96^2 \times 0.5 \times 0.5}{0.05^2}$$

=384

Since the target population is estimated to be less than 700, the following formula was used to determine the actual sample size.

$$N_0 = \frac{n}{1 + (n-1)/N}$$

Where;

N_0=reduced Finite sample Size

n=Large sample size when the population is more than 10,000=384

N= the estimate of the population size.

$$\frac{384}{1 + (384-1)/700}$$

N_0 = **249 Respondents**

3.7 Sampling techniques

Purposive sampling was used to sample Likuyani Sub County because it is a cosmopolitan area with a population that belongs to different social economic status and different types of secondary schools. Purposive sampling is whereby the sample subjects are selected based on variety of criteria determined by the researcher (Kothar *e*t *al*., 2004). Six secondary schools involved in the study were purposively selected from all the four locations in the Sub-County as displayed in Table 3.3.

Table 3.3: Sampling frame: Distribution of secondary schools in Likuyani Sub-County.

Location	Day/Mixed	Girls Boarding	Boys Boarding	Day/Boarding And Mixed	Total
Likuyani	5	2	1	0	**8**
Nzoia	8	2	1	2	**13**
Sinoko	4	0	0	0	**4**
Kongoni	10	0	0	0	**10**
Total	**27**	**4**	**2**	**2**	**35**

Table 3.4: Proportion of respondents in respective schools in Likuyani

School in Likuyani Sub-County	Form Three	Form Four	Total	No. Sampled
St. AnnesNzoia	70	50	120	43
Lwanda secondary	70	60	130	46
Kongoni secondary	50	64	114	41
Evugwi secondary	56	40	96	34
John the Baptist	70	80	150	53
St. Basils academy	50	40	90	32
Total	**366**	**334**	**700**	**249**

Source: class registers (2017)

Using the class registers as shown in Table 3.4, probability proportional to size sampling technique was used to sample the number of respondents in each

school.

Stratified sampling technique was used to select respondents from each class in the participating schools. Stratified sampling involves grouping of a study population into smaller groups known as strata which are formed based on members' shared attributes or characteristics (Mugenda, 1999). In this study, students in each sampled school were classified based on class and sex. A separate list of boys and girls was generated in each secondary school. Then random sampling was applied within the boys and girls subgroups to select each student until a desired number was reached in each school.

3.8 Data collection instruments

A structured-self-administered questionnaire was utilized to gather information. The questionnaire was structured into four sub-sections; consistent with the conceptual framework (Figure 1.1). The first part of the questionnaire assessed the demographic and socioeconomic characteristics of the students and their guardians respectively. The second part contained a food frequency questionnaire that assessed the type and frequency of Sugar-sweetened beverages consumed by the students. The third sub-section of the questionnaire assessed student's nutritional knowledge of SSB consumption based on eight knowledge items. The fourth sub-section utilized a Likert scale to measure the attitude of students towards SSB consumption.

3.9 Pre-test of the data collection instruments

A pre-test of research instruments was carried on 10% of respondents (N=25 students of Mautuma secondary school in the neighboring Sub-county (Lugari), Kakamega County, in order to establish their validity and reliability. It helped to adjust the

wording and administration of the questionnaire. Lugari Sub County is also a cosmopolitan settlement scheme like Likuyani Sub County.

3.9.1 Validity

Validity is the degree to which results obtained from the analysis of the data represent the variables (Mugenda, 1999). Validity was assured by training of research assistants, standardizing of the research tools and ensuring the completeness and correctness of the collected data. The supervisors' inputs were also used in formulating questions that adequately generated information for the study.

3.9.1 Reliability

Reliability is the degree to which a research instrument yields consistent results after repeated trials (Mugenda, 1999). A test-retest technique was used to establish the reliability of the questionnaire. A Cronbach's reliability test on 58 items was also carried out to during the pre-test as shown in table 3.5. A Cronbach Alpha Coefficient of 0.563 was obtained. Following the pre-test, the questionnaire was redesigned and the number of items reduced to 56. This yielded an acceptable Cronbach Alpha Coefficient of 0.72 at post-test.

Table 3.5: Reliability statistics

Reliability Statistics	Cronbach's Alpha	N of Items
Pre-test	0.563	58
Post-test	0.721	56

3.10 Data collection procedures

Five research enumerators with nutritional backgrounds were hired and familiarized on the data collection tool. Logistical arrangements were made available to the research enumerators during the data collection period. The researcher supervised the research assistants to ensure that data collection was done according to the sampling technique.

3.11. Data analysis

After data collection, the items were coded then entered into Statistical Package for Social Sciences (SPSS) software, version 21 for analysis. Both descriptive and inferential statistics were used. Frequencies and percentages were used to describe both independent variables and dependent factors. Associations between variables at bivariate level were tested using chi-square and binary regression analysis at multivariate level. Associations were considered significant at $p<0.05$.

Table 3.6: Summary of the data analysis of variables

Variable	Variable Type	Indicator	Analysis
Demographics Variables	Independent	Age, Gender, School, Income, education Levels	Descriptive Statistics (median, frequencies & Statistics)
Food frequency	Dependent	Frequency of Intake	Descriptive Statistics
Nutrition knowledge	Independent	Level of Knowledge	Knowledge score & Frequencies and
Attitude	Independent	Perception	Descriptive Statistics
Associations (Independent vs. dependent)		*P-value*	Chi-Square and Logistic Regression Analysis

3.12 Ethical and logistical considerations

A letter to seek approval to conduct the study was obtained from Kenyatta University Graduate School (Appendix 3). Ethical clearance to carry out the study was sought from the Kenyatta University Ethical Review Clearance (Appendix 5). Thereafter, a research permit was obtained from NACOSTI to conduct the study in Likuyani Sub-county. (Appendix 6).

Further, permission to carry out the study in the district was sought from the Ministry of Science, Education, and Technology through the County Director of Education and the principals of the schools involved in the study. Prior, to the data collection, a consent form was provided to the students and parents to which they signed after being explained to the nature and purpose of the study by both the researcher and their class teachers. Participation of respondents in the survey was voluntary and they were free to withdraw at any point during the survey at their pleasure. To ensure confidentiality, respondents were asked not to provide their names as well as those of their parents on the consent forms and questionnaire.

CHAPTER FOUR: RESULTS

This chapter presents the results of the study as per the objectives. Data on the demographic factors, nutritional knowledge and attitude are displayed using frequency tables, figures, and cross-tabulations.

4.1 Demographic factors

Data from 249 students were analyzed in this study. The socio-demographic factors covered in the study were gender, age, class of the respondents, education level and income of the parent/guardian. The results were presented in Table 4.1.

Table 4.1: Demographic characteristics of respondents and their parents/guardian in Likuyani Sub County.

Gender	**Frequency**	**Percent**
Male	132	**53**
Female	117	47
Total	249	100
Age		
16	49	19.7
17	87	**34.9**
18	80	32.1
19	33	13.3
Total	249	100
Class		
Form Three	121	48.6
Form Four	128	**51.4**
Total	**249**	**100**
Educational Level of parent/guardian		
None	53	21.3
Primary	62	24.9
Secondary	80	**32.1**
College/University	54	21.7
Total	249	100
Occupation of parent/guardian		
Employed (salaried)	54	21.7
Retired	42	16.9
Unemployed	37	14.9
Business	72	**28.9**
Casual Labourer	44	17.7
Total	**249**	**100**

4.1.1 Gender of respondents

Table 4.1 shows that more than half of the respondents were male 53% whereas females represented 47% of those who participated in the study. Most of the students were male.

4.1.2 Age of respondents

Table 4.1 shows that 34.9% of the respondents were aged 17 (32.1%) 18 years old (19.7%) aged 16 years and only 13.3% were 19 years old.

4.1.3 Class of the respondents

Table 4.1 shows that half of the respondents surveyed were in form four 51.4% and 48.6% were in form three.

4.1.4 Education level of respondents parents

As displayed in table 4.1, 32.1% of student's parent/guardians had secondary school education, 24.9% had primary school education level represented and about 21.3% and 21.7% had no formal education and college education respectively.

4.1.5 Occupations of respondents parents

Table 4.1 shows that 28.9% of student's respondent's parent/guardians were engaged in some of the business, 21.7% were salaried, 17.7% were casual labourers and at least 14.9% were unemployed.

4.2. Type and frequency of intake of sugar-sweetened beverages by students

The types of SSBs assessed in this study were soda, Energy drinks, Fruit drinks and sweetened beverages like coffee and tea. Each response listed below. Table 4.2 displays the frequencies of consumption of different types of sugar-sweetened beverages.

Table 4.2: Types and frequency of sugar-sweetened beverage consumption

Type of SSB	Frequency Categories	Frequency	Percent
Soda	None	48	19.3
	Once per day	51	20.5
	2 times per day	8	3.2
	3 times a day	5	2.0
	Once a week	57	**22.9**
	2-3 times a week	17	6.8
	Once a month	63	25.3
	Total	**249**	**100**
Energy Drinks	None	97	39.0
	Once per day	39	15.7
	2 times per day	23	9.2
	3 times a day	25	10.0
	Once a week	25	10.0
	2-3 times a week	10	4.0
	Once a month	30	12.0
	Total	**249**	**100**
Fruit Drinks	None	56	22.5
	Once per day	32	12.9
	2 times per day	16	6.4
	3 times a day	11	4.4
	Once a week	50	20.1
	2-3 times a week	17	6.8
	Once a month	67	**26.9**
	Total	**249**	**100**
Sweetened beverages like tea, coffee	None	11	4.4
	Once per day	62	24.9
	2 times per day	93	**37.3**
	3 times a day	50	20.1
	Once a week	10	4.0
	2-3 times a week	6	2.4
	Once a month	17	6.8
	Total	**249**	**100**

From Table 4.2, it is evident that soda was consumed at least once a month by 25.3% of respondents. A large proportion of respondents 39%, reported not to drink energy drinks. More than a quarter 26.9% of respondents drank fruit drinks every month.

Results show that sweetened beverages were consumed at least twice per day at 37.3%

4.2.1 Level of Sugar-sweetened beverages consumption

The level of sugar-sweetened beverages was calculated by computing the mean for each response as a composite score for all the respondents. The composite score was further recoded to a binary variable of high and low to determine the level of sugar-sweetened beverage consumption as illustrated in Table 4.3 wherein, there was high level of sugar- sweetened beverage consumption among more than 53.8% of respondents. Less than half of respondents 46.2% reported low consumption of sugar-sweetened beverages.

Table 4.3: Level of sugar-sweetened beverages consumption by the respondents

The level of sugar-sweetened beverage consumption	Frequency	Percent
Low	115	46.2
High	134	**53.8**
Total	**249**	**100.0**

4.2.2 a: Risk estimate of respondents' gender and level of sugar-sweetened beverage consumption

The risk estimate has been done using the odds ratio to show association between gender and the level of consumption of sugar sweetened beverages. Results are presented in Table 4.4.

Table 4.4: Risk estimate of respondents' gender and level of sugar sugar-sweetened beverage consumption

Risk Estimate			
		95% Confidence Interval	
	Value	Lower	Upper
Odds Ratio for Gender (Male / Female)	1.002	.608	1.651
For cohort frequency of Consumption = Low	1.001	.765	1.310
For cohort frequency of Consumption = High	.999	.793	1.258
N of Valid Cases	249		

Table 4.4.illustrates that the odds ratio for gender is equal to 1.002 C.I (0.608-1.651) implying there is no significant difference on the level of sugar-sweetened beverages consumption among male and female students in the survey.

4.2.2b: Risk estimate of class of respondents and level of SSBs consumption

Table 4.5 illustrates the odds ratio analysis for forms three against four respondents. Analysis shows that form four students are 17% (O.R=0.83 C.I 0.5-1.367) less likely to consume sugar-sweetened beverages than form three students.

Table 4.5: Risk estimate of class of respondents and level of SSBs consumption

Risk Estimate			
		95% Confidence Interval	
	Value	Lower	Upper
Odds Ratio for Class (Form Three / Form Four)	.830	.504	1.367
For cohort frequency of Consumption = Low	.904	.691	1.184
For cohort frequency of Consumption = High	1.090	.866	1.372
N of Valid Cases	249		

4.2.2c: Level of SSBs consumption disaggregated by gender and class of respondents

Table 4.6 shows that there was an equal level of consumption (50%) among male form four respondents. There was a notable difference in consumption among male form four and form three respondents; low 41.7% in form three and 50% form four; High 58.3% among form three against 50% form four. Among female respondents, there was a minimal difference among the high level of consumption among form four (53.6%) and form three respondents (54.1%).

Table 4.6: Level of sugar-sweetened beverage consumption disaggregated by gender and class of the respondents

Gender	Form	level of Consumption	Frequency	Percent
Male	Form Three	Low	25	41.7
		High	35	**58.3**
		Total	**60**	**100.0**
	Form Four	Low	36	50.0
		High	36	50.0
		Total	**72**	**100.0**
Female	Form Three	Low	28	45.9
		High	33	**54.1**
		Total	**61**	**100.0**
	Form Four	Low	26	46.4
		High	30	53.6
		Total	**56**	**100.0**

4.2.3 Volume of sugar-sweetened beverages consumed by students.

Volumes of SSB were classified under 300mls, 500mls, and 1 litre. The table 4.7 displays frequencies and percentages of volumes of particular SSBs consumed by students.

Table 4.7: Volume of sugar-sweetened beverages consumed by Students

Soda	**Frequency**	**Percent**
300mls	163	**65.5**
500mls	72	28.9
1 litre	14	5.6
Total	**249**	**100.0**
Energy Drink	**Frequency**	**Percent**
300mls	134	**53.8**
500mls	101	40.6
1 litre	14	5.6
Total	**249**	**100.0**
Fruit Drinks	**Frequency**	**Percent**
300mls	122	49.0
500mls	101	40.6
1 litre	26	10.4
Total	**249**	**100.0**
Sweetened Beverages like tea, coffee	**Frequency**	**Percent**
300mls	120	**48.2**
500mls	88	35.3
1 litre	41	16.5
Total	**249**	**100.0**

Information from Table 4.7 illustrates that majority of the students preferred consuming 300mls of identified sugar-sweetened beverages Soda at 65.5%, Energy drink at 53.8%, Fruit Drinks at 49%, and Sweetened beverages at 48.2%.

4.3: Nutritional knowledge of respondents

In this section a few aspects on contents and health effects of SSBs were assessed. Nutrition knowledge was measured using nutritional composite score. Table 4.8 illustrates the proportion of respondents' response to nutritional knowledge statements

Table 4.8: Nutritional-related knowledge aspects of sugar-sweetened beverages

SSBs are High in Sugar	Frequency	Percent
False	14	5.6
True	223	**89.6**
No Idea	12	4.8
Total	249	100.0
100% fruit Juice is high in Calories	Frequency	Percent
False	66	26.5
True	91	36.5
No Idea	92	**36.9**
Total	249	100.0
High Levels of SSBs consumption contributes to overweight	Frequency	Percent
False	91	36.5
True	106	**42.6**
No Idea	52	20.9
Total	249	100.0
High levels of SSBs consumption contributes to Dental erosion	Frequency	Percent
False	26	10.4
True	186	**74.7**
No Idea	37	14.9
Total	249	100.0
High levels of SSBs consumption contributes to diabetes	Frequency	Percent
False	23	9.2
True	198	**79.5**
No Idea	28	11.2
Total	249	100.0
One gram of sugar contain the same amount of calories as one gram of fat	Frequency	Percent
False	82	32.9
True	52	20.9
No Idea	115	**46.2**
Total	249	100.0
One gram of sugar contain the same amount of calories as one gram of Sweetener	Frequency	Percent
False	59	23.7
True	65	26.1
No Idea	125	**50.2**
Total	249	100.0

From table 4.8, 89% of respondents from the survey were in agreement that sugar-sweetened beverage contained high sugar content. Close to half 42.6% of respondents were able to correctly point out that SSBs contain high levels of calories and contribute to overweight. Majority of respondents 50.2% of respondents were able to distinguish the composition of one gram of SSB compared to either fat or sweetener.

4.3.1 Nutritional knowledge level on SSBs

According to data in Table 4.9 majority of respondents, 73.9% had moderate nutritional knowledge about sugar-sweetened beverages and only 19.7% had good knowledge about the sweetened beverage.

Table 4.9: Nutritional knowledge level of respondents on sugar-sweetened beverages

Knowledge Assessment Categories	Frequency	Percent
Poor Knowledge	16	6.4
Moderate	184	73.9
Good Knowledge	49	19.7
Total	**249**	**100.0**

4.3.2 Nutritional knowledge level of respondents on sugar-sweetened beverage consumption disaggregated by gender and class

Table 4.10 illustrates the difference in the level of knowledge among the study respondents by class and gender. Among male respondents, those with good knowledge of sugar-sweetened beverages, form four students had a higher proportion (26.4%) as compared to their counterparts in form three (16.7%). Among female respondents with good knowledge of sugar-sweetened beverage, form four respondents had a 12 fold higher proportion at 23.2% than form three respondents at 11.5%.

Table 4.10: Nutritional knowledge level of respondents on sugar-sweetened beverage consumption disaggregated by gender and class of the respondents.

Gender	Form	level of Knowledge	Frequency	Percent
Male	Form Three	Poor	6	10.0
		Moderate	44	**73.3**
		Good Knowledge	10	16.7
		Total	**60**	**100.0**
	Form Four	Poor	8	11.1
		Moderate	45	**62.5**
		Good Knowledge	19	26.4
		Total	**72**	**100.0**
Female	Form Three	Poor	1	1.6
		Moderate	53	**86.9**
		Good Knowledge	7	11.5
		Total	**61**	**100.0**
	Form Four	Poor	1	1.8
		Moderate	42	**75.0**
		Good Knowledge	13	23.2
		Total	**56**	**100.0**

4.3.3 Cross-tabulation of nutritional knowledge and level of SSB consumption

The inferential analysis in table 4:11 was done to find out if nutritional knowledge of high school students in the survey was associated with the level of sugar-sweetened beverages.

Table 4.11: Cross-tabulation of nutritional knowledge and level of SSB consumption

Level of Consumption	Poor	Moderate	Good	$\chi^2(df)$	*p-value*
Low	4(3.5)	82(71.3)	29(25.2)	3.11(2)	0.211
High	12(9)	102(76)	20(15)		

The results in Table 4:11 show no significant association (p=0.211) with the level of SSBs consumption.

4.4 Attitudes of respondents towards sugar-sweetened beverages

Attitudes towards SSB consumption was measured using a 5 point Likert scale. Attitude towards SSBs was classified as either negative or positive. Table 4.12 illustrates attitudinal response on sugar-sweetened beverages.

Table 4.12: Attitude of respondents towards SSB consumption

When I drink SSBs I feel Satisfied	Frequency	Percent
Strongly Agree	67	26.9
Agree	107	43.0
Neither agree nor Disagree	49	19.7
Disagree	15	6.0
Strongly Disagree	11	4.4
Total	**249**	**100.0**
Drinking SSBs is Healthy		
Strongly Agree	29	11.6
Agree	72	28.9
Neither agree nor Disagree	77	30.9
Disagree	52	20.9
Strongly Disagree	19	7.6
Total	**249**	**100.0**
Difficulty in drinking less SSBs		
Strongly Agree	34	13.7
Agree	54	21.7
Neither agree nor Disagree	29	11.6
Disagree	97	39.0
Strongly Disagree	35	14.1
Total	**249**	**100.0**
Soft Drink's good taste		
Strongly Agree	87	34.9
Agree	124	49.8
Neither agree nor Disagree	20	8.0
Disagree	11	4.4
Strongly Disagree	7	2.8
Total	**249**	**100.0**
My parent's approval to drink lessSSB		
Strongly Agree	60	24.1
Agree	96	38.6
Neither agree nor Disagree	30	12.0
Disagree	37	14.9
Strongly Disagree	26	10.4
Total	**249**	**100.0**
School Canteen should increase the prices of SSbs		
Strongly Agree	25	10.0
Agree	25	10.0
Neither agree nor Disagree	21	8.4
Disagree	83	33.3
Strongly Disagree	95	38.2
Total	**249**	**100.0**

From the results in Table 4.12, Close to 43%of respondents felt satisfied when they drank SSBs, 30% neither agreed nor disagreed that drinking sugar-sweetened beverages were healthy. Less than 10% strongly disagreed that drinking SSB was bad. Half of the respondents (49.8%) were in agreement that soft-drinks had good taste and that at least 38.6% had their parent's consent to drink less sugar-sweetened beverages. About 38% strongly disagreed with a price increase of sugar-sweetened beverages in the school canteen.

4.4.1 General attitude assessment towards sugar-sweetened beverages

An attitude composite score of 0-5 was calculated from the mean of responses; where Students mean score of less than 2.5 was considered to have a negative attitude. That whose mean score was above 2.6 but less than 5 was considered to have a positive attitude. Table 4.13 displays at attitude satisfaction of students. More than half of respondents 57% expressed a positive attitude towards.

Table 4.13: Attitude held by respondents on sugar-sweetened beverages

Attitude Satisfaction	Frequency	Percent
Negative	107	43.0
Positive	142	**57.0**
Total	249	100.0

4.4.2 The attitude of respondents towards SSB consumption disaggregated by gender and class.

Table 4.14 illustrates a comparative perceived attitude level towards SSB among sugar-sweetened beverages. From table 4.14, data shows 62.3% of female form three and 71.4% form four respondents expressed a positive attitude towards SSB consumption.

An equal proportion (50%) of form four male respondents held both negative and positive attitude towards sugar-sweetened beverage consumption.

Table 4.14: Attitude of respondents towards SSB consumption desegregated by gender and class

Gender	Class	Attitude level	Frequency	Percent
Male	Form Three	Negative	32	53.3
		Positive	28	46.7
		Total	**60**	**100.0**
	Form Four	Negative	36	50.0
		Positive	36	50.0
		Total	**72**	**100.0**
Female	Form Three	Negative	23	37.7
		Positive	38	62.3
		Total	**61**	**100.0**
	Form Four	Negative	16	28.6
		Positive	40	71.4
		Total	**56**	**100.0**

4.4.3 Cross-tabulation of attitudes of the respondents and their level of SSB consumption

Table 4.15 displays across-sectional analysis of attitudes of students and frequency of sugar-sweetened beverages. Chi-square analysis shows an association between the attitude of students and frequency of sugar-sweetened beverages among respondents in the survey

Table 4.15: Cross tabulation of attitudes and level of SSB consumption of the respondents

Level of Consumption	Attitude level		$\chi^2(df)$	*p-value*
	Negative (%)	**Positive (%)**		
Low	42(36.5)	73(63.5)	3.628(1)	**0.05**
High	65(48.5)	69(51.5)	(N=249)	

4.5 Demographic factors and level of SSBs consumption

4.5.1 Gender and SSBs level of consumption

Table 4.16 illustrates cross-tabulation of gender and extent of SSB consumption. From the table, the gender of respondents was closely associated with frequent consumption of sugar-sweetened beverages χ^2 *(df=1)* (1.401, *N* =249) *p=0.03*.

Table 4.16: Cross-tabulations: Gender and SSB level consumption of the respondents

	Gender		χ^2 *(df)*	*p-value*
level of Consumption	Male (%)	Female (%)		
Low	61(53)	54(47)	1.401(1)*(N=249)*	**0.03**
High	71(53)	63(47)		

4.5.2 Age and the level of SSBs consumption

Results displayed in table 4.17 illustrates cross-tabulation analysis between age and the level of SSB consumption indicate that age of respondents is directly associated with frequent consumption of sugar-sweetened beverage consumptionχ^2 *(df)* (9.038 N=249), *p=0.029.*

Table 4.17: Cross tabulation: Age of respondents and their levels of SSB consumption

Level of Consumption	**Age**				χ^2 *(df)*	*p-value*
	16(%)	**17(%)**	**18(%)**	**19(%)**		
Low	15(13)	40(34.8%)	39(33.9)	21(18.3)	9.038(3) (*N=249*)	**0.029**
High	34(25.4)	47(35.1)	41(30.6)	12(9)		

4.5.3 Class of the respondents and sugar-sweetened beverages consumption

Table 4.18 illustrates the association between class of students and level of sugar-sweetened beverages. There was no direct relationship between class and frequency of

consumption $\chi^2(df)$ (15.08, N=249), $p = 0.463$

Table 4.18:Cross-section: class of respondents and level of sugar-sweetened consumption

Level consumption	Form Three	Form Four	$\chi^2(df)$	*p-value*
Low	53(46.1)	62(53.9)	**0.538*(1)*** (N=249)	0.463
High	68(50.7)	66(49.3)		

4.5.4 parent/guardian's education level and level of consumption

Table 4.19 illustrates cross-tabulation between the student's parent/guardian's education level and frequency of consumption of sugar-sweetened beverages. Chi-square analysis shows that there was no significant association between parent/guardian's level of education and consumption of sugar-sweetened beverages.

Table 4.19: parent/guardian's education level and level of SSB consumption

Level of Consumption	Parent's education level				$\chi^2(df)$	*p-value*
	None	Primary	Secondary	Tertiary		
Low	23(20)	21(18.3)	41(35.7)	30(26.1)	**6.682(3)** (N=249)	**0.083**
High	30(22.4)	41(30.6)	39(29.1)	24(17.9)		

4.5.5 Parent/guardian's occupation and sugar-sweetened beverage consumption

Table 4.20 illustrates the relationship between the parent/guardian's occupation and frequency of sugar-sweetened beverages. Chi-square analysis reveals no significant association between parent/guardian's occupation and level of sugar-sweetened beverage consumption

Table 4.20: Cross-tabulation: parent/guardian's occupation and SSB consumption

The Level of Consumption	Occupation of parent/guardian					$\chi^2(df)$	*p-value*
	Paid Work N (%)	**Retired N (%)**	**Unemployed N (%)**	**Business N (%)**	**Casual Labourer N (%)**		
Low	26(22.6)	19(16.5)	15(13)	35(30.4)	20(17.4)	0.538(1) (N=249)	0.463
High	28(20.9)	23(17.2)	22(16.4)	37(27.6)	24(17.9)		

Test of hypothesis: Regression Analysis

The study sought to test the following hypotheses:

1. There is no association between Demographic factors and level of Sugar- sweetened Beverages consumption among high schools students in Likuyani Sub-county,
2. There is no association between nutritional knowledge and level of Sugar-sweetened Beverages consumption among high schools students in Likuyani Sub-county
3. There is no association between attitude and level of Sugar-Sweetened Beverages consumption among high schools students in Likuyani Sub-county

Table 4.21 Displays regression analysis

Regression analysis illustrating predictors to the level of SSB consumption among respondents

Regression Analysis	Sig.	Exp(B)	95% C.I.for EXP(B)	
			Lower	Upper
Nutrition Knowledge Level	**0.021**	1.439	.899	2.303
Attitude of Respondents	**0.045**	.704	.389	1.274
Gender of Respondents	0.887	1.041	.601	1.802
Age of Respondents	**0.003**	.622	.453	.853
Form of Respondents	0.457	1.246	.698	2.226
Parent/guardian's Education	**0.037**	.750	.572	.983
Parent/guardian's Occupation	0.582	.945	.773	1.156
N	249			
Constant	.021	12.497		

Table 4.21 illustrate that coefficients of Nutritional knowledge Attitude, Age and parent/guardian's educational level are statistically significant as such, influence sugar-sweetened beverage consumption. They were significant predictors of sugar-sweetened beverage consumption. Regression analysis displayed in Table 4.2.1illustrate that there is a strong association between, nutritional knowledge (p=0.021), attitude (0.045), age (0.003) and parent/guardian's educational levels (0.037). As such the null hypotheses were rejected.

1. Chi-square test only indicated an association between age (0.029) and gender (0.003) with the level of SSBs consumption. However, regression analysis showed that age and breadwinner's education level were directly associated with the level of SSBs consumption. Thus the null hypothesis was rejected based on the few socio-

demographic factors found significant

2. Bivariate analysis revealed no significant association between nutrition knowledge *(p=0.211*) with the level of SSB consumption, however, regression analysis, invalidates chi-square analysis to establish a strong predictor of SSB beverage consumption (*p=0.021*). As such, the null hypothesis was rejected.
3. Attitude was found significant in both bivariate analysis (0.05) and regression analysis (0.045) and as such the null hypothesis was rejected.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter discussed analyzed data and the plausible implication of the study, conclusion and recommendations. The discussion was presented as per the objectives of the study as well as the hypothesis tested.

The Specific objectives of the study were

i. To determine the type and frequency of SSBs consumption among high school students.
ii. To examine nutritional knowledge of SSBs by high school students.
iii. To assess attitudes towards consumption of SSBs by high school students.
iv. To assess the relationship between demographic factors and consumption of SSBs.

5.2 Frequency of sugar-sweetened beverage consumption

This study established that more than half (53.8%) of high students surveyed consumed high amounts of sugar-sweetened beverages. This corroborates Ventura and colleagues (2010) study which reported high daily consumption of SSBs in U.S.A in both adults and children. Closely looking into particular beverage consumption reveals a skewed pattern in the frequency of sugar-sweetened beverages. For instance, soda was consumed by majority of the respondents at least once a month though others (25%) cited once a week. The energy drinks were the least consumed with the majority (39%) indicating that they do not consume these drinks at all; at least 10% of respondents consuming them either three times a week or once a week. Of all Sugar-sweetened

beverages, sweetened beverages such as coffee or tea were highly consumed. This contrasts Han and colleagues (2014) study on consumption patterns of SSBs in the U.S.A, which revealed that Soda was the most heavily consumed SSB among adolescents.

The frequency of consumption indicates that sweetened beverages like tea and coffee were consumed at least twice daily by 37.3% of the respondents. With regards to volume consumed, across all beverages listed, 300ml was highly consumed.

Findings on the frequency of sugar-sweetened beverages was self-reported as such, prone to reporting bias, therefore, cannot be generalized to other population of the same age group. Descriptive analysis indicates a low consumption of soda, fruit drinks, and energy drinks majorly limited to at least once a week or not. Whilst, the aforementioned drinks are easily accessible to the respondents, affordability, and ease could be a plausible reason to low frequency consumption rates. Findings further illustrate no difference in sugar-sweetened beverage consumption among male and female respondents (OR=1). Cross-sectional national Study by Miller and colleagues (2017) among American high school students revealed a ten-fold decrease in soda consumption between the years 2007-2015. Across the identified sugar-sweetened beverages, this study has established that at least half of respondents (50%) consumed the 300ml by volume. Ombongi (2009) study among school going children in Kenya established that 70% of pupils sampled consumed at least 300ml of sugar-sweetened beverages. Malik and Hu (2013) epidemiological prospective study revealed that one serving per day of sugar-sweetened beverage is directly proportionate to 0.06 unit increase in Body Mass

Index (BMI) as such promotes weight gain more so in children and adolescents predisposing them to cardio metabolic disease risk

5.3 Nutritional knowledge of students regarding sugar-sweetened beverages

Nutritional knowledge contributes significantly towards eating habits. This study assessed student's nutritional knowledge on sugar-sweetened beverages. Findings illustrated that students were fully aware that SSBs contained high sugar calories. The findings in Table 4.8 showed that, at least 42.6% of students mentioned that sugar-sweetened beverages contributed to weight gain, dental erosion (74.7%) and diabetes (79.5%). Descriptive analysis on knowledge composite score, reveals that overall, respondents had moderate knowledge level on the effects of SSBs on health. In addition, respondents exhibited limited knowledge on calorie levels of sugar and fat. Bivariate analysis revealed no significant association *(p=0.211*) with the level of SSB consumption, however, regression analysis, invalidates chi-square analysis to establish a strong predictor of SSB beverage consumption (*p=0.02*). As such, the null hypotheses were thus rejected. This finding contrasts with Mbithe and others (2015) study findings wherein, despite majority of students exhibiting moderate knowledge on the ill effects of unhealthy sugary dinks, there was no significant relationship between nutritional knowledge and the level of SSBs consumption.

This underscores the critical need to raise awareness among children and adolescents on what to look for on labels on packaging as well as the merits and demerits of the content in the Sugar-Sweetened Beverages. Increased knowledge of food value improves dietary practices whereby people understand how to utilize a healthy diet for greater

benefits to their health. Achieving this calls for clear methods or ways of displaying nutritional information, easily readable to this cohort of the population.

5.4 Attitudes towards sugar-sweetened beverages

Attitude is one of the key determinants of food choice and consumption. It is determined through an assessment of one's beliefs regarding the consequences arising from behavior and an evaluation of the desirability of these consequences. This study assessed attitudes towards Sugar-Sweetened Beverages consumption. Findings indicated that more than half of the respondents in the survey expressed a positive attitude towards sugar-sweetened beverages. This finding corroborates evidence from a Nigerian study by Fadupin and others (2014) among university students in Ibadan University where majority of the students expressed a positive attitude towards sugar-sweetened beverages. Taiwanese study by Lun-Su (2012) among high school students established that students with negative attitudes towards SSBs were likely to drink less sugar-sweetened beverages. Positive attitudes towards SSBs consumption, however, contribute to a high consumption of the same. Kinyua (2013) asserts that attitudes towards healthy food choices could be influenced by the nature of the environment. As such, it is paramount that school set-ups be able to promote a positive attitude towards desirable nutritional lifestyle. Given an environment such as high schools in Kenya, peer influence is more likely to contribute to a positive attitude towards high Sugar-Sweetened Beverage consumption. Presence of Nutritional Counseling sessions in school set-ups would perhaps contribute significantly to desirable attitudes on SSBs. Sartor *et al.*, (2011) asserts that factors such as aesthetic values of food or health benefits of food, influence intention of an individual towards consumption of certain

foods and sensations towards foods differ from one individual to another, for example, one may find a food to be too sweet, while another may not perceive it the same way.

5.5 Relationship between demographic factors and sugar-sweetened beverages consumption

Chi-square test of independence showed a direct association between select demographic variables and consumption of sugar-sweetened beverages. Statistics revealed that gender of respondents was directly associated with the level of consumption of Sugar-Sweetened Beverages identified. This study did not establish an association between class of respondents and frequency of consumption of sugar-sweetened beverages. This finding disagrees with Bere *et al*., (2018) study, wherein inferential analysis established that the class of respondents was associated with frequency of soda consumption.

All respondents in this survey were teenagers with majority aged eighteen years old. Chi-square analysis and binary logistic analysis indicated a direct association with consumption of sugar-sweetened beverages. This finding was consistent with Andersen, Myhre, & Paulsen (2016) study whereby analysis showed an increase in age among study respondents was significantly associated with frequent coffee consumption. Ochola and Masibo (2014) assert that school age and adolescence is a dynamic period of growth and development forming a strong foundation for good health and productive adult life. Thus, they noted that appropriate dietary intake is critical for forming good eating habits and provides the much-needed nutrients for growth, long-term health, cognition, and educational achievements. This study has not established an association

between parent/guardian's educational level, occupation and student's frequency of sugar- sweetened beverage consumption at the bivariate level. However, on regression analysis, parent/guardian's educational level was established to be a predictor of sugar-sweetened beverage consumption. This finding validates Kasusu and Nyamunye. (2012) assertions that adolescents' frequency of sugar-sweetened beverage consumption is influenced by the education level of the parents. Additionally, this evidence corroborates findings from Mise, *et al*., (2012) study which established that Kenya's parents are the major influencers of soft drinks consumption.

5.6 CONCLUSION

This study has established that frequency of consumption of Sugar Sweetened beverages varies depending on the type of beverage, and that overall, the more than half of the students' surveyed reported consuming high amounts of sugar-sweetened beverages. Observations from the study showed that energy drinks were the least consumed while sugar-sweetened beverages like tea, coffee and cocoa were the most highly consumed SSBs. By volume, 300ml packing was most preferred by all respondents across all classes of study. Moderate nutritional knowledge on possible effects of SSBs such as weight gain and dental erosion was observed among respondents. There was however, limited knowledge on calorie composition components of SSBs. Regression analysis, illustrated that there was direct relationship between nutritional knowledge and consumption of the Sugar-Sweetened Beverages. Further, this study has established that majority of the students expressed a positive attitude towards SSBs consumption. Additionally, this study has established a direct association between gender, age, attitude, Nutritional knowledge and consumption of sugar-sweetened beverages.

Overall, the study has been able to achieve its specific objectives as outlined in the summary above.

5.7 RECOMMENDATIONS

The following recommendations were made in light of the study findings.

- The Ministry of Health in conjunction with the Ministry of Education to incorporate nutritional literacy in the education programs for the students to be aware of the demerits of consuming Sugar-Sweetened Beverages. This will also contribute to change in attitude and eventually change in behavior.
- The government and other organizations to formulate and enforce policy guidelines on the use of sweeteners such as high fructose corn syrup in the manufacture of SSBs.
- Policy makers to come up with interventions that will discourage youths from consumption of SSBs.

5.8 AREAS OF FURTHER RESEARCH

Further studies to be carried out to cover aspects like the influence of health education and taxation on consumption of SSBs

This study did not analyze data as per the categories or types of schools in relation to SSBs consumption and therefore future researches should explore the relationship between the type of school (boarding or day school, mixed or pure girls' /boys' school, private schools and then urban/ rural schools) and SSBs consumption.

REFERENCES

Aila, F. O., Ondiek, G., Mise,J, K..& Odera, O. (2012). impact of channel strategy on customer value of Kenyan soft drink companies. *interdisciplinary journal of contemporary research in business*, *3*(9*);1256-66.http://profiles.uonbi.ac.ke/files/impact.pdf.*

Ajzen, I. (1991). Organizational Behavior and Human Decision Processes. *Elsevier*, 179-211.

Avery A, Bostock, L. And McCullough F. (2015). A systematic review investigating interventions that can help reduce consumption of Sugar-sweetened beverages in children. *JHum Nutr.Diet.2015 Jan: 28(suppli):52-64*

Barclay A and B Miller (2017). Declining consumption of added sugars and sugar sweetened beverages in Australia: a challenge for obesity prevention. *The American Journal of Clinical Nutrition,* vol 105, issue 4, https://doi.org/10.3945/ajcn.116.45318.

Bere, E., Bolt-Evensen K, Vik FN, Klepp KI(2018). Consumption of sugar sweetened beverages and artificially sweetened beverages from childhood to adulthood in relation to socio-economic status -15 year follow-up in Norway. *International journal of behavioural nutrition and Physical Activity 2018.15:8. https://doi.org/10.1186/512966-018-0646-8*

Boseley Sarah (2014). Mexico enacts soda tax in effort to combat world's highest obesity rate/World*...the guardian.com.https://www.the guardian.com>...*

Carmen L, Veronica C, Marian L, Neuhouseer, Valerio G, and Antonio R (2015). Students' consumption of beverages and snacks at school and away from school. A case study in the North East of Italy. *Front Nutr.2015;2:30. Doi:10.3389/fnut.2015.00030.PMCID:PMC4595772*

Centers for Disease Control and Prevention (2013). National Diabetes Fact Sheet, National Estimates and General Information on Diabetes and Prediabetes in the United States (www. Document).URL http://www.cdc. Gov/diabetes/pubs/estimates//s.htm (accessed 15 Jan 2013).

Fadupin G, Ogunkunle MO & Gabriel OO (2014). Knowledge, attitude and consumption pattern of alcoholic and sugar-sweetened beverages among undergraduates in a Nigerian University. *Afr. J. Biomed. Res. Vol.17); 75- 82*

Gase, L. N, Roble SB, Barragan NC, KUOT (2014). Relationship between Nutritional knowledge and the amount of SSB consumed in Los Angeles County. *Health Educ. Behav.https;//doi.org/10.1177/1090198114529128*

Gunnars,K.(2015). Reasons why Sugar is bad for you *.https://justnaturallyhealthy.com.>author*

Han, E. Lisa M, Powell (2014). Consumption patterns of Sugar Sweetened Beverages in the United States. Acad. *Nutr. Diet.2013:113:43-53[PMC free article][Pul med]*

Kasusu K., Nyamurye K.(2012). Health and Oral Health related knowledge, attitudes and behaviours. Astudy of Secondary School students in Dar-es Salaam, Tanzania.Across-sectional study of 16-20 year old students. The univesity of Bergen. Collections. *Centre for International Health. http://hdl.handle.net/1956/6187*

Kinyua L.W., (2013). Association of Nutrition, Knowledge Attitude with dietary practices and nutritional status of female undergraduate students attending university colleges within Nairobi Metropolis.*Erespository.uonbi.ac.ke.>handle>kinyua*

Kothari CR(2004) Research Methodology: Methods andTechniques. *New Age international*; 2004

Laura,O.Connor,E. ,Imammura,Z.Yasuaki H. Nita, G. (2015). Consumption of SSBs,artificially sweetened beverages and fruit juice and incidence of T2D.*BMJ2015;351;h3576* *https://doi.org/10.1136/bmj.h3576*

Leech Joe (2015) 13 ways that sugary soda is badfor your health.*https://www.healthline.com>nutrition*

Malik VS, Pan A, Willett WC,Hu FB. (2013). Sugar-sweetened beverages and weight gain in children and adults: a systematic review and meta-analysis. *American Journal of Clinical Nutrition. 2013;98(4):1084-102.*

Mbithe D, Kigaru, Cornelia L,C.W.Macharia, Mutie and ZipporahW(2015). Nutrition Knowledge,Attitude and practices among urban Primary School children in Nairobi City, Kenya. A KAP study. *BMC Nutrition, BMC services. https://doi.org/10.1186/540795-0040-8*

Mercola(2015).Drinking Sugary drinks increases risks of heart disease. *http;//articles.mercola;com/sites/articles/---/2015/--/sugary drinks-heart disease-risks*.

Miller G, Merlo C, Demissie Z; Sliwa S, Park S, (2017). Trends in Beverage Consumption Among High School Students — the United States, 2007–2015. *Weekly* 66(4); 112–116

Mugenda,O. M. and Mugenda, A. G. (1999). Research methods: Quantitative and Qualitative methods. *Acts press. Nairobi Kenya; 5:43.*

Nelia P Steyn & Norman J Tempe (2012). Evidence to support a food-based dietary guideline on Sugar consumption in South Africa. *BMC Public Health*: Vol 12:502 https://doi.org/10.1186/1471-2458-12-502

NesheimM.and Nestle M.(2012). The internationalization of the obesity Epidemic. The case of Sugar sweetened sodas. *Oxford University Press. Doi:10.1093/acprof:oso/9780198733201.003.0005.*

Ochola S and Masibo P (2014).Dietary intake of school children and adolescents in developing countries.*Ann NutrMetab 2014;64 (suppl2):24-40. https://doi.org/10.1159/000365125*

Ombongi G (2013). The contribution of sugar-sweetened beverages to caloric and Vitamin C Dietary Intake and Nutritional Status of School Children aged 10-13 years in Westlands Nairobi. Unpublished Master's Thesis. The University of Nairobi.

Paulsen, M. M., Myhre, J. B., & Andersen, L. F. (2016). Beverage Consumption Patterns among Norwegian Adults. *Nutrients, 8(9)* pg561. doi.org/10.3390/nu8090561

Pan A, HU FB (2011). Effects of carbohydrates on satiety: differences between liquid and solid food. *Current Opinion in Clinical Nutrition and Metabolic Care.2011; 14(4):385-90*

Pieniak Z, Aertesens J, and Verbeke W, (2010). Subjective knowledge and objective knowledge as determinants of Organic vegetable consumption, Food quality, and preferences, *Nutrition Research online* Volume11, issue11, pages 1325-1332.

Rampersaud GC, Kim H, Gao Z, House LA (2014). Knowledge, Perception and behaviours of adults concerning non alcoholic beverages suggest some lack of comprehension related to sugars. *Nutr Res.2014 Feb;34(2): 134-42.doi:10.1016/j.nutres.2013.11.004.Epub2013 Dec4*

Renata M., Singh,G. Shehab K, Pellin S (2012). Global, Regional, and National consumption of Sugar-sweetened Beverages, Fruit Juices, and Milk, Asystematic assessment of beverage intake in 187 countries. *https://now.tufts.edu>news-releases>su...*

Republic of Kenya (2012a, 5).Kenya Health Policy 2012-2030. Ministry of Medical Services, Ministry of Public Health and Sanitation.

Republic of Kenya 2012b, National Nutrition Action Plan2012-2017. Nairobi; Ministry of Public Health and Sanitation. (Ministry of Health, 2012)

Sanjay B, Sukumar V, Sutapa A, Barry P, SharE(2014). Averting Obesity and Type 2Diabetes in India through SSB taxation, an economic-Epidemiologic modelling study.*https://www.ncbi.nlm.nih.gov>articles*

Sartor F, Donaldson,L. Markland DA, Loveday H, Jackson MJ, Hans-Peter Kubis (2011). Soft drinks affect taste.*www.bristol.ac.uk>110609-sweet*

Singh GM, Mich R. Khatibzadek, S., Lim, S., Ezzatim, and MozaffarianD(2015). Estimated Global, Regional, and Nutritional Disease Burdens related to SSB consumption. *Circulation,Jour2015 Dol:10:1161/CIRCULATION AHA.114.010636*

Su, A. Y.-I..(2012). Factors influencing the consumption of Sugar-Sweetened beverages by Taiwanese Hospitality students. *Journal of Hospitality Marketing &Management.*3(3).doi:org/10.1080/19368623.2011.615019

Tugendhaft A, Mercy M, Jacob L, Lumbwe C (2015). The potential impact of a 20% tax on sugar-sweetened beverages on obesity in South Africa.*Occ Health Southern Africa.2014;20(5):6-8*

Ventura EE, Jaimie ND, and Goran Ml (2010). The sugar content of Popular Sweetened Beverages Based on Objective Laboratory Analysis. Focus on Fructose content.*Obesitydoi;10.1038/oby.2010.255.*

WHO, (2015). Guidelines: Sugars intake for adults and children. Geneva: *World Health Organisation http;//www.who.int/media centre/news/release/2015/ sugar-guideline/en/.*

Yang X, Huang C, Tian (2014)Sugar Sweetened Beverage consumption and the risk of Coronary heart diseases. A meta-analysis of prospective students. *Atherosclerosis.2014;234:11-16.doi:10.1016/j.atherosclerosis 2014.01.037*

Zoellner J, Estabrook PA, Davy BM, Chen YC,You W.(2012). Exploring the Theory of Planned Behaviour to explain SSBs consumption. *Journal of Nutrition Education and Behaviour, Volume 44, issue2, pages 172-177*

APPENDIXES

Appendix I: Consent form for the students

Hallow, my name is Fridah Khavayi, a masters student in Community Health at Kenyatta University. I am pleased to inform you that you have been identified to participate in the study on "Nutrition knowledge, attitude and consumption of sugar sweetened beverages among high school students in Likuyani Sub County, Kakamega County.

The main objective of the study is to assess the nutritional knowledge, attitude and the level of consumption of Sugar sweetened beverages among high school students in Likuyani sub county, Kakamega County.

Your responses will be treated very confidential and for research purposes only. You are kindly asked to sign this form for acceptance to participate in the study.

Sign----------Date----------

THANK YOU

Appendix II: Questionnaires

A) Socio-Demographic Characteristics

Tick appropriately

1. What is your gender? Male ☐ ☐ Female

2. How old are you…….

3. In which class are you? Form 3 ☐ Form 4 ☐

4. What is the level of education of your breadwinner?

    a) None

    b) Primary

    c) Secondary

    d) college/university

5. What is the occupation of your breadwinner?

    a) Employed

    b) Unemployed

    c) Retired

    d) Business

    e) Casual labourer

B) The frequency of consumption of Sugar-Sweetened Beverages (SSBs)

The following questions are about the frequency of consumption of SSBs.

1. How often do you consume the following drinks & beverages that contain sugar (tick where appropriate)

Type	None	Once per day	2x per day	3+ per day	1x time per Week	2-3 times a week	4+ times a week
Soda							
Sport/Energy drink							
Sweetened Tea/Coffee							
Fruit Drinks(Afia, Demonte)							

C) Volume of SSBs consumed

On the day you drank SSBs how much did you drink?

Type of beverage	300mls	500mls	1 litre
Soda			
Energy drinks			
Fruit drinks			
Sweetened beverages			

D) CONSUMER ATTITUDE TOWARDS SSBS.

2. The following statements were used to show the attitude of the respondents towards SSBs (**Please circle one answer in each row**).

	Strongly disagree	Disagree	Neither agree nor Disagree	Agree	Strongly Agree
Wheni drink SSBs i feel satisfied					
Drinking SSBs is healthy					
There is difficulty in drinking less SSBs					
Soft Drinks have a good taste					
My parents want me to drink less SSBs					
School canteen should increase the prices of SSBS					

Knowledge of Sugar-Sweetened Beverages

3. Please indicate whether the following statements are true or false (please circle one answer for each statement)

	False	**True**	**Don't Know**
Consumption of Sugar-Sweetened beverages is addictive			
SSBs are high in calories			
SSBs are high in sugar			
100% fruit juice is high in calories			
High levels of SSBs consumption contributes to overweight			
High levels of SSBs consumption contributes to dental cavity/erosion			
High levels of SSBs consumption is associated with diabetes			
High levels of SSBs consumption is associated with High blood pressure			
High levels of SSBs consumption is associated with Asthma			
One gram of sugar contains the same amount of calories as one gram of fat			
One gram of sugar contains more amounts of calories than one gram of sweetener.			

Appendix III: Research approval

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 12th August, 2015

TO: Ms. Fridah Mmbaya
C/o Community Health Dept.
KENYATTA UNIVERSITY

REF: I57/12145/04

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the Graduate School Board at its meeting of 29th July, 2015 approved your M.P.H. Research Proposal entitled "Nutrition Knowledge, Attitudes and Consumption of Sugar Sweetened Beverages among High School Students in Likuyani Sub-County, Kakamega County".

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission of Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking Forms per semester. The form has been developed to replace the progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.

SILVERIA THIONG'O
FOR: DEAN, GRADUATE SCHOOL

c.c. Chairman, Community Health Dept.

Supervisors:

1. Prof. Judith Waudo
   C/o Foods Nutrition & Dietetics Dept.
   Kenyatta University
2. Dr. Samuel Mwangi
   C/o Sociology Dept.
   Kenyatta University

ST/cao

Appendix IV: Research authorization

TEACHERS SERVICE COMMISSION

Telephone: (020)8163419
Email:likuyanideo@yahoo.com

When replying please quote
Ref: KAK/LIK/373942/

TSC COUNTY DIRECTOR KAKAMEGA COUNTY
P.O. BOX 224-30205
MATUNDA
5TH JULY,2015

FRIDAH MMBAYA

TSC NO.373942

Thro'

Head teacher
St.Annes Nzoia Girls Secondary school
P. o box 343
Moi's bridge.

RE: AUTHORITY TO CONDUCT RESEARCH ON NUTRITION KNOWLEDGE ,ATTITUDE AND CONSUMPTION OF SUGAR SWEETENED BEVERAGES AMONG HIGH SCHOOL STUDENTS IN LIKUYANI SUB-COUNTY. – W.E.F 5TH JULY 2015.

The above mentioned is a student in **Kenyatta University**. She has been granted permission to carry out research in this District as indicated above.

Kindly accord her the necessary assistance she may need.

IYADI FUNDIA
FOR: DISTRICT EDUCATION OFFICER
LIKUYANI SUB-COUNTY.

Appendix V: Ethical approval

KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE

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Our Ref: KU/R/COMM/51/559

Date: 16th October, 2015

Fridah Mmbaya
Kenyatta University,
P.O Box 43844, Nairobi.

Dear Fridah

RE APPLICATION NUMBER PKU/402/I 371– "NUTRITION KNOWLEDGE ATTITUDES AND CONSUMPTION OF SUGAR SWEETENED BEVERAGES AMONG HIGH SCHOOL STUDENT IN LIKUNYANI SUB-COUNTY KAKAMEGA COUNTY, KENYA".– VERSION 2

1. IDENTIFICATION OF PROTOCOL
The application before the committee is with a research topic, "**Nutrition knowledge attitudes and consumption of sugar sweetened beverages among high school student in Likunyani Sub-County Kakamega County, Kenya**" – **Version 2 dated** 29th September, 2015.

2. APPLICANT
Fridah Mmbaya

3. STUDY SITE
Kakamega County, Kenya

4. DECISION
The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines **AND APPROVED that the research may proceed for a period of ONE year from 16th October, 2015.**

5. ADVICE/CONDITIONS
i. Progress reports are submitted to the KU-ERC every six months and a full report is submitted at the end of the study.
ii. Serious and unexpected adverse events related to the conduct of the study are reported to this board immediately they occur.
iii. Notify the Kenyatta University Ethics Committee of any amendments to the protocol.
iv. Submit an electronic copy of the protocol to KUERC.

If you accept the decision reached and advice and conditions given please sign in the space provided below and return to KU-ERC a copy of the letter.

KENYATTA UNIVERSITY OFFICE OF THE CHAIRMAN 16 OCT 2015 ETHICS REVIEW COMMITTEE P.O BOX 43844 - 00100 NAIROBI

PROF. NICHOLAS K. GIKONYO
CHAIRMAN ETHICS REVIEW COMMITTEE

I ..FRIDAH K. MMBAYA..accept the advice given and will fulfill the conditions therein.

Signature..... Dated this day of..26TH OCTOBER.. 2015.

cc. Vice-Chancellor

Appendix VI: NACOSTI permit

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/81276/10428**

Date: **20th April, 2018**

Fridah Khavayi Mmbaya
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Nutrition knowledge, attitudes and consumption of sugar sweetened beverages among high school students in Likuyani Sub County, Kakamega County,"*** I am pleased to inform you that you have been authorized to undertake research in **Kakamega County** for the period ending **20th April, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Kakamega County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

DR. STEPHEN K. KIBIRU, PhD.
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kakamega County.

The County Director of Education
Kakamega County.

Appendix VII: Map likuyani sub-county