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

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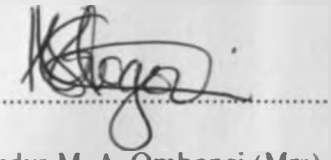
Declaration

This dissertation is my original work and to the best of my knowledge has not been presented for a degree or any award in any other university.



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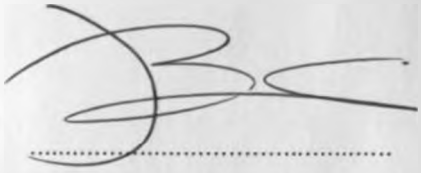
This dissertation has been submitted for examination with our approval as university supervisors.



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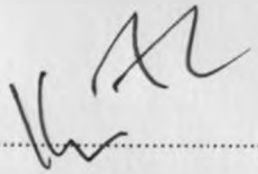

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Dedication

This work is dedicated to my family Kenneth, Crystal and Ethan, Mum and Dad.

Acknowledgement

This work was realised through the sacrifice, support and dedication of many committed people. My supervisors, Prof. Jasper K. Imungi, Prof. Edward G. Karuri and Prof. Wambui Kogi-Makau spent countless hours reviewing my work. I particularly wish to thank Prof. J.K. Imungi, for the dedication and commitment with which he meticulously reviewed the dissertation during the preparation stage. The long hours we spent together carefully putting piece by piece to make a whole, will forever leave me indebted. I also wish to extend my gratitude to other lecturers namely Dr. W. Ekaya, Mrs P. Kurji, and Mr E. Obudho for lending a hand in experimental design during the proposal development stage.

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Acronyms and Abbreviations

- Bx – Degrees brix
- BMI – Body mass index
- FGD – Focus group discussion
- g – gram
- HPLC – High performance liquid chromatography
- Kcal – Kilocalorie
- KEBS – Kenya Bureau of Standards
- KSh – Kenya shilling
- ml – millilitre
- mg – milligram
- MoE – Ministry of Education
- MPPS – Modified proportionate probability to size
- PPS – Proportionate probability to size
- RDA – Recommended dietary allowance
- RDI – Recommended dietary intake
- SES – Socioeconomic status
- SSBs – Sugar sweetened beverages
- WHO – World Health Organisation
- BAZ – BMI-for-age Z scores
- HAZ – Height-for-age Z scores

Operational Definitions

- **Added sugar**

Throughout this study added sugar referred to all the sugar that was present in the SSB during analysis. The intrinsic and extrinsic type of sugar present in the sugar sweetened beverages (SSBs) was classified as 'added sugar' since they are chemically indistinguishable.

- **Household**

A household consisted of a group of related or unrelated persons, who lived together in the same dwelling unit, who acknowledged one adult male or female as the head of the household, who shared the same housekeeping arrangements, and who were considered to constitute one unit.

- **Nutritional status**

Throughout this study, nutritional status was determined using the height-for-age and BMI-for-age indices. This is because weight-for-age is inadequate for monitoring growth beyond childhood (around 10 years) due to its inability to distinguish between relative height and body mass. Therefore, the BMI-for-age complements the height-for-age in the assessment for thinness (low BMI-for-age), overweight and obesity (high BMI-for-age) and stunting (low height-for-age) in school aged children and adolescents.

- **School children**

Throughout this study, the age group that was referred to as school children comprised of children aged 10-13 years who attended public primary schools in Westlands division.

- **Sugar sweetened beverages**

Throughout this study sugar sweetened beverages (SSBs) meant fruit flavoured drinks. The drinks were either concentrated, in solid (reconstituted) or in ready to drink state. Fruit juices, fruit nectars, carbonated non-alcoholic drinks and fruit based soft drinks were excluded.

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

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University of Nairobi, 2009

1 ABSTRACT

Consumption of sugar sweetened beverages (SSBs) among school children is becoming increasingly common in Kenya today. Some of the beverages are attractive to parents and guardians of the children because they contain nutritional label claims, which are not necessarily authenticated. Vitamin C is among the nutrients that are very commonly claimed to be present in these beverages. Excessive and prolonged consumption of the beverages is likely to result in positive energy balance, leading to overweight and possibly obesity in the children. The present study was therefore designed to investigate the contribution of SSBs to dietary intake of calories and vitamin C, and nutritional status of school children in Westlands Division of Nairobi. A cross sectional survey involving 202 children, 91 males and 111 females selected from the three categories of public primary schools A, B, C, was carried out. The children were selected proportionately from the three categories of school with 96 from category A, 30 from B and 76 from C. A structured previously pre-tested questionnaire was administered to the children. A food frequency, a 24-hour recall and focus group discussion were also carried out. A rapid market appraisal was carried out and samples of selected SSBs were analysed for sugar content as ^{0}Brix and vitamin C as reduced ascorbic acid. Anthropometric measurements were taken as a measure of nutritional status.

The households in which the children lived comprised of 55% females and 45% males, which was slightly in variance with the national census. Category C had the highest proportion of professional parents. Categories B and A parents were mainly from middle and lower socio-economic families. On the nutritional status based on the height-for-age Z scores, 91.6% of the children were within the normal range, while 6.9% were moderately stunted and 1.5% severely stunted. Category A had the highest stunting at 12.5%. The market appraisal revealed 50 different brands in three forms: ready to drink, concentrated and solid powders. Ready to drink beverages were the commonest among the children, consumed at an average of 347ml daily. The

mean caloric intake was 137.4Kcals. Some SSBs contained very low levels of calories suggesting they are sweetened with non-nutritive sweeteners. The mean intake for males was higher than for the females although on average females consumed more than males. About 70% of SSBs analysed had no vitamin C. The SSBs that contained vitamin C had a mean of 9.2mg equivalent of 33.5% RDA. Only 11.5% of the SSBs had nutrition label information, of which 41.6% had claim of containing vitamin C. Majority (87.6%) of the school children consumed SSBs every day in school. Quencher® was the most widely consumed by 76.4% of the children. The mean (137.4kcals) intake of calories from SSBs was equivalent to 6.5% and 7.7% of the RDA for males and females respectively. Up to 64% of children consumed more than the minimum amount (120kcals) likely to cause overweight when consumed daily for a period of four years. Television and peer influence were commonest in influencing the choice beverage.

This study concludes that consumption of SSBs is high among the three categories of schools and could lead to overweight. Vitamin C is not present in many SSBs even where the labels indicate so. Therefore, SSBs contribute significantly to the caloric and vitamin C dietary intake of school children.

2 INTRODUCTION

2.1 Background

Habits develop when people are young and such habits are likely to persist into adulthood. Schools provide a highly effective and efficient environmental setting for establishing healthy attitudes towards food. The school context offers a great possibility to reach large numbers of the population, including young people, school staff as well as families and community members (WHO, 2006). Consequently, interventions targeted at healthy nutrition need to be emphasised early in childhood and adolescence in order to reverse the effects of overweight and poor eating habits.

Consumption of sugar sweetened beverages (SSBs) is associated with overweight and high incidences of type 2 diabetes. Obesity and overweight are no longer considered diseases of high socio-economic status groups, as it is increasingly being observed in low socio-economic status groups too. Overweight among low income pre-school children has been associated with high consumption of sugar sweetened drinks (Monteiro *et al.*, 2005). Consumption of soft drinks by children has increased with consumers obtaining 188kcal/d more than non consumers. Changes in food intake among children may partly explain the rise in childhood obesity observed in the recent past (St-Onge *et al.*, 2003).

Vitamin C is instrumental in the development of fibrous connective tissue (collagen). Vitamin C also increases bioavailability of both non-haem and haem iron from foods. This makes it an important vitamin in the growth and development of school children. There are increased losses

of vitamin C during large-scale institutional food preparation necessitating the need for complementary supply of vitamin C to school children. Fruits contain high levels of vitamin C and fruit juices can therefore be a major source of vitamin C (Davies *et al.*, 1991). Vitamin C is often added in soft drink formulations which serve to stabilize their quality, especially where colour and flavour are concerned. SSBs prepared in this manner therefore can serve as significant sources of vitamin C.

In Kenya, the consumption of SSBs is on the increase as is demonstrated by the increase in brands available in the market today. A quick glance at the children also reveals this trend. School children can be seen carrying these SSBs to school each morning. However the extent and magnitude of consumption of these beverages by school children still remain speculative since data are still largely missing.

2.2 Statement of the problem

Consumption of SSBs worldwide has doubled in the last decade. This is evident from the increase in the reported consumption rates among children. In a study conducted in the US, an average teenager consumes 15 to 20 teaspoons a day of added sugar from soft drinks alone. Adolescents (aged 12-17 years) obtained 11 percent of their calories from soft drinks (USDA, 1996). Other reports also indicated high consumption of sweets and soft drinks among adolescents (WHO/HBSC, 2006). Young people easily accessed products which have high-sugar, high-salt, high-fat that are attractive and palatable, but in many cases devoid of nutrients. In many countries, SSBs typically cost less and are more readily available than healthier options (WHO/HBSC, 2006). There is no doubt that the trend is similar in developing countries but few studies have been carried out in Africa to show the extent of consumption. A study conducted in

South Africa indicated that school children from different social economic status consumed large volumes of soft drinks (Temple *et al.*, 2006).

In Kenya, the urban population is growing rapidly. Nairobi, a cosmopolitan city, is faced with strikingly similar consumption patterns and food habits as other cosmopolitan cities of the world. Cultivated as consumers at very early ages, children are trained to desire foods and beverages whose typical consumption may compromise their health (WHO, 2006). SSBs are drinks of choice for children to take to school. This is caused by the limited time the parents have to prepare nutritious alternatives and the fact that these products are cheaper in the market than healthier alternatives. Consumption of SSBs is rampant among children from across the social economic classes. A variety of SSBs are used. Some contain nutritive sweeteners while others contain non-nutritive sweeteners. Some are available ready to drink while others are dilutable and still others are available as reconstitutable powders or crystals. The last two are prepared ready to drink for the child to take to school. Many of the SSBs also carry label information indicating that they contain vitamin C. Information on the consumption of SSBs and their contribution to energy and vitamin C intake by school children in Kenya is scarce. This study sought to bridge this gap by assessing the contribution of SSBs to dietary intake of vitamin C and calories in relation to the nutritional status of children aged 10-13 years.

2.3 Justification

"The evidence for an association between SSBs and weight gain is limited, and age, baseline body mass index (BMI) and other factors may modify the association. Additional studies are needed to further test this hypothesis, but the limited nutrient content and high caloric value of SSBs suggest that these beverages should be regulated" (Newby, 2007). This study also sought

to establish the vitamin C contributed by SSBs as proportion of the RDA. Vitamin C is generally readily available and therefore less attention has been paid to it. Structural growth and development in school children is rapid during the pre-adolescent period and vitamin C plays a critical role in fibrous and collagen development. Besides, school children aged 10-13 years are at a transition period of adolescence that is characterized by behavioural changes. Some of these changes may lead to negative health consequences such as smoking and habitually avoiding healthy foods like fruits, vegetables and their products. There are few reports of low serum vitamin C levels in adolescents, mainly those who routinely shun fruits and vegetables and those who smoke cigarettes, and they may be at a high risk of the vitamin deficiency (Spear, 2002). It is important that children meet their RDA of vitamin C for optimum growth.

A study seeking to associate SSBs with weight gain will present a broader perspective to the contribution of SSBs to weight gain and obesity in children. This study will generate data and the status of consumption trends of SSBs and its nutritional impact to the health of school children. Studies on the contribution of SSBs to the dietary intake of calories and vitamin C and how it relates to the nutritional status of school children in Kenya are scanty.

2.4 Aim

To contribute to knowledge on consumption of SSBs, and contribution to dietary intake of calories and vitamin C and the nutritional status of school children

2.5 Main objective

To assess the contribution of SSBs to dietary intake of calories and vitamin C and the nutritional status of children aged 10-13 years in Westlands, Nairobi.

2.6 Specific objectives

1. To determine the demographic and socio-economic status of households with school children aged 10-13 years in Westlands, Nairobi
2. To assess the nutritional status of school children aged 10-13 years in Westlands, Nairobi
3. To carry out a market appraisal of the sugar sweetened beverages in Westlands, Nairobi.
4. To determine the amounts of vitamin C and calories of selected market samples of SSBs consumed by the children aged 10-13 years in Westlands, Nairobi
5. To determine the consumption of SSBs by school children aged 10-13 years in Westlands, Nairobi
6. To determine the social and economic factors that influence the types and quantities of SSBs consumed by children aged 10-13 years in Westlands, Nairobi

2.7 Study hypothesis

SSBs contribute significantly to daily dietary caloric and vitamin C intake of school children aged 10-13 years in Nairobi which leads to a positive energy balance.

2.8 Limitations of the study

The recall bias is one of the problems that could have affected the results of this study. Children aged 10-13 years may not clearly remember the exact volumes of SSBs consumed. This setback was dealt with by conducting a focus group discussion (FGD) with the children to corroborate this information.

This study incorporated laboratory analysis of only market samples of SSBs reportedly consumed by the children. Other SSBs in the market that were not reported consumed by the school children were therefore not analysed. However the samples reported as consumed represented a wide variety that is popular among school children in urban areas.

Variables such as genetic composition, birth weight, and sickness at that time, food accessibility, availability and utilization of SSBs may have influenced the nutritional status. This was beyond the scope of this study and was factored in the conclusions made.

The total dietary intake using a 24-hour recall usually gives a more exact estimation of total energy intake. The 24-hour recall method was used on a sub-sample to determine the total dietary intake. The results were used to project the consumption among the rest of the samples. The 24-hour recall is a tedious method requiring both time and money. Resources and time were limited to effectively carry out this procedure on the whole sample. Therefore, conclusions from the study finding were drawn within this limitation.

3 LITERATURE REVIEW

3.1 School children and school diets

The school going age is considered to range from 5 years to 18 years in majority of countries in the world today. School children are vulnerable to both internal and external factors as they adjust to the new life away from home for at least eight hours daily. Some of the main issues that influence adolescents are peer pressure, transitional related factors, new social environment, and new physical environment, and these come with a number of risks. The diets served in school or packed from home or bought in food vending outlets in the school environs may be devoid of vital nutrients. Nutrition and health programmes the world over have paid less attention to the school going children since they are not categorized among the vulnerable groups.

3.1.1 Nutritional status of school children

There has been gradual but steady improvement in the nutritional status of children worldwide. This is reflected the world over with the exception of developing countries where malnutrition is still a major problem. Nutritional status of school children is critical for growth and development in the later years. In a study conducted in Chile, there were significant increases in the risk of obesity (body mass index between the 85^{th} and 95^{th} percentiles) from 8.3% to 19.6% in prepubertal males, from 5.4% to 14.6% in pubertal males, from 10.2% to 16.2% in prepubertal females, and from 9.7% to 24.9% in pubertal females (Muzzo *et al.*,2004).

3.1.2 Influence of the social economic status on the nutritional status

Social economic differentials have been well documented in several industrialized countries, with higher social economic status (SES) being associated with better health than the lower socioeconomic status, whether SES was measured by income, education, occupation or composite of all three. Effects of social economic disparities on the nutritional status have also been observed. Dietary intake studies have shown that people from higher SES consume more nutritious foods that mainly consist of fruits and vegetables, low fat dairy products, lean meats and whole grains than those of lower SES. Ricciuto and Tarasuk (2007) found a positive relationship between income and nutrient intake. The strongest relationships were observed for vitamin A and C with the amount purchased increasing with the level of income. This implies that low SES individuals are likely to consume diets that are deficient of Vitamin A and C. Food selection was found to be varying systematically with increased income.

It is has been established that those who belong to a high SES have higher education, knowledge and increased dietary awareness. This may positively contribute to the more informed choices of foods with studies in the industrialized countries confirming this trend. This may lead to health messages being focused on the higher SES and inadvertently neglecting the lower SES. This is a gap in knowledge that this study sought to address by stratifying the SES from the middle to lower class. By focusing on the middle-low class which has a large proportion of the population in Nairobi, future interventions will find the results of this study more useful as baseline.

3.1.3 Adolescence stage

Adolescence is one of the periods of dramatic change throughout ones lifetime. During this time, the body changes physically and social transition takes place as an individual seeks self image.

Hormonal changes resulting in biological changes give rise to nervousness and confusion that may result in neglect of appropriate nutrition and health behaviour in favour of what is perceived to be trendy escapades. The hormonal imbalances results in sudden growth spurt which creates increased nutritional needs. This makes it a nutritionally vulnerable period as outlined by Spear (2002) mainly due to greater demand for nutrients as a result of dramatic increase in physical growth and development. Secondly, change of lifestyle and food habits of adolescents affects both nutrient needs and intake. Thirdly, there are adolescents with special nutrient needs such as those who participate in sports, have chronic illness, diet excessively or those who use alcohol and drugs. This necessitates the need to focus on the dietary intakes in adolescents. There are few studies documented in Kenya on the nutritional status of adolescents mainly because this category is not considered vulnerable.

Studies have shown that dietary intakes of adolescents are often inadequate. In addition adolescents consume diets that have high amounts of sugars, fats, salts and inadequate amounts of fruits and vegetables. This is compounded by reduced physical activities in some individuals. These imbalances are likely to develop into cardiovascular diseases, type 2 diabetes and obesity. Although these diseases have been thought to occur in adults, recent studies have shown that obesity is common among adolescents. Majority of programs with successful outcomes targeting adolescents have tended to be behaviourally based (Hoelscher *et al.*, 2002). This implies for interventions to have positive results, it needs to focus on changing ones way of life. This can best be learnt in the early years of life especially during adolescence.

3.2 Changing trends in food consumption habits and caloric intake

There is a general increase in calorie consumption not only by adults but also by children. This is possibly reflected in the increase in portion sizes resulting in increased energy intake as discussed by Newby (2007). The study revealed an increase in energy from carbohydrates was mainly due to increased consumption of refined grain products. For example, consumption data from the United States of America (USA) indicate that the proportion of calories from fat has decreased and that from carbohydrates has increased (Newby, 2007). Further, the energy intake and portion sizes of food consumed at home and away from home have increased considerably between 1977 and 1998. Worth noting is the fact that the portions of salty snacks consumed by children in the USA showed an increase by 93 kilocalorie (kcal), soft drinks by 49 kcal, hamburgers by 97 kcal and French fries by 68 kcal. Body weights of the children are increasing in all developed countries and across all age groups. Statistics from the National Health and Nutrition Examination Survey (NHANES) of 1999–2000 showed that 65% of adult Americans are overweight or obese. This can, largely, be attributed to the increase in consumption of refined grain products as indicated by the American Health Foundation.

There has been a change in beverage and soft drinks consumption patterns over several decades (Hill and Peters, 1998). In an international survey comparing young people's health in various countries in Europe in 2004, WHO found that, in Israel, Malta, the Netherlands, Slovenia, Scotland and the United States, daily soft drink consumption is 40% or more of the daily food consumption. The study further reported a high consumption of sweets and soft drinks as common among adolescents. On average, skipping breakfast tendencies were found to be higher

in female than male. This is a popular method of weight control, but often results in higher consumption of mid-morning snacks (WHO, 2004).

Mbato (1988) conducted a study on health promoting preparations in Kenya, covering a narrow range of SSBs that were in the Kenyan market at the time. Since then, many products have been introduced in the market and it is important to ascertain their contribution to the dietary intake of vitamin C in school children. This is because the labels of these products indicate the presence of vitamin C. However, little information on the consumption patterns of the Kenyan population exists. The findings of the present study could be used as the baseline for similar studies in this country.

3.3 Sources of calories and vitamin C in Kenyan diets

In Kenya, maize is the staple food. It is prepared as *ugali* - a solid paste served with a variety of dishes ranging from *nyama choma* (roast meat) to kales and a wide rage of traditional vegetables. Maize can also be prepared into porridge- a thin paste-that is served as a beverage. There are a variety of maize-based breakfast cereals but these are costly and out of reach for most Kenyans. Maize can also be cooked in a mixture of maize and beans (*githeri*) and vegetables. Other sources of calories are wheat and wheat products, millet, sorghum, potatoes and bananas. The main sources of vitamin C are fruits and vegetables. Citrus fruits and juices are particularly rich sources of vitamin C but other fruits including cantaloupe and honeydew melons, cherries, kiwi fruits, mangoes, papaya, strawberries, tangelo, tomatoes, guavas and water melon also contain varied amounts of vitamin C. Vegetables such as cabbage, broccoli, brussels sprouts, bean sprouts, cauliflower, kale, mustard greens, red and green peppers and peas may be more important sources of vitamin C than fruits, given that the vegetable supply often extends for

longer periods during the year than does the fruit supply (WHO/FAO 1998). Fruits such as oranges, passion fruits, water melons, paw paws, avocadoes, mangoes and lemons are readily available in the markets in Kenya all year round. Plums and pears are available only in specific seasons. Traditional vegetables such as amaranth and spider plant are available too. However it must be noted that Kenyans are not habitual eaters of fruits in meals. Their main sources of vitamin C therefore are the leafy vegetables which are generally incorporated in most meals.

3.4 Nature and types of SSBs

A beverage may be defined as a liquid prepared for drinking other than water. The most important components of a non-alcoholic fruit beverage are water, sugar, acid and the characteristic fruit flavour (Imungi, 2008). According to the Codex Alimentarius Commission of the FAO and WHO, SSBs are categorized as fruit flavoured drinks, fruit flavoured drinks in solid form and fruit squashes. In Kenya, standard specifications define fruit flavoured drinks as "concentrated or ready to drink products prepared from water, sugar, natural identical or artificial flavourings, permitted colourings and other optional ingredients" (KEBS, 2000). Fruit flavoured drink in solid form is defined as a "dry crystalline product containing sugar, citric acid, ascorbic acid and fruit flavour such as orange, lemon, lime, tangerine or any other fruit flavour and permitted colour intended for consumption after reconstitution" (KEBS, 2003). Fruit squash is defined as "a soft drink prepared from pulp or juice along with pulp and diluted sugar syrup so that the fruit content is not less than 20 per cent by mass, and intended for consumption on dilution" (KEBS, 1999).

Kenya standards specifies the degrees Brix for fruit flavoured drinks to "show a minimum reading of 30° brix for concentrated products and 10° brix for ready to drink products when

measured at 20° C in accordance with the methods of test stipulated in Kenya Standard 05-432, methods of test for fruit juices and similar products" (KEBS, 2000). Juices are placed in two categories. Clear juices such as apple juice and cloudy juices which may include orange juice and mango juice. Fruit nectars or fruit juice nectars are produced from fruit juices or fruit ingredients (such as pulps or comminutes) by adding water and sugar and maybe food grade acid. The minimum level of fruit or fruit ingredients is specified by different standards. For example, orange and other citrus fruit juice nectars contain a minimum 50 percent juice, and mango nectar contains minimum 25 percent pulp (Imungi, 2008). Fruit drinks on the other hand do not have a minimum level of fruit ingredients specified by law. They can therefore be prepared solely from synthetic ingredients.

3.5 Consumption of SSBs

The global strategy on diet, physical activity and health recognises the prevalence of obesity and overweight in developing countries and even in low income groups in richer countries. Genetic, social and environmental factors have been associated with weight gain and obesity (WHO, 2004). Harnack *et al.*, (1999) found increased consumption of SSBs as an important risk factor in the development of obesity in school children. In this group the total energy intake was positively associated with soft-drink consumption, ranging from adjusted mean of 7650kJ daily for non-consumers to 8435kJ for those drinking an average of 265ml daily. There was also a trend towards direct proportionality between consumption and age, with consumption at 50% by preschool children, 64.1% and 82.5% by school-age children and adolescents respectively. Ludwig *et al.*, (2001) examined the relationship between consumption of SSBs and childhood obesity through a prospective study and found a positive association between the high consumption of SSBs and childhood obesity.

A recent study on the consumption of 'extra' foods by Australian children ranked SSBs as the highest contributor to the proportion of extra calories. Increased consumption of SSBs led into an increased mean 222g of daily average intake of extra calories (about a cup) for 2-3 year olds to 714g (nearly three cups) for 16-18year olds. 'Extra' foods contributed 40.9% energy, 19.4% protein, 47.3 % total fat, 47.0% saturated fat, 53.4% sugar, 25.9% dietary fibre and approximately 20-25% of selected micronutrients. The total nutrient intake from both core and 'extra' foods combined met 70% of the recommended dietary intake (RDI) for all micronutrients for each age and sex subgroup. The over-consumption of 'extra' foods reduced micronutrient intake by reducing consumption of nutritious core foods (Rangan *et al.*, 2008). Moynihan and Petersen (2004) found that "A positive energy balance of just 120 kcal (equivalent to one can of soft drink) each day would cause a weight gain of 4.5 kg per year, so that the same quantity over a period of four years would cause a normal weight child to become obese."

Soft drinks have replaced milk and may possibly lead to calcium deficiency with a potential risk of osteoporosis and fractures in adulthood. Interventions instituted early in childhood and adolescence to reverse the possible adverse health effects of overweight and poor eating habits achieve more desirable results (St-Onge *et al.*, 2001). In Kenya increased production of SSBs in the market today undoubtedly reflects the changing consumption patterns of the populations. Various age groups in adolescents require different energy levels which are closely linked to the nature of activities and the requirements for optimal growth. The RDAs of these groups are shown in Table1. The table also shows the requirements for vitamin C.

Table 1: Energy and vitamin C requirements for children aged 10-16 years

Sex	Age (years)	Energy (kcal)	Vitamin C(mg)
Male			
	10-12	2200	20
	12-14	2400	27.5
	14-16	2650	30
Female			
	10-12	1950	20
	12-14	2100	27.5
	14-16	2150	30

Source: Sehmi 1993

A study by Mbato (1988) compared the consumption patterns of health promoting preparations and their cost to that of the locally available natural foods in Nairobi. Results indicated that majority of the population from the low SES spent a large proportion of their income on health promoting commercial preparations. The study used three estates in the city and may not give true representation of the different SES. It also, did not establish reasons why poor populations spend more on health promoting commercial preparations instead of locally available nutritious foods.

3.6 Physiological role of Vitamin C and its occurrence in foods

Vitamin C (ascorbic acid and ascorbate) is a six-carbon lactone which is synthesized from glucose by all animals except the primates and humans. These have to rely on dietary sources for the vitamin. Vitamin C is synthesized in the liver in some mammals and in the kidney in birds and reptiles. It is an electron donor (reducing agent or antioxidant) and probably all of its biochemical and molecular roles can be accounted for by this function (WHO/FAO 1998). The role of this vitamin in wound healing and growth promotion is due to its participation in the synthesis of fibrous connective tissue, specifically in promoting post-translational hydroxylation of proline and lysine residues in collagen (Davies *et al.*,1991). For example, the consequences of

scurvy, such as the breakdown of connective tissue fibres and muscular weakness, are both linked to hydroxylation reactions in which ascorbate maintains loosely bound iron in the ferrous form to prevent its oxidation to the ferric form, which makes the hydroxylase enzymes inactive. In the eye, vitamin C concentrations may be 50 times higher than in the plasma and may protect against oxidative damage of light. It is also present in the gonads, where it may play a critical role in sperm maturation. Spermatogenesis involves many more cell divisions than does oogenesis, resulting in an increased risk of mutation (WHO/FAO 1998). Vitamin C increases the bioavailability of both non-haem and haem iron in foods by increasing its absorption by 200–600 percent. The degree of the bioavailability depends on the simultaneous presence of vitamin C and iron in the gut, for example the amount of iron containing food consumed with a meal and the amount of vitamin C ingested. These properties of vitamin C underscore its vital role in the provision of nutrients for rapid growth and development of children.

Vitamin C as an ascorbate is found in many fruits and vegetables. Although fruits and vegetable contain large amounts of ascorbic acid, the culinary treatment which they receive can substantially reduce the levels before these foods reach the consumer. Plant materials rich in ascorbic acid are also rich in ascorbic acid oxidase which may normally be inactive or contained within the vesicles and fine chopping of vegetables is known to increase the enzyme activity, by breaking the barrier between the enzyme and the substrate and by availing oxygen from the atmosphere (Davies *et al.*, 1991).

The vitamin C content in food is strongly influenced by season, d tion of transport to the market, length of time on the shelf and in storage, cooking practices the chlorination of the

water used in cooking (Davies *et al.*, 1991). Cutting or bruising of produce releases ascorbate oxidase. Blanching inactivates the oxidase enzyme and help to preserve ascorbate, so do lowering pH of and excluding oxygen like in the preparation of sauerkraut (pickled cabbage). In contrast, heating in the presence of oxygen and exposure to copper and iron, or to mildly alkalinic conditions destroys the vitamin (WHO/FAO 1998). Too much water can leach vitamin C from plant tissues during cooking or blanching. Therefore, it is important to realize that the amount of vitamin C in food is usually not the major determinant of its availability for supply but rather regularity of intake (WHO/FAO, 1998). The RDA for vitamin C for various age groups is indicated in Table 2.

Table 2: Recommended daily allowances for vitamin C for various age groups

Age group	Vitamin C RDA (mg/day)
Infants (0–6 months)	Breast-feeding by a well-nourished mother
Infants (6–12 months)	20
Children > 13 years and adults	30
Pregnant women (2^{nd} and 3^{rd} trimester)	50
Lactating women	50

Source: WHO, 1999

The recommended intake of 30mg for children older than 13 years and adults of vitamin C per day would be covered by a slice of less than 100 g of papaya (Imungi and Wabule 1990); one medium sized guava (Imungi et al., 1980); half an orange or 50ml of citrus fruit juice; by a good-sized tomato (30g) or a small helping of good quality leafy vegetables (50g) or by a large helping (120g) of potatoes, depending, on the preparation, processing and storage methods used (WHO, 1999).

Another factor that is known to influence vitamin C reserves intake is the SES which is associated with income levels. Availability of vitamin C foods is higher during the harvest

period when the fruits and vegetables are in season. During this period, intakes by the whole population are high. There are increased losses of vitamin C during large-scale institutional food preparation, especially in school meals necessitating a need to seek complementary supply of vitamin C. There is evidence of mean plasma and leucocytes vitamin C concentrations being lower in males than in females and that this difference persists into old age.

Fruits are an important source of vitamin C and fruit juices are a major contributor to vitamin C intake. Vitamin C is often included in soft drink formulations which serve to stabilize their quality, especially where colour and flavour are concerned. In certain instances it serves as an important processing acid for example, in removing oxygen from solutions in order to increase product shelf-life. This emphasizes the need for presence of vitamin C in SSBs especially in situations where they are consumed as a preference to natural fruit-based products. SSBs can be a useful source of vitamin C to the school children dietary intake. The industry, government and organizations concerned with health and nutrition, however, need to institute a policy to specify the minimum levels of the vitamin in SSBs manufactured.

3.7 Importance of school setting in the promotion of good eating habits

Schools provide a setting in which children from diverse social class backgrounds converge. They are an effective platform for promoting health since they attract over one billion children world wide. Through these children it is easy to reach school staff, families and communities as a whole (WHO, 1996). This emphasizes the important opportunity provided by schools for the dissemination of preventive nutrition messages. Schools offer the most effective way of communicating key health messages to a large population including the youth, school staff, families and community members (WHO, 1998). Furthermore, school years are the most

influential stages of childhood in which health messages can be reinforced. It is also at this stage that skills, attitudes and lifelong beliefs are developed. Habits develop when people are young and are likely to persist into adulthood.

Children spend at least 9-10 years of their lives in elementary school and 6-8 hours a day, a situation comparable to that of adults in the work environments (WHO, 2004). Therefore, the need for promotion of good nutrition is evident and according to Kwan (2005) it can easily be integrated into general health promotion, school curricula and activities. Children can be provided with skills that enable them to make healthy decisions and to adopt a healthy lifestyle. School-based health promotion strategies with a focus to healthy eating can be an effective means of promoting healthy lifestyles.

Global and national initiatives to achieve universal access to basic education mean that more children have the opportunity to go to school than before. A large proportion of the children who have no access to basic education may need health interventions and services. School health programs can help to ensure that children are healthy and able to take full advantage of what is often their first and only opportunity for formal education. Children who begin school with the worst health status have the most to gain from health and nutrition programs. They also have a lot to gain educationally since they show great improvement in cognition as a result of health improvement. Thus, school health programs particularly benefit the poor and the disadvantaged. Increasing numbers of countries have recognized the need to ensure good health and development during the vulnerable early years of life. Integrated management of childhood illness, early child development and growth monitoring promotion programs all help to ensure

that a child who enters school fits well and is ready to learn. But the school age child continues to be at risk of ill health, especially the female. Their health often deteriorates during the school years since less attention is paid to this age group. School health programs will ensure that these children remain healthy during the years that are critical for education. http://www.schoolsandhealth.org/why-school-health.htm.

Perez-Rodrigo and Aranceta (2001) highlights the importance of the 'settings approach' in health promotion and the popularity it has gained. This is mainly because this approach recognises that there is a valuable opportunity to influence health through policy measures and education within specific settings such as schools, workplaces, hospitals or cities. This is largely because such settings provide the most effective and efficient way to reach a large segment of the population.

A significant proportion of Kenyan school-going children suffer from mild, moderate and severe malnutrition, while a significantly larger number of the children experience mild to moderate growth retardation (MoE 2005). In the Kenya education sector support programme 2005-2010, one of the strategies to achieve its objectives is to incorporate public health interventions in school activities. School nutrition education can include a component on promotion of consumption of health giving foods. Integrating nutrition information in the activities of the school curriculum will contribute towards achieving the goal of providing universal primary education by 2015 in Kenya. This is because school based programmes which are used as school retention strategies ensure that children from disadvantaged homes receive basic nutrients.

3.8 Gaps in Knowledge

Kenya is a developing country whose population is becoming urbanized. Nairobi, a cosmopolitan city, is getting increasingly industrialised. The urban population spends many hours in traffic jams moving from one part of the city to another. School children are also trapped in this lifestyle. They travel long distances from home to school, at times across the city. This makes it almost impossible for these children to go home for lunch. This is further aggravated by the lack of enough time by the parents to prepare nutritious meals for the children to carry to school for lunch. Consequently, parents and school children, alike, have resorted to meals that are easy to prepare and time saving. SSBs require little time to prepare and are easy to carry. Studies on SSBs consumption in Kenya are scarce. This study seeks to provide data that will be useful in establishing the trends in SSBs consumption.

School going children are at a vulnerable age which is exposed to negative influence, yet they are not categorised as one of the vulnerable groups. In third world countries such as Kenya, low SES children with the worst health, have the most to gain from nutrition programmes. Though there exist school feeding programmes especially in the arid and semi arid lands in Kenya, interventions that target nutritional well being are inadequate. This underscores the need to target this age group.

Obesity is on the rise in developed and developing countries; Kenya is faced with a similar predicament. The extent and magnitude of consumption of SSBs remains speculative in Kenya. Information on SSBs labels claiming that they contain vitamin C is still unaddressed. There is need for evidence on the association of SSBs and weight gain in Kenya, especially Nairobi.

4 METHODOLOGY

4.1 Background of study area

The study took place in Westlands Division in Nairobi. The Division consists of six locations namely Parklands, Kitisuru, Highridge, Kangemi, Kilimani and Lavington. Westlands is a suburb of Nairobi that was until the early 1980s composed of residential homes and a few shops. It has now developed into a major commercial and economic area outside the central business district of Nairobi. Apart from being a commercial centre, Westlands is also one of the eight administrative divisions in Nairobi. (www.wikipedia.com).

Westlands is one of the divisions of Nairobi that has the three categories of schools as ranked by the MoE into A, B and C. MoE stratifies public primary schools in Nairobi based on the resources the school and on the capacity of parents to pay a portion of the school fees. Category A schools have basic resources and the government provides all the funds required to run their operations. They cater for low income earners. Parents in category B schools are required to pay a small percentage of school fees to cater for some of their operations. These schools attract children from middle to low income groups. A large proportion of school fees and extra curricula activities are catered for by parents of category C schools. Majority of the parents are drawn from the high SES. There are a total of 27 public schools in Westlands, division; Nairobi. Of these 13, 4 and 10 belong to category A, B and C schools respectively.

SSBs are found in all selling outlets throughout the Westlands divisio[illegible]he major points of sale are shops along the roads and around all the public schools. *Kiosks* [illegible]ll shops) are the major stockists of reconstitutable solid SSBs with most of them selling in sec[illegible]y. Ready to drink SSBs

were sold by many vendors in open air markets and shops. Large stores and supermarkets hold the highest number of the concentrated and ready to drink SSBs packed in different volumes.

4.1.1 The study population

The study population consisted of children aged 10-13 years in public primary schools in Westlands Division.

4.2 Study design

This study was both descriptive and analytical. It comprised a cross-sectional survey, market appraisal and laboratory analysis of selected market samples of SSBs.

4.3 Sampling

Westlands division was purposively selected because it is one of the divisions in Nairobi that is wealthy, according to the recent demographic survey. A quick pilot survey indicated that a majority of the people in the higher socio-economic class living in the area took their children to schools that were considered to belong to their social class regardless of the distance to be covered, mainly high cost private schools that are scattered all over Nairobi. It was also observed that part of the population that was living in the area hailed from informal settlements and low income earners who create a labour force for the wealthy. This is the population that took their children to the public primary schools which are subsidized by government. This study involved taking a sample of children aged 10-13 years for the survey, market appraisal of SSBs selling in Westlands and samples of SSBs for laboratory analysis. Probability proportionate to size (PPS) and modified probability proportionate to size (MPPS) method in the sub-sample for the 24-hour recall. The PPS method allocates a sample size in relation to its size in the population. The MPPS method was used to balance the sub-sample for the 24-hour recall method.

4.3.1 Sampling unit

The study used two sampling units; children aged 10-13 years in selected public primary schools in Westlands division and SSBs consumed by the school children as reported during the interview.

4.3.2 School sample

There were 27 public primary schools scattered throughout the six locations in Westlands division. Categories A, B and C type of schools had 13, 4 and 10 schools respectively.

4.3.2.1 School sample size determination

Using the stratified sampling method, the public primary schools were clustered into categories A, B and C as determined by the MoE. Schools were randomly sampled using probability proportionate to size (PPS). The sampling frame consisted of twenty seven public primary schools in Westlands division. The clusters were used to stratify the schools according to the SES of the households of the school children. The categories used to classify the schools constituted a cluster which therefore made three clusters.

4.3.2.2 School sampling procedure

The stratification of primary schools according to different classes is a general characterisation of the different SES of the households of children in the schools. A list of all the public primary schools in the three categories are thirteen in category A, four in Category B and ten in category C was written out. The ratio was therefore 13:4:10. The minimum number of school that was sampled from B is one. When n (number of schools to be sampled from Westlands division) is equal to one in category B.

$$n = \left(\frac{27 \times 1}{4}\right)$$

$$n = 7$$

A total of seven schools were sampled from the twenty seven schools in Westlands division. Using the PPS method at a ratio of 13:4:10, in category A, B and C, respectively, three schools were drawn from category A, one school in B and three schools in C. Random number tables were used to sample schools from the three categories. A numbered list of the schools in each category was made and random numbers from a random table were used to select the schools. In category A Karura forest, Kihumbuini and Bohra road primary schools were selected. In category B Loresho primary school was selected. In category C Nairobi, Hospital hill and Milimani primary schools were selected.

4.3.3 School children sample

The number of school children to be sampled was determined using the proportionate to size method (PPS). The total population of children aged 10-13 years was obtained from the MoE and was used to determine the number of children to be sampled in each school. The PPS method was used to allocate the number of children in each school. Table 3 shows the distribution by sex of the children in the sampled schools.

Table 3: Distribution of school children by sex in sampled schools

Name of the school	Category	Sex						Total		
		Male			Female					
		11yrs	12yrs	13yrs	11yrs	12yrs	13yrs	11yrs	12yrs	13yrs
Karura forest	A	14	23	12	13	4	10	27	27	22
Kihumbuini	A	77	75	63	68	74	74	145	149	137
Bohra road	A	29	31	32	36	41	38	65	72	70
Loresho	B	78	76	69	67	77	70	145	153	139
Hospital hill	C	72	62	52	71	71	80	143	133	132
Milimani	C	84	71	69	70	76	76	154	147	145
Nairobi	C	98	103	96	115	99	105	213	202	201

4.3.3.1 Determination of school children sample size

The school children sample size was determined using the following formula adopted from Fisher *et al.* (1991)

$$N = \left(\frac{z^2 pq}{d^2} \right)$$

Where;

N = the desired sample size (when population is greater than 10,000). The population of school children aged 10-13 years in Westlands division was 17,475.

Z = the standard normal deviate was set at 1.96 which corresponds with 95 percent confidence level.

P = the proportion in the target population estimated to have a particular characteristic. There was no estimate on the level of overweight in school children in Kenya. Therefore 50% was used.

q =1.0-p

d = degree of accuracy was set at 0.07

$$N = \left(\frac{(1.96)^2 (0.50)\ (0.50)}{(0.07)^2} \right)$$

From the formula, the calculated N was obtained as 196

Attrition allowance of 5% of 196 yielded 10 children.

Therefore, the sample size was 206 children aged 10-13 years in public schools in Westlands division.

4.3.3.2 School children sampling procedure

The PPS method was used to determine the number of children who were sampled in each school. This was determined based on the population of children aged 10-13 years in the sampled schools. The following were determined as the number of children in the schools; category A 100 children, in Category B, 31 and 77 children in category C. The PPS method was used in each category of school to determine the number of children to be sampled. In category A, 13, 62 and 25 in Karura forest, Kihumbuini and Bohra road primary schools school children were sampled respectively. In category B Loresho primary school a sample of 31 children was drawn. In category C, 34, 20 and 23 children were drawn from Nairobi, Hospital hill and Milimani primary school respectively. Table 4 shows the actual number and sex of children sampled in each school.

Table 4: Number of children sampled in seven schools

Name of the school	Category	Sex						Sub-total			Total
		Male			Female						
		11yrs	12yrs	13yrs	11yrs	12yrs	13yrs	11yrs	12yrs	13yrs	
Karura forest	A	3	4	2	2	1	1	5	5	3	26
Kihumbuini	A	11	11	9	10	10	10	21	21	19	122
Bohra road	A	3	4	4	5	5	4	8	9	8	48
Loresho	B	5	5	5	5	6	5	10	11	10	62
Hospital hill	C	4	3	2	3	3	4	7	6	6	48
Milimani	C	4	4	3	4	4	4	8	8	7	46
Nairobi	C	6	6	4	8	5	5	14	11	9	68
Total											

The ratio of male to female was used to determine the number of male and female sampled in each school.

4.3.3.3 Inclusion and exclusion criteria

Children older than 13 years or less than 11 years old in the same setting were excluded from the study. In schools where more than one child from the same household was in the desired age bracket and the two children happened to be randomly sampled, a toss of a coin was done and one child was excluded. A replacement of the excluded child was taken from the same setting and same sex. Those who were unwilling to participate in the interview were replaced from the same sex and age.

4.3.3.4 Focus group discussion sub-sample

The FGD sub-sample was drawn randomly from the sampled population that was interviewed. Eight children were used as the ideal number for the FGD. Numbers one to eight were written on pieces of paper and the other pieces of paper were left blank. All those who picked the eight numbers were eligible to be in the FGD. Seven FGDs were conducted per school.

4.3.3.5 Sub-sample for 24-hour recall method

The minimum sub-sample for the 24-hour recall is 30. The PPS method was used to determine the number of households for the 24-hour recall. This method yielded 15 households in category A, 4 households in category B and 11 in category C. Modification of the PPS increased the number in category B from 4 to 8. This made the total sub-sample for the 24-hour recall to be 34.

4.3.4 SSBs sample

All the SSBs were identified by the school children. They were then randomly sampled from the shops, kiosks or canteens near the schools where some of the school children purchased the SSBs. Categorization was done into solids, concentrated and ready to drink. Thirteen samples which were identified by the school children were analysed in the laboratory.

4.3.5 Market appraisal of SSBs sold in Westlands, Nairobi

A quick survey on the kiosks, school canteens, shops and supermarkets around the 27 schools was conducted to determine the type of SSBs available for purchase and their volumes and costs.

4.3.6 Sampling Procedure

The sampling procedure is illustrated in figure 1.

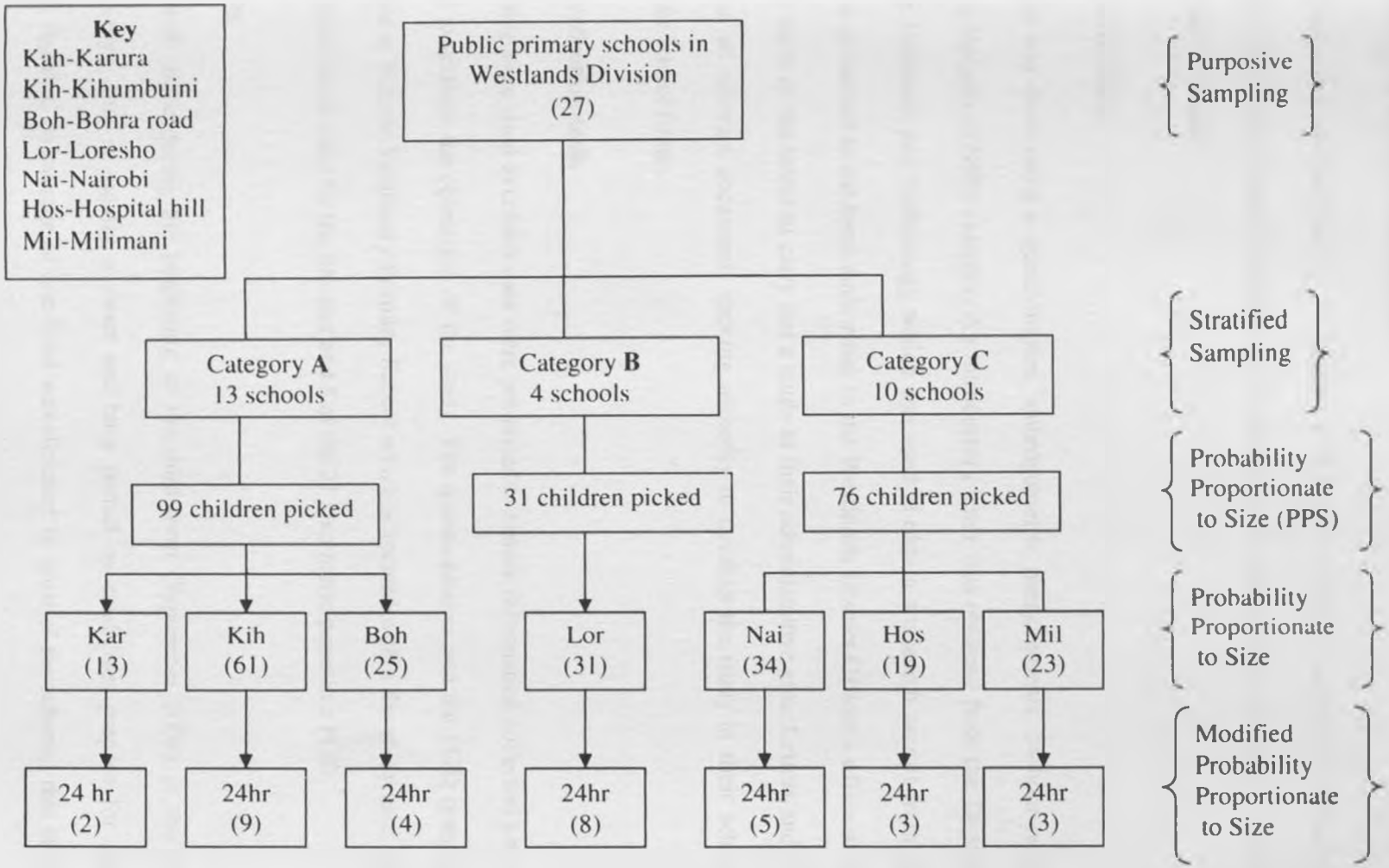

Figure 1: Sampling procedure

4.4 Pre-testing of the questionnaire

The questionnaire was pre-tested using 21 children of Kabete Veterinary Laboratory Primary School which was not one of the sampled schools. The feedback from the pre-test was used to improve the quality of the questionnaire.

4.5 Data collection

Data collection was done using a questionnaire, anthropometric measurements, 24-hour recall, FGD and laboratory analysis of SSBs samples. An introductory letter was obtained from the Department of Food Science, Nutrition and Technology which was used to obtain a research permit from the MoE. This letter was presented to the local authorities in the Westlands District Officer's office on Waiyaki Way to notify them of the intent to carry out a study in their administrative area. Letters and a copy of the permit and all relevant documents seeking authority to conduct the study in their schools were presented to the school heads.

4.5.1 Data collection tools

All the tools that were used to collect data were pre-tested to ensure information collected was relevant and adequate to address the objectives of the study. The questionnaires and the FGD question guide were pre-tested at Kabete Veterinary Primary School which is located within the study area. A total of 21 school children were used for the pre-test and 8 of the 21 also participated in a FGD.

4.5.2 Survey

The survey took place during the beginning of the third term (September 2008) in the schooling system. In Kenya, this is usually a short and busy period as candidates prepare for their final examinations. Besides, an average of one hour was allocated in most of the schools, this necessitated

the use of research assistants. Market samples of SSBs were shown to the children to enable them to quantify and specifically identify the type of SSBs carried to school.

4.5.2.1 Recruitment and training of research assistants

Two female and one male research assistants were recruited and trained. They were identified through referrals by my friends. Two were university graduates (one was male and one female) while the third one had completed secondary school education. A written and oral interview was conducted. The three possessed good communication skills.

The training program was for 2 days and was conducted by the principal investigator. It covered objectives of the training session, how to conduct the interview, procedures on how to take measurements and ethical considerations. This equipped the research assistants with the necessary skills to collect quality data.

4.5.2.2 Calibration of equipment

A number of equipment types were used during the process of data collection as shown in Table 5.

Table 5: Equipment used in data collection

Equipment	Purpose	Calibration process
Electronic weighing scales	To measure the weights of the school children sampled in kilograms.	Taken to the department of weights and measures for calibration
Height boards	To measure the heights of the school children in metres.	All the height boards were checked to ensure all the readings began at zero. They were placed on a level ground when taking the readings.
Tape recorder	To record the FGD proceedings.	The cells were checked each morning and were replaced when found to have reduced in power.
Kitchen weighing scales	To measure the weights of food samples during the market survey and during the 24-hour recall method.	Taken to the department of weights and measures for calibration

4.5.2.3 Questionnaire counterchecking

Every evening the research assistants and the principal investigator checked through all the questionnaires that had been completed and corrections were made before more questionnaires were filled out the next day. All the difficulties encountered in the field were discussed, and where necessary, beneficial amendments to the data collection process were made. The principal investigator conducted the 24-hour recall, since she was more skilled and experienced and required a shorter time to conduct the interviews.

4.5.2.4 Anthropometric measurements

To take the anthropometric measurements the weighing scales and the height boards were placed on a flat surface. The children were required to remove all heavy garments such as sweaters, jackets and shoes. Two measures were taken each time and where the second measure was found to have large variation, a third measurement was taken and only two closely related values were recorded. The two measurements were added and divided by two to obtain an average after fieldwork each evening. Height measures were recorded in centimetres (cm) and weight in kilograms (kg). The children stated their dates of birth. School records obtained from the class teachers were used to verify this information.

4.5.2.5 24-hour recall

A sub-sample for the 24-hour recall was randomly picked from the interviewed children. The parents were informed and written consent sought through the school administration. The households that agreed were visited. The meals consumed in the previous 24 hours were recorded and approximation done using a measuring cylinder and water. A total of 34 households participated in the 24-hour recall.

4.5.2.6 Focus group discussions (FGD)

A total of 7 FGDs each comprising of 8 children were conducted in all the schools. The principal investigator was the moderator in all the discussions. One research assistant was the observer while the other took notes. The proceedings of each discussion were recorded using tape recorder to clarify points missed out. The main issues discussed are outlined in the question guide attached in Appendix 2.

4.5.3 Laboratory analysis of samples

Laboratory analysis was carried out in an accredited laboratory in KEBS under the supervision of a laboratory analyst. The laboratory used was at 20°C with a relative humidity of 65 ± 5%. A hand refractometer was used to determine the total soluble solids and High Performance Liquid Chromatography was used to determine vitamin C content in the SSBs.

4.5.3.1 Determination of total soluble solids

Total soluble solids of the SSBs were determined as °Brix (°Bx) using a hand refractometer. The values represented sugar contents as percent. The samples of ready to drink SSBs and concentrated SSBs were determined in the form they are when packed for consumption in the market. The SSBs that were in solid form were reconstituted using 1 gram (g) with 200millilitre (ml) of deionized water. The degree Brix was used to calculate the amount of energy consumed by each child by multiplying by 4 to yield kilocalories (kcals).

4.5.3.2 Determination of vitamin C

Vitamin C was determined as reduced ascorbic acid using the British Standard method; Foodstuffs determination of vitamin C by High Performance Liquid Chromatography (Albuquerque *et.al.*, 2005). Determination of the total ascorbic acid which constitutes ascorbic acid and erythorbic (luoascorbic) acid. Metaphosphoric acid reduces erythorbic acid to L (+) ascorbic acid. The following conditions for the HPLC were used;

Stationary phase:	Lichrospher® 100 reverse phase 18 encapped, 250 X 46mm, 5mm
Mobile:	N – cetyl–N–N–N trimethylammonium bromide phosphate buffer
Flow rate:	1.2mm/minute
Injection volume:	20µl
Detection:	UV 265nm

The vitamin C was determined as the sum of L (+) ascorbic acid and dehydro L (+) ascorbic acid. Vitamin C was extracted from the sample to be analysed using metaphosphoric acid solution. A reducing solution was used to transform dehydro L (+) ascorbic acid to L (+) ascorbic acid. Total L (+) ascorbic acid content was determined by HPLC with UV detection at 265 nm. Ascorbic acid content was expressed as % $^{m}/_{m}$.

4.6 Data analysis

Data collected during the survey and food frequency questionnaires were analysed using Statistical Package for Social Sciences (SPSS) version 12.0.1 and Microsoft office Excel 2003. Nutri-Survey for linear programming (Erhardt, 2004) was used in the initial processing of the 24-hour recall data. Anthropometric data was analysed using AnthroPlus software (WHO, 2007). The laboratory analysis results were analysed using Microsoft office Excel 2003 and SPSS version 12.0.1.

4.6.1 Data cleaning and processing

Initial data cleaning was done on the questionnaires before entry into various packages. Frequencies and pivot Tables were used to clean and process the data.

4.7 Ethical considerations

During the study, all the relevant permits and authority was sought from the MoE, city council of Nairobi, Provincial Nutrition Office, Provincial Commissioner Office, District Commissioner's office, District Education Office, in writing. Copies of letters and permits were given to the local

administration including the Division Education Officer and the District Officer in Westlands division. Authority was also sought from the school heads. The parents were sensitized by the school administration on the intent and purpose of the study one month before the commencement of the study. Children participated on the basis of informed choice and consent was sought from all the children sampled. The research assistants treated the children with respect and care. While conducting the 24-hour recall, the principal investigator and the research assistants maintained confidentiality and anonymity of the children as they visited their homes. The school administrations were also informed verbally where the findings of the study will be available. These places are the Ministry of Health Provincial Nutrition Office, the University of Nairobi library (Jomo Kenyatta Memorial Library) and at the Department of Food Science, Nutrition and Technology, Applied Human Nutrition Unit Reference Room, (University of Nairobi).

5 RESULTS AND DISCUSSIONS

This chapter is divided into seven main sections; demographic and socio-economic status, market appraisal of SSBs in the area of study, types of SSBs consumed by the school children, contents of calories and vitamin C in SSBs consumed by school children, factors influencing the consumption of SSBs and nutritional status, dietary intake and consumption of SSBs.

5.1 Demographic and socio-economic status of the households with school children

The demographic and social economic status in this study focused on; the sampled children, the age of the school children, the characteristics and the economic status of their families.

5.1.1 Distribution of school children by sex

Slightly over half (55%) of the school children were females while the rest (45%) were males. This is in slight variance with the ratio in the general population which is 52:48 in females and males respectively if one had to assume that all the children within this age group were going to school which is not necessarily the case. The school enrolment records of the MoE are 51.5: 48.5 in females and males respectively (CBS, 2006) which agree with the trend established in this study. The distribution by sex within the school categories is shown in Table 6.

Table 6: Number by sex in each school category in Westlands

Category of school	Sex				Total	
	Male		Female			
	N	%	N	%	N	%
A	47	49.0	49	51.0	96	100.0
B	11	36.7	19	63.3	30	100.0
C	33	43.4	43	56.6	76	100.0
Total	91	45.0	111	55.0	202	100.0

The proportion of female was higher than that of male in each of the three categories of schools. In all the categories of schools it was noted that the male population was lower than the female population. This is in agreement with the findings of the KDHS (2003) that females are more than males in the population. The slight variation can be attributed to the sampling variation, in this case urban schools, whereas the national data and MOE data are country averages.

5.1.2 Age of children

The mean age of the school children sampled was 12.3 years. The minimum age was 10.1 and a maximum age of 13.9 years within a standard deviation of 0.8 which indicated a minimum disparity in age of children. Table 7 shows the mean age and sex in each category of schools.

Table 7: Distribution of mean age, sex and school category

Category of school	Male			Female		
	N	mean (SD)	Range	N	mean (SD)	range
A	47	12.4(0.7)	10.8-13.4	49	12.4(0.7)	10.8-13.7
B	11	12.1(0.8)	10.9-13.9	19	12.0(0.8)	10.8-13.0
C	33	12.3(1.0)	10.2-13.9	43	12.2(1.0)	10.0-13.9
Total	91	12.2(0.9)	10.2-13.9	111	12.2(1.0)	10.1-13.8

SD: standard deviation; n=number of children

There was no significant difference between the mean age of the male (mean = 12.2, SD = 0.9) and the female (mean=12.2, SD = 1.0), t (200) = 0.436, p>0.5). Therefore the age groups within the three school categories are comparable throughout the study.

5.1.3 Family characteristics of the school children

Most of the families surveyed were small with 80.2% having less than four children. A large (59%) proportion of the families did not live with any relative. However, 29.2% lived in families which had a cousin, an uncle, an aunt, or a grandparent. It was noted that majority (10.4%) of the children who had no siblings were from single parent families and were found mainly in category A schools. Table 8 shows the number of siblings by school category.

Table 8: Number of siblings by school category

Number of siblings to the index child	School category							
	A		B		C		Total	
	N	%	N	%	N	%	n	%
0	10	10.4	2	6.7	4	5.3	16	7.9
1	17	17.8	5	16.7	16	21.1	38	18.8
2	19	19.8	10	33.3	30	39.5	59	29.2
3	29	30.2	8	26.7	12	15.7	49	24.3
4	8	8.3	4	13.3	7	9.2	19	9.4
>4	13	13.5	1	3.3	7	9.2	21	10.4
Total	96	100	30	100	76	100	202	100.0

Category C schools were found to have the highest percentage (65.9%) of smaller families of 1-3 children which is probably indicative of the higher levels of education and awareness of the benefits of a small family by this socio-economic group. Comparatively, the proportion of families with 1-3 children in categories B and A schools were 56.7% and 48%, respectively. The mean household size across the three categories of school was found to be similar with slight disparities as shown in Table 9.

Table 9: Mean household size and number of children by school category

	A		B		C	
	children	HH size	Children	HH size	children	HH size
Frequency (n)	96		30		76	
Min-max	1-9	2-16	1-7	2-10	1-10	2-13
Mean (SD)	3.6(1.6)	5.6 (2.1)	3.4(1.3)	5.6(1.5)	3.4(1.6)	6.3(2.1)

The family size reported was found to be similar with the national average of five siblings (KDHS, 1999). However it is notable across the three categories of schools that relatives and househelps in the family increased the household sizes. The mean number of siblings in category A was slightly higher than in category B and C. This may be due to higher levels of education in category C and B since they are from higher SES which may influence the family size to be smaller.

5.1.4 Economic status of the households of the children

The economic status was measured using the occupation of the parents or guardians, the type of property owned and the means of transport the children used to school. These indicators of economic

Table 8: Number of siblings by school category

Number of siblings to the index child	School category							
	A		B		C		Total	
	N	%	N	%	N	%	n	%
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1	17	17.8	5	16.7	16	21.1	38	18.8
2	19	19.8	10	33.3	30	39.5	59	29.2
3	29	30.2	8	26.7	12	15.7	49	24.3
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5.1.4 Economic status of the households of the children

The economic status was measured using the occupation of the parents or guardians, the type of property owned and the means of transport the children used to school. These indicators of economic

status were purposively chosen due to the difficulty children of this age would have in quantifying family income.

5.1.4.1 Occupation of the households of the school children.

The occupations of the parents and guardians of the children were categorised as high level, middle level, low level and unemployed. The different levels of occupations of the households of the children are shown in Figure 2. The high level comprised of teachers, surgeons, bankers, nurses, directors, lawyers, doctors, surveyors and architectures. The Middle level category comprised of laboratory technicians, secretaries, librarians, drivers, police officers, receptionists, office messengers and cashiers.

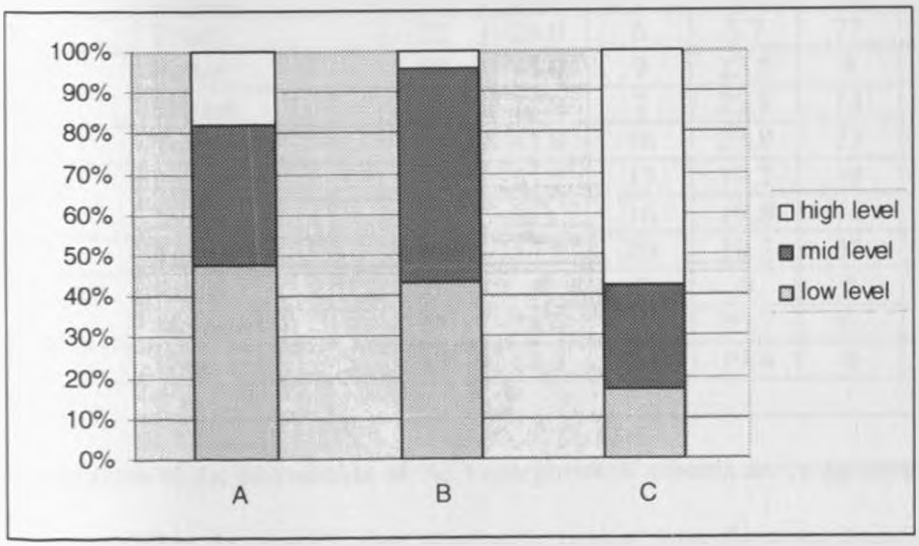

Figure 2: Occupation levels of the households of the children within school categories

The low level comprised of parents and guardians whose jobs were not regular and therefore, the income varied from day to day. These included painters, plumbers, masons, electricians cooks, cleaners, caretakers, househelps, watchmen, waiters, green grocery vendors, eateries, carpenters, vegetable vendors, shoe shiners, charcoal sellers, tailors and hairdressers.

Table 10 shows the occupation by school category. When the occupation of the parents was grouped by school category, category C had the highest percentage of high level occupations with mothers being 76.5% and fathers 70.4% respectively. The trend was similar in the middle level occupations that required some level of tertiary education, the mothers were 51.9% and fathers were 22.5%, respectively. The highest proportions of low level were found in category A. This reflects the parents and guardians of the children in this category of schools were mainly from low socio-economic groups.

Table 10: Occupation status by school categories

Occupation	Parent	School category						Within total	
		A		B		C			
		N	%	N	%	N	%	N	%
High level	Father	11	20.4	5	9.3	38	70.4	54	15.4
	Mother	11	21.6	1	2.0	39	76.5	51	14.6
	Total	22	21.0	6	5.7	77	73.3	105	
Mid level	Father	22	55.0	9	22.5	9	22.5	40	11.4
	Mother	6	22.2	7	25.9	14	51.9	27	7.7
	Total	28	41.8	16	23.9	23	34.3	67	
Low level	Father	34	51.5	13	19.7	19	28.8	66	18.9
	Mother	51	63	16	19.8	14	17.3	81	23.1
	Total	85	57.8	29	19.7	33	22.4	147	
Unemployed	Father	0	0	0	0	2	100	2	0.6
	Mother	17	58.6	6	20.7	6	20.7	29	8.3
	Total	17	54.8	6	19.4	8	25.8	31	
Total								350	100

The occupations of the households of the 3 categories of schools are in agreement with the criterion used by the MOE in the classification of schools. Indeed, it confirms the disparity among the 3 school categories in terms of their SES.

5.1.4.2 Property ownership by the households of the school children.

Results showed that 97.0% of all the families owned mobile phones, 94.6% indicated owning a radio, 91.1% a television set and only 35.1% owned a car. Ownership of property was more of an indication

of the SES of the household than of affluence. Table 11 shows the distribution of households by school category and property ownership.

Table 11: Percentage of property ownership by school category

Property ownership	School category											
	A				B				C			
Frequency	0	1	2	>2	0	1	2	>2	0	1	2	>2
M/phone	4.2	27.1	40.6	28.2	3.3	10.0	43.3	43.3	1.3	10.5	21.1	64.4
Television	15.6	64.6	19.8	0	3.3	86.7	10.0	0	2.6	61.8	26.3	9.2
Radio	8.3	71.9	14.6	5.2	6.7	66.7	23.3	3.3	1.3	53.9	38.2	6.6
Car	86.5	13.5	0	0	66.7	30.0	3.3	0	36.8	30.3	18.4	14.5

Television set was a common property across the three categories of schools, but 15.6%, 3.3% and 2.6% in category A, B and C respectively did not own television sets. The trend is similar with the ownership of other properties with the notable one being the car ownership where 86.5% and 36.8% in category A and C respectively did not own a car. However, if ownership of a car was an indicator of SES, then it means that category C which was presumably the domain of the high class children was affordable by about 13% and 34% of families from lower SES who took their children to category A and B schools respectively. On ownership of mobile phones, category C reflected the highest (42.0%) of those who owned more than three. This would indicate ownership of more than one mobile phone by one or both of the parents and or ownership of the mobile phone by older children as well. This is still an indication of the higher SES of households of category C as compared to category A and B. Radios were not popular among all the three categories with majority owning one. This compares differently with television that is more evenly distributed across the three categories with a majority owning between one and two televisions. This further confirms the varying SES among the three school categories.

5.1.4.3 Means of transport used by the children to school

The means of transport used to school was walking by 48.5%, public transport by 27.2%, private school transport by 10.4% and 13.9% by family vehicles. Figure 3 shows the distribution of children by means of transport to school.

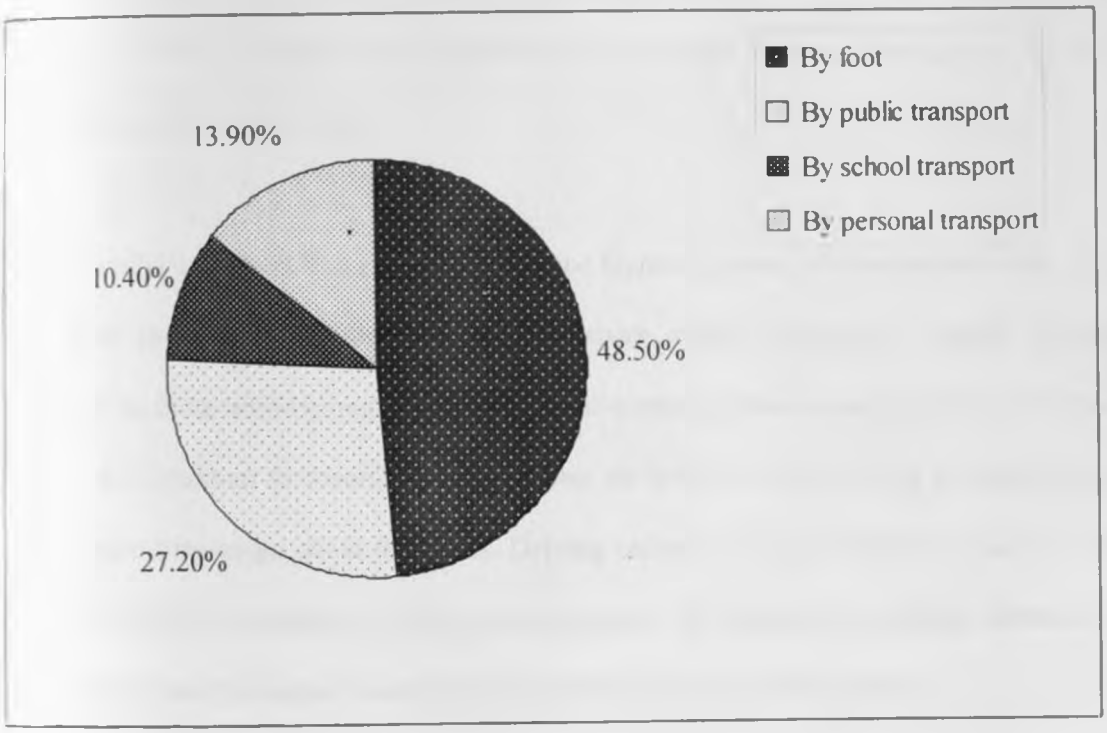

Figure 3: Distribution of children by means of transport to school

Close to 50% of the children walked to school with majority (68.8%) belonging to category A schools. The distribution of the means of transport within the three categories of school is shown in Table 12.

Table 12: Distribution of the means of transport used by children by school category

Means of transport	Category of school					
	A		B		C	
	n	%	N	%	N	%
Foot	66	68.8	11	36.7	21	27.6
Public	26	27.1	13	43.3	16	21.1
School transport	1	1.0	4	13.3	16	21.1
Personal vehicle	3	3.1	2	6.7	23	30.3
Total	96	100.0	30	100.0	76	100.0

Majority of the school children who walked to school were in categories A and B. Children who walk to school usually will live within the vicinity of their schools. Families within the low socio-economic group will seek schools within a walking distance from their residential. In category C, only a small proportion (27.6%) walked to school and about 21% and 30% of the children, respectively used private school transport and family cars.

Further analysis showed that category C had the highest number of households which owned cars and used them to transport children to school. Private school transport is usually expensive and is affordable to those who belong to the high social-economic class especially those who find it difficult to drive their children to school. It saves parents the bother of traffic in the morning and evening and affords them time to go about their jobs. Driving children to school leads to a decline in the level of activity which may contribute to the growing number of overweight children. However, researchers have also attributed changes in weight gain to the eating and snacking habits.

Therefore, whether the children use vehicles to school which reduces their activity level, there is need to further examine their snacking variety, choice and frequency of consumption. This is true, given that those who use vehicles to schools are likely to come from higher SES and thus likely to meet their RDA.

5.2 Nutritional status of the school children

The nutritional status of the study children was measured on the basis of two indicators; height-for-age Z-scores (stunting) and BMI-for-age Z-scores (overweight).

5.2.1 Height-for-age Z-scores (HAZ)

The mean age of children was 147.1 months with a range of 120.6 months to 166.5 months. The mean height was 146.4 cm with a range of 121.7 cm to 172.0 cm while the mean weight was 39.1 kg with a range of 21.9 kg to 84.2 kg. Figure 4 shows the distribution of children by sex and height for age z scores against the WHO reference data.

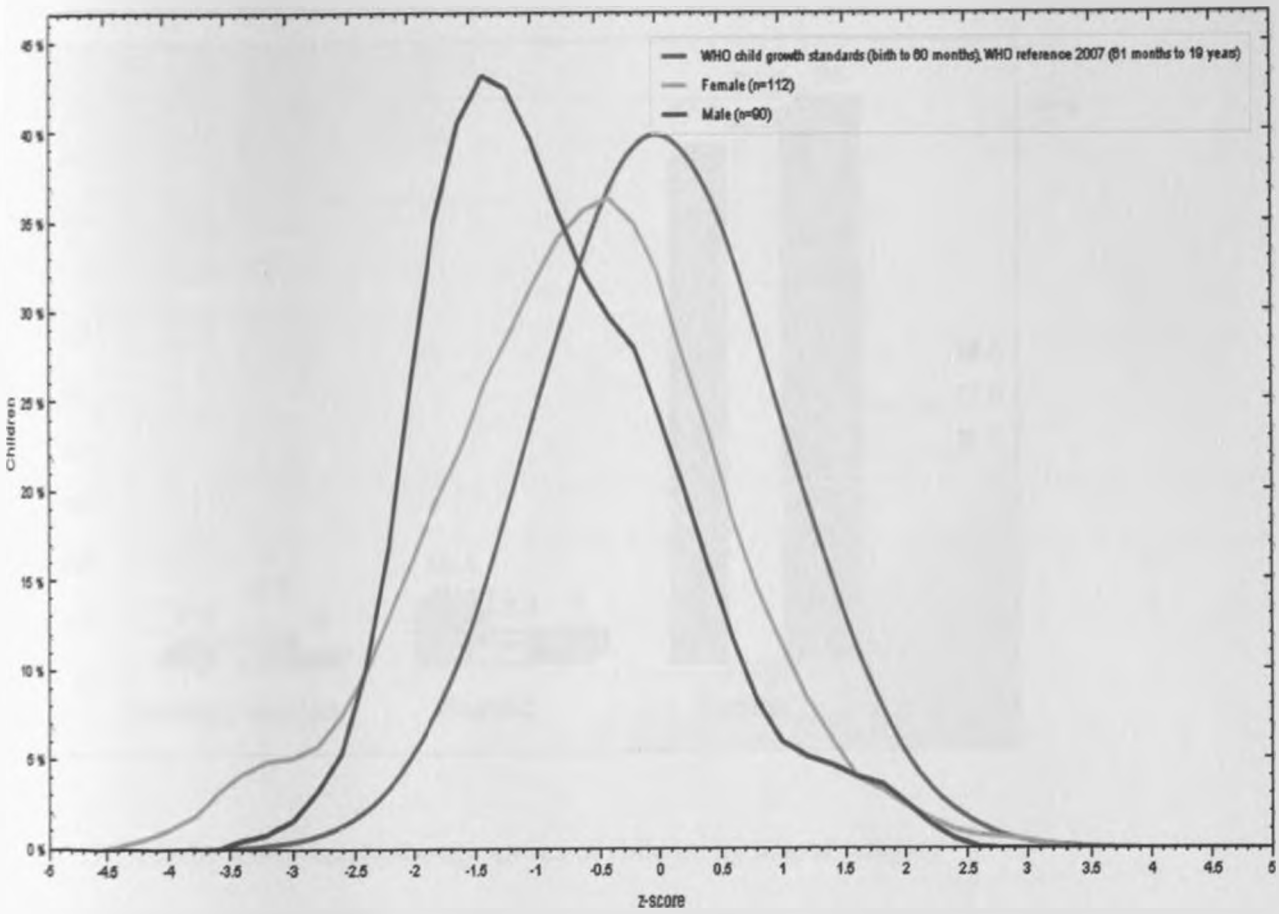

Figure 4: Distribution of height-for-age Z-score of children by sex.

The HAZ distribution for the male was generally more negatively skewed with a peak of -1.5 while that of the female was at -0.5. This indicates the male were more stunted than the female although the female had widespread values on both ends of the tail. Using the WHO growth reference data 2006, majority (91.6%) of the children were within the normal range of HAZ (-1 and +1 s.d.) while 6.9% were moderately stunted (short for the reference standard height) and 1.5% were severely stunted.

Figure 5 shows the distribution of the nutritional status among the three categories of schools. A total of 12.5% of children from the category A were found to be stunted. Stunting is indicative of chronic undernutrition as a result of inadequate dietary energy intake early in life, below the minimum requirement level to maintain the balance between energy intake and energy expenditure.

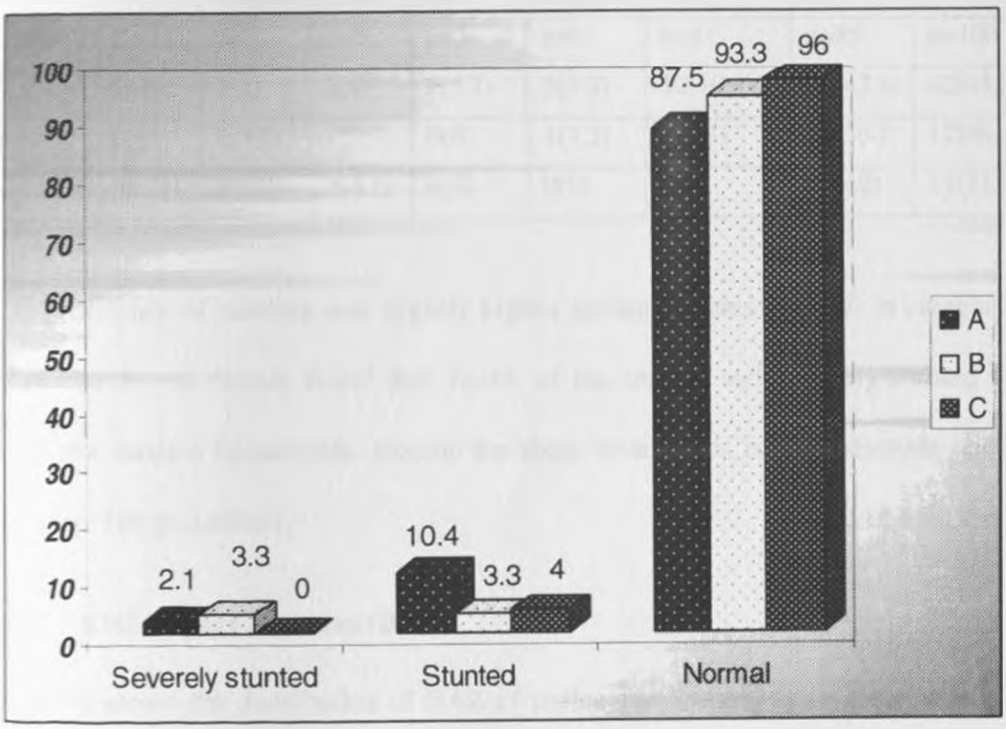

Figure 5: Distribution of height-for-age scores of children by school category

SES influences the availability of food for adequate nutrient intake by the household members. It would therefore be expected that children from families where parents or guardians have low incomes would have poorer general nutritional status than children with professional parents or guardians. As shown in Table 13, a slightly larger proportion of female than male were stunted in all categories of schools. The higher stunting rates in female than male can be attributed to the higher physiological demands for female than the male during the adolescent stage. Growth spurt is experienced during adolescence; hence an increase in nutrient intake is expected. It is also possible that especially in the

low SES group where stunting was more common; during food shortage where males are tend to be given more food than female.

Table 13: Percentages of height-for-age Z-scores by school category

School category	Severely stunted			Stunted			Normal		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
	N=1	n=5	n=6	n=5	n=6	n=11	n=85	n=100	n=185
A	0(0)	2(2)	2(2)	5(5.2)	5(5.2)	10(10.4)	42(43.8)	42(43.8)	84(87.6)
B	0(0)	1(3.3)	1(3.3)	0(0)	1(3.3)	1(3.3)	11(36.7)	17(56.7)	28(93.4)
C	1(1.4)	2(2.7)	3(4.1)	0(0)	0(0)	0(0)	32(42)	41(53.9)	73(95.9)

The prevalence of stunting was slightly higher among females (14.3%) in category A than in category C (4.7%). It was further found that 72.0% of the stunted and severely stunted school children were from low income households. Income for these households is unpredictable and availability of food therefore not guaranteed.

5.2.2 BMI-for-age Z-scores (BAZ)

Figure 6 shows the distribution of BAZ of males and females against the WHO reference chart. The children BAZ distribution was generally negatively skewed against the reference data. It is notable that the children were 5% lesser than the reference peak for the BAZ. This means that the children were generally lesser in their weight for age when compared with the reference WHO reference chart. The males and females had similar peaks with the male tail being negatively elongated.

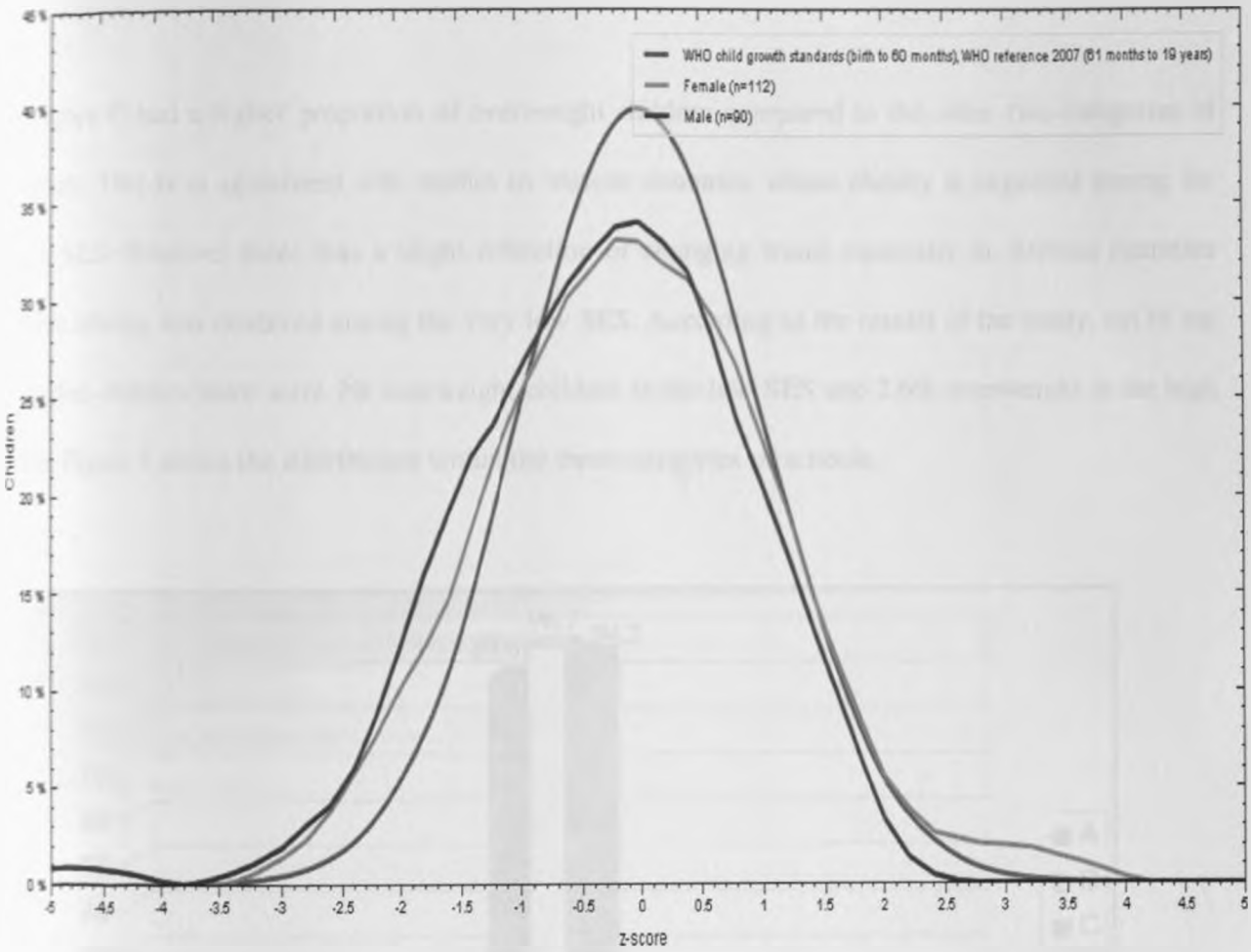

Figure 6: BAZ distribution of male and female.

The BMI-for-age Z scores indicated that the proportion of those with chronic undernutrition was only 5% majority (92.6%) were within the normal range. About 1.0% was overweight and another 1% obese. Table 14 shows the mean BMI-for-age z scores by school category.

Table 14: Mean BMI-for-age Z scores by school category

Category of school	Sex					
	Male			Female		
	N	Mean (SD)	Range	N	Mean (SD)	Range
A	47	-0.5(1.0)	-2.8-1.5	49	-0.2(1.1)	-2.6-3.0
B	11	-0.5(0.8)	-1.7-0.6	19	-0.1(1.0)	-2.3-1.2
C	33	-0.1(1.3)	-4.8-1.7	43	0.1(1.2)	-2.5-3.3
Total	91	-0.3(1.1)	-4.8-1.7	111	-0.1(1.1)	-2.6-3.3

SD: standard deviation; n=number.

Category C had a higher proportion of overweight children compared to the other two categories of schools. This is in agreement with studies in various countries where obesity is expected among the high SES. However there was a slight reflection of changing trend especially in African countries where obesity was observed among the very low SES. According to the results of the study, out of the sampled children there were 2% overweight children in the low SES and 2.6% overweight in the high SES. Figure 7 shows the distribution within the three categories of schools.

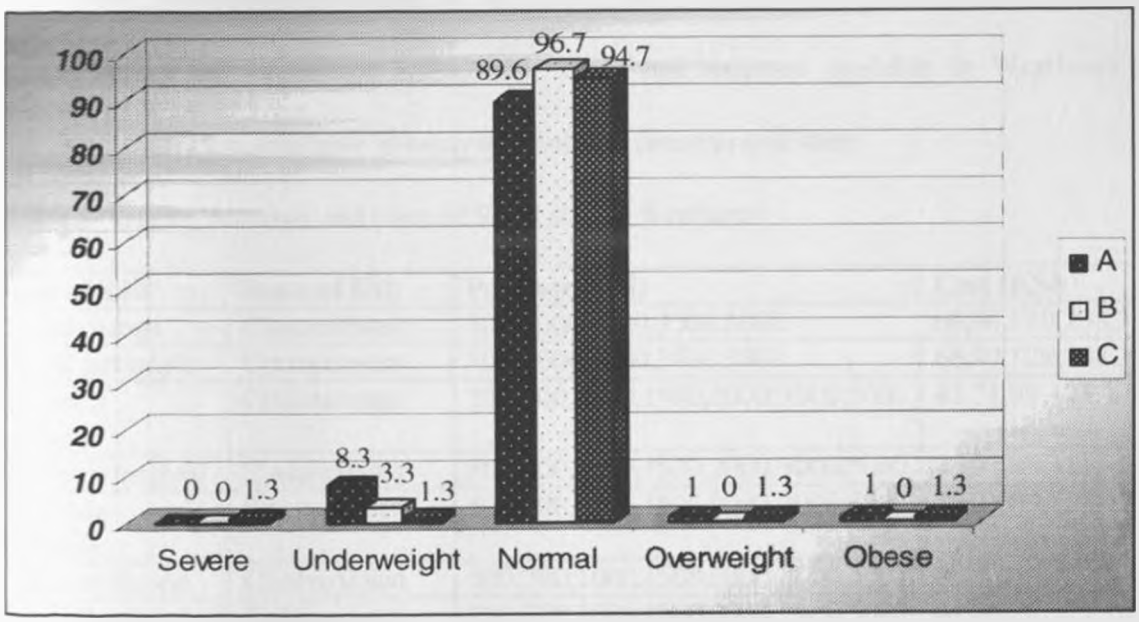

Figure 7: Distribution by percentages of children by BMI-for-age Z-scores by school categories

This trend of obesity being found in varied SES is not strange in Africa where cultural beliefs associate bodyweight with wellbeing. A FGD in the low SES indicated that those children who were overweight, had mothers who were housewives and spent long hours preparing what they regarded as nutritious foods for their families. Most of the foods consumed were mainly starch and there were 5 to 6 meals per day.

Malnutrition in terms of BAZ was found to be mainly prevalent in the households with temporary or low paying menial jobs. There were no cases of severe undernutrition amongst children whose

households had high level professional occupations. All the stunted males were found to be in category A schools and the stunted females were evenly distributed across the three categories of schools. However, there was no significant difference between the prevalence of stunting between the male and female. The double burden of malnutrition is clearly depicted in this study as is the case in developing countries today since there are those who are stunted and those are overweight within the same SES status.

5.3 Market appraisal of SSBs in Westlands

Table15 shows the variety of SSBs, their costs and volumes available in Westlands division. Quencher® brand was available in ready to drink and concentrated state.

Table 15: Variety, volumes and costs of SSBs sold in Westlands

Name of SSB	State of SSB	Packages (ml)	Cost (KSh)
Cordial orange	Concentrated	700,1000,1500,3000,5000	68,90,129,238,375
Cordial pineapple	Concentrated	700,1000,1500,3000,5000	68,90,129,238,375
Highlands cocopine	Concentrated	500,700,1000,1500,2000,3000,5000	45,71,89,121,172,228,335
Highlands tropical	Concentrated	500,700,1000,1500,2000,3000,5000	45,71,89,121,172,228,335
Highlands pineapple	Concentrated	500,700,1000,1500,2000,3000,5000	45,71,89,121,172,228,335
Highlands lemon	Concentrated	500,700,1000,1500,2000,3000,5000	45,71,89,121,172,228,335
Savannah orange	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,121,160,210,335
Savannah punch	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,117,160,210,298
Savannah pineapple	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,117,160,210,298
Savannah cocopine	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,117,160,210,298
Pep passion	Concentrated	1000,1500,2000	94,132,175
Pep mango	Concentrated	1000,1500,2000	94,132,175
Pep mixed fruit	Concentrated	1000,1500,2000	94,132,175
Trufru lime juice	Concentrated	700,1000	78,112
Quencher orange	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,117,160,220,315
Quencher strawberry	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,117,160,220,315
Quencher lemon	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,117,160,220,315
Quencher pineapple	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,117,160,220,315
Quencher fizto	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,117,160,220,315

Name of SSB	State of SSB	Packages(ml)	Cost(Ksh)
Quencher tangerine	Concentrated	500,700,1000,1500,2000,3000,5000	42,65,85,117,160,220,315
Quencher orange	Ready to drink	200,300,500	10,23,32
Quencher strawberry	Ready to drink	200,300,500	10,23,32
Quencher lemon	Ready to drink	200,300,500	10,23,32
Quencher pineapple	Ready to drink	200,300,500	10,23,32
Quencher fizto	Ready to drink	200,300,500	10,23,32
Quencher tangerine	Ready to drink	200,300,500	10,23,32
Marche orange	Ready to drink	200,300	17,25
Marche pineapple	Ready to drink	200,300	17,25
Marche lemon	Ready to drink	200,300	17,25
Afia apple	Ready to drink	300,500	35,40
Afia ace	Ready to drink	300,500	35,40
Afia tropical carrot	Ready to drink	300,500	35,40
Afia orange	Ready to drink	300,500	35,40
Africola	Ready to drink	300,500	35,40
Vital juice black currant	Ready to drink	300,1000	40,110
Vital juice orange	Ready to drink	300,1000	40,110
Vital juice apple	Ready to drink	300,1000	40,110
Splash	Ready to drink	300	35
Juice cola coke	Solid	5g	5
Juice cola orange	Solid	5g	5
Delavy cocktail	Solid	5g	5
Delavy orange	Solid	5g	5
Delavy cola	Solid	5g	5
Delavy pineapple	Solid	5g	5
Delavy strawberry	Solid	5g	5
Super drink pineapple	Solid	5g	5
Super drink orange	Solid	5g	5
Super drink strawberry	Solid	5g	5
Jus orange	Solid	5g	5
Jus kenafric	Solid	5g	5

The reconstituted SSBs containing the least vitamin C are the cheapest. A packet costs KSh 5.00 which can be reconstituted to give 2000ml. However they were not sold openly in many shops because they are known to be harmful when consumed and a possible avenue for selling drugs to school children. The concentrated and ready to drink SSBs were readily available in many shops and supermarkets. A

few school canteens stocked SSBs despite the directive by the MoE not to have school canteens within the school compound.

5.4 SSBs consumption by the school children

This section covers the diversity of SSBs available in the market and the volumes of these products consumed by the school children. Further, the section presents and discusses the amount of calories and vitamin C in the SSBs.

5.4.1 Types of SSBs consumed by the school children

Out of the sampled children, a majority (87.6%) were consuming SSBs daily while in school. A small (12.4%) proportion of the children did not consume SSBs when in school. The most popular (89.7%) type of SSB consumed by the children was the ready to drink. Figure 8 shows the different states of SSBs consumed. FGDs confirmed this popularity as many school children found the packaging attractive, re-useable, easy to carry and packed in a variety of sizes that catered for different economic needs. It is understandable why dilutable SSBs were not popular to the school children because these can be cumbersome to reconstitute within the precincts of the school. This is mainly due to unavailability of portable water.

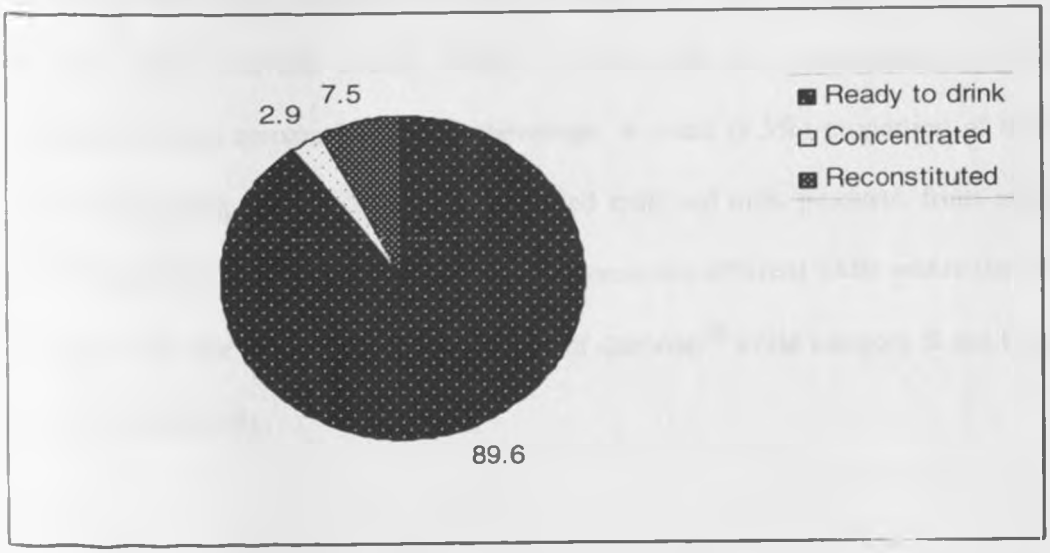

Figure 8: State of SSBs

Table 16 shows the diversity of SSBs consumed by the children. The commonly consumed SSB (76.4%) was quencher® and is available in five flavours namely orange, strawberry, blackcurrant, lemon and pineapple. The most popular flavour was the orange. It was mainly packed in the 300ml bottle. It is available as a concentrated and ready to drink beverage.

Table 16: SSBs consumed by the school children

Name of SSB	Frequency	Percent
Quencher orange	39	19.3
Quencher fizto	30	14.9
Quencher lemon	12	5.9
Quencher pineapple	28	13.9
Quencher strawberry	24	11.9
Savannah pineapple	2	1.0
Savannah orange	1	0.5
Marche lemon	1	0.5
Marche orange	8	4.0
Highlands pineapple	3	1.5
Splash	7	3.5
Afia apple	6	3.0
Juice cola coke	5	2.5
Juice cola orange	5	2.5
Juice cola pineapple	1	0.5
Delavy orange	2	1.0
Consumed none	28	13.9
Total	202	100.0

Reports from the FGDs indicated the reason for the popularity as being the intense advertisement in the televisions, radios and bill boards. When a choice SSB was not available, most (70.9%) of the respondents did not consume any other beverage. A small (8.3%) proportion of the school children were not consuming SSBs but instead consumed milk and milk products, fruits and real fruit juice. Table 17 shows the proportion of children who consumed different SSBs within the school categories. Category A were the highest (26%) consumers of quencher® while category B and C consumed 16.7% and 11.8% respectively.

Table 17: The proportion (%) of children in school categories and the SSBs they consume

Name of SSB	School category					
	A		B		C	
	N	%	N	%	N	%
Quencher orange	25	26.0	5	16.7	9	11.8
Quencher fizto	22	22.9	4	13.3	4	5.3
Quencher lemon	4	4.2	0	0	8	10.5
Quencher pineapple	13	13.5	5	16.7	10	13.2
Quencher strawberry	12	12.5	6	20.0	6	7.9
Savannah pineapple	1	1.0	0	0	1	1.3
Savannah orange	0	0	0	0	1	1.3
Marche lemon	0	0	1	3.3	0	0
Marche orange	4	4.2	3	10.0	1	1.3
Highlands pineapple	0	0	0	0	3	3.9
Splash	0	0	0	0	7	9.2
Afia apple	0	0	0	0	6	7.9
Juice cola coke	3	3.1	0	0	2	2.6
Juice cola orange	5	5.2	0	0	0	0
Juice cola pineapple	0	0	0	0	1	1.3
Delavy orange	2	2.1	0	0	0	0
Consumed none	5	5.2	6	20.0	17	22.4
Total	96	100.0	30	100.0	76	100.0

Consumption of SSBs was generally higher in category A school than in C especially the reconstituted SSBs such as juice colas®. The FGDs confirmed that children from category C did not consume the cheap, poor quality reconstituted SSBs.

5.4.2 Consumption of SSBs by the school children

The mean volume of the SSBs consumed by the children was 374 ml per day with a range of 200ml to 2000ml. Consumption by volume is shown in Figure 9. The study indicated over 70% of the children consumed more than 300ml of SSBs daily.

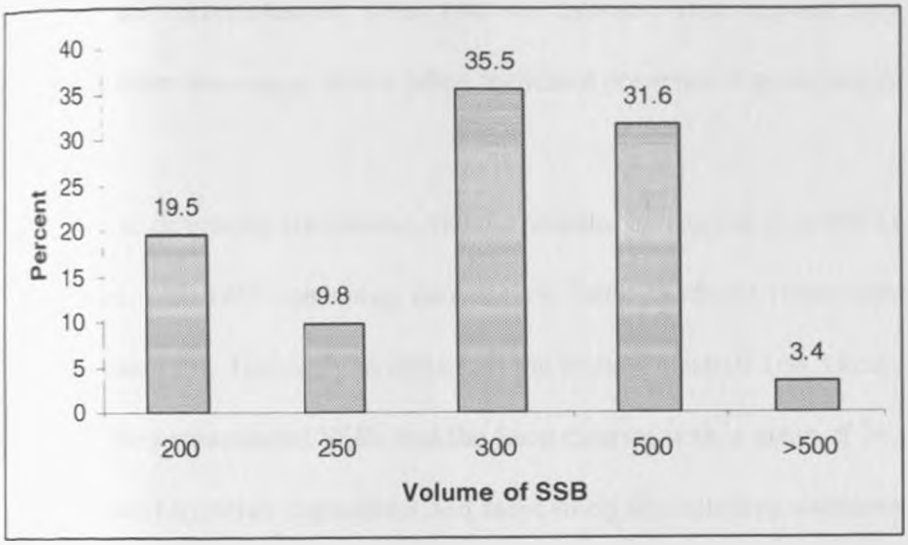

Figure 9: Consumption of SSBs (in millilitres) per day by children

Of the children who carried the SSBs to school, 67% consumed all of it while in school. Of those who did not consume the entire volume in school, 71.4% shared with friends, while 28.6% disposed the remains. Out of those who shared, 59.3% shared up to 150ml and 28.7% shared up to 200ml, while the remainder of the children shared smaller amounts, which would not be easily quantified. When not in school 30.1% of the children consumed up to 250ml of SSBs, 14.6% consumed up to 350ml, 18.9% consumed up to 500ml, while 1.5% consumed more than 500ml. The rest (34.9%) did not consume any SSBs at all. This shows that at least 65.1% of the children consumed more than 200ml of SSBs, which would yield more than an average of 90kcals when at home. Indeed if this amount of SSBs were extra to adequate dietary intake of energy, the school children would be exposed to increased risks of having a positive energy balance that may lead to weight gain.

5.5 Calories and vitamin C contribution to dietary intake by SSBs

5.5.1 Caloric content in SSBs consumed by the children

Different brands of SSBs had different amounts of calories in them. Quencher® brands had the highest content of calories with the blackcurrant flavour containing between 200 to 240kcal. Some brands

especially the reconstitutable SSBs had no calories. This implies they had been sweetened with substances other than sugar. Some labels indicated presence of permitted sweeteners.

In analysis to determine the caloric content revealed a range of 0 to 650 kcal per volume consumed by the children, with 14% containing no calories. Table 18 shows mean calories from the different states of SSBs consumed. The ready to drink had the highest mean of 168.3 kcal per volume consumed by the children. The reconstituted SSBs had the least calories with a mean of 26.1. This clearly indicates that it is sweetened by other ingredients and most likely the nutritive sweeteners. This is further confirmed by instructions given on the labels where a sachet of 5g is to be diluted in 2000ml of water.

Table 18: Means calories in various states of SSBs consumed by school category

School category		Ready to drink	Concentrated	Reconstituted	None consumed
A	N	81	0	10	5
	Mean	165.7	0	25.6	0
	SD	93.9	0	7.7	0
B	N	25	0	0	5
	Mean	158.7	0	0	0
	SD	71.8	0	0	0
C	N	53	5	3	15
	Mean	176.4	132.7	28	0
	SD	107.9	96.5	0	0
Total	N	159	5	13	25
	Mean	168.3	132.7	26.1	0
	SD	95.5	96.5	6.8	0

The FGD confirmed that most of the children who consumed the reconstituted SSBs had an irritation on their throats after consumption. Consumption of these SSBs is not a preserve of those from the low SES but also the high SES consumes them.

A majority of the school children consumed the ready to drink SSBs which have the highest (168.3) calories. This implies majority of the school children consumed relatively sweeter and attractively packed SSBs. This explains why there was a wide range of ready to drink SSBs in the market. The

mean intake from SSBs was 137.4kcal. This intake is above 120 kcal that if consumed daily for one year would cause one to gain 4.5kg annually, and if regularly consumed for one year by an adolescent whose weight is normal, the adolescent will became obese after a period of four years (Moynihan and Petersen, 2004). This mean calorie in SSBs contributed 6.5% and 7.7% of RDA in male and female respectively.

5.5.2 Vitamin C content in selected SSBs brands

Laboratory analyses showed that 71.8% of SSBs consumed had no trace of vitamin C. Only a small proportion (28.2%) of SSBs had varying levels of vitamin C. Out of those who consumed SSBs that contained vitamin C, 14.3% consumed less than 20 mg, 59.2 % consumed between 20mg and 35 mg while the rest consumed from 35mg to 120mg of vitamin C. Only 11.5% of the products had nutrition information labels that are useful to consumers on the nutrients and additives present. Table 19 shows the levels of vitamin C in the SSBs in different packages.

Table 19: Packages of SSBs consumed and claim for presence of vitamin C on the labels

Vitamin C in SSB(mg)	Volume of SSB consumed				Rich in vitamin C	No claim
	200ml	250ml	300ml	>500ml		
	%	%	%	%	%	%
7-20	10	75	4.7	12.2	5.5	38.4
20-30	80	25	14.2	15	30.5	15.4
30-40	10	0	76.1	0	47.3	0
>40	0	0	5.0	72.8	16.7	46.2
Total	100	100	100	100	100	100

However, a majority of the SSBs either had pictorials of fruits depicting health-giving messages. Laboratory analysis revealed 41.6% of those SSBs that claimed to contain vitamin C had none. The results above show that some of the SSBs which had no claim of containing vitamin C were found through laboratory analysis to contain some. Up to 46.2% in this category contained more than 40mg of vitamin C in 300ml. Vitamin C intake from the SSBs ranged from 0 to 120mg depending on the volume consumed with a mean intake of 9.2mg. This mean vitamin C intake from SSBs contributed

33.5% of the RDA. Table 20 shows the means of vitamin C found in various states of SSBs. The reconstituted has the highest mean (12mg) level of vitamin C and the concentrated was found with the least at 4.5mg.

Table 20: Means of vitamin C in various states of SSBs consumed by school categories

School category		Ready to drink	Concentrated	Reconstituted	None consumed
A	N	81	0	10	5
	Mean	11.4	0	6.4	0
	SD	22.2	0	11.8	0
B	N	25	0	0	5
	Mean	7.4	0	0	0
	SD	14.1	0	0	0
C	N	53	5	3	15
	Mean	10.6	4.5	30.7	0
	SD	24.4	10	12.1	0
Total	N	159	5	13	25
	Mean	10.5	4.5	12	0
	SD	22.2	10	15.6	0

Vitamin C that is found in the reconstituted SSBs is high because it is in solid state thus relatively more stable than that in liquid state. However, it is important to note that majority of the children consume the ready to drink SSBs whose mean is 10.5mg.

5.6 Factors influencing consumption of SSBs by the school children

The social and economic factors examined were source of information and nutrition awareness.

5.6.1 Source of information on the choice of SSBs consumed.

About 34% of the school children first learnt about their choice SSBs from television, 28.5% from peers, 19.9% from parents and 16.1% from supermarket. School promotion and radio received the least percentage as shown in Figure 10.

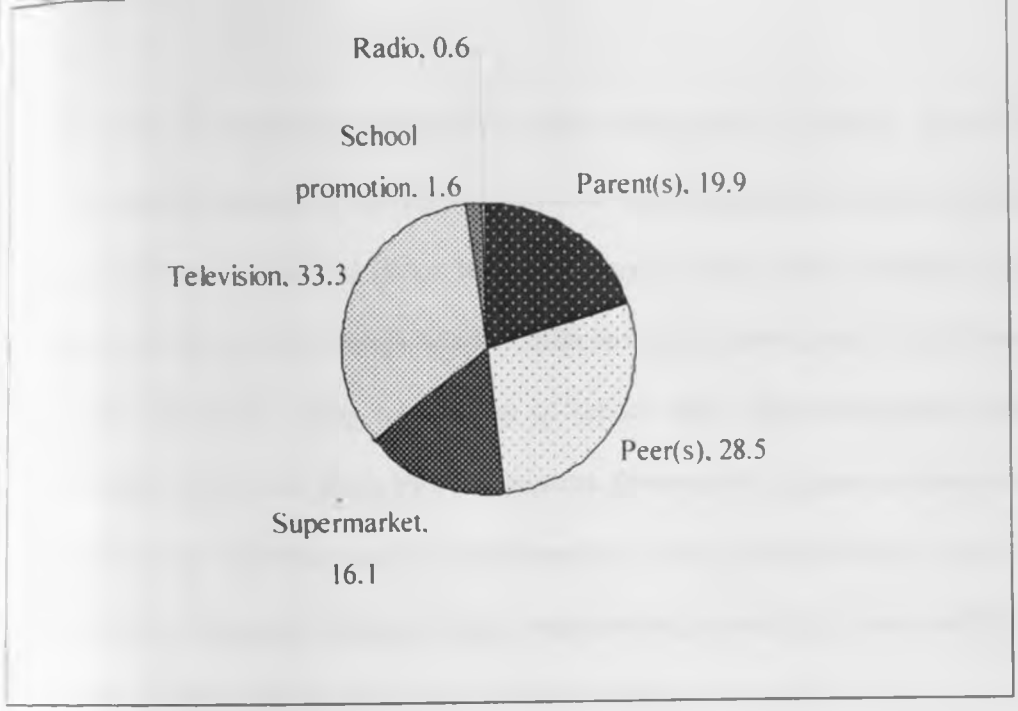

Figure 10: Source of information on the choice SSB

The highest percentage learnt about their preferred SSBs from television followed by peer education. This shows the importance of television as well as peer influences in information dissemination among school children. The school age children are usually exposed to both positive and negative influences on food habits. Television becomes a powerful source of information on food in urban areas. The rural areas will be different where television is scarce and may be the radio more common. At the same time, positive learning opportunity can occur in the classroom when nutrition education is integrated into the learning activities and parents provide support and reinforcement at home (Schelnker and Long. 2007). The study showed a large proportion (33.3%) of the school children who had televisions in their homes heard about the SSBs for the first time from the televisions. Parents as a source of information on SSBs contributed 20.1%. This shows the critical role played by parents in the nutrition education and awareness of the children. Parents and guardians augment in reinforcing nutrition information.

Majority (67%) of the children decided on which SSB to carry to school. About 22% of the children were influenced by parents in making the decision. Other factors that determined which SSB was taken to school were taste, cost and peers, but these played minor roles. Findings from the study further showed that 42.7% of the children bought SSBs from the supermarket, 35.4% from a shop near their homes and 5.3% from a shop on the way to school. Only 2.9% bought the SSBs from the school canteen, while 3.4% were given by their parents. Perhaps this further explains why the effect of the advertisements on SSBs that were on televisions was more popular that those aired in the radios. From the focus group discussion across the three categories of schools, the school children fondly mentioned some of the popular local advertisements that are shown on televisions.

A total of 69.8% of children made the decision to buy the SSBs, while 22.8 % had the beverage bought for them by parents or guardians. This shows that in order for nutrition awareness to have the desired impact, it should target not only the children but also their parents and guardians. Most (84.2%) of the SSBs were bought either at shops near homes or in supermarkets. Only a small proportion (7.4%) bought on their way to school. Indeed, a survey in the public primary schools showed no presence of school canteens in a majority of the schools. Only 7.4% had school canteens.

The age of 10-13 years of the pre-adolescence stage is characterised by rapid growth and development, generating pressure for self control. At this age, inappropriate concepts of body image may lead to chronic dieting or eating disorders. It is also during this period that nutrition and health concepts can be effectively learnt. Family food attitudes are imitated by these children, but increasing outside activities compete with family mealtimes and family conflicts arise (Schelnker and Long, 2007).Focusing on this age group for nutrition education can therefore foster a healthier adult population because of promotion of lifelong healthier choices.

5.6.2 Nutrition awareness and preference of SSBs consumed

Out of the school children, 87.6% consumed SSBs, while 12.4% did not consume any SSBs in school. Given a choice on what to consume, 61.9% preferred fresh fruits and their products, of these, 88.8% chose the fruits because they were healthier than SSBs. The remaining 38.1% of the children who would choose SSBs, 82.9% indicated sweetness as the main criterion for the choice. Only 4% of the children indicated choosing SSBs because they were cheaper and more readily available.

Statistical test for association between preference for SSBs and the reason for choice, the value of the chi-square statistic was found to be 128.42 at 2df. This value was found to be highly significant ($p<0.001$), indicating the preference (choice) the children made was strongly influenced by the reason for choice. The results showed 61.7% know fruits were healthier than SSBs. However, the reason given by majority of the children for not taking these products instead of SSBs was based on other factors and not nutritional awareness. The neighbourhoods in which most of these schools were located were a few metres from *kiosks* (roadside shops) that were vending fresh fruits and vegetables. In some areas, the children passed through markets and selling points as they went to school each day. A market survey conducted in the area revealed fruits were relatively cheaper than the SSBs consumed by these children. A 200ml SSB on average costs Ksh 17.00 which is almost four times the cost of an orange. Yet children rarely purchased the fruits to take to school in spite of a majority indicating the fruits were healthier than SSBs. May be the convenience offered by the beverage SSBs compared to intact fruits lead to the choice of the latter and not the former. SSBs are taken mainly for thirst quenching and they can be taken little at a time, which is not the case with intact fruit. It is also possible that the packaged SSB elicited a higher degree of sophistication by the child than a fruit.

5.7 Nutritional status, dietary intake and SSBs consumption

In this subsection the dietary intake is presented as well as the relationship between dietary intake and nutritional status and SSBs intake.

5.7.1 Consumption of other foods and dietary intake of calories and vitamin C

Most of the children consumed other foods as indicated in Table 21. The mean total energy intake per day was 1,352.6kcal and vitamin C mean intake was 35.1mg. The SSBs contributed a mean of 137.4kcal which is 10.2% of the total dietary intake while 9.2mg mean of vitamin C contributed 26.2% of the total vitamin C intake.

Table 21: Frequency of food consumption

		Never consumed		Regularly consumed	
Food group	Food item	n	%	n	%
Cereals	Ugali	0	0	202	100
	Rice	2	99	200	1
	Chapati	35	17.3	167	82.7
	Bread	11	5.4	191	94.6
	Cake	42	20.8	160	79.2
Tubers and roots	Sweet potatoes	37	18.3	165	81.7
	Irish potatoes	14	6.9	188	93.1
Legumes and seeds	Beans	21	10.4	178	89.6
	Peas	52	25.7	150	74.3
	French	89	44.1	113	55.9
Meat	Meat	17	8.4	185	91.6
	Chicken	37	18.4	165	81.6
Eggs	Eggs	24	11.9	178	88.1
Milk	Milk	2	1	200	99
Vegetables	Kales	9	4.5	196	95.5
	Cabbages	23	11.4	179	88.6
	Amaranth	102	50.4	100	49.6
Fruits	Oranges	16	7.9	186	92.1
	Mangoes	47	23.4	155	76.6
	Pineapples	82	40.6	120	59.4
	Passions	91	45	111	55
	Guavas	98	48.5	104	51.5
Fats and oils	Fats	158	78.2	44	21.8
	Oils	4	2	198	98

Although a decline in activity has been found to contribute to the growing number of overweight children, some researchers have pointed out to the changes in snacking habits. A comparison of diet surveys during the past 25 years indicate that today's children do not select snacks that are higher in kilocalories than children in the past years but they eat more snacks more often, which has added to their energy intakes (Schelnker and Long, 2007). When expressed as a percentage of the RDA, as shown in Table 22, SSBs contributed about 26% and 38% of the total food intake and RDA in males, respectively.

Table 22: Calories and vitamin C SSBs expressed as a percentage of the RDA and total intake

Nutrient	Contribution by SSB (mean)	Food mean nutrient intake	RDA		SSB % of total food intake		SSB % of RDA	
			Male	Female	Male	Female	Male	Female
Vitamin C(mg)	9.2	35.1	23.6	23.6	26.1	26.1	38.6	38.6
Calories(Kcal)	159.5	1,352.6	2300	2025	11.8	11.8	6.9	7.9

5.7.2 Nutritional status and vitamin C intake

As indicated earlier 91.6% of the children were within the normal BMI-age-Z score. Further analysis indicated that despite the high intake of SSBs most children gained little vitamin C. Most of the school children gained no vitamin C yet were within the normal BMI-age index. There was no correlation between BAZ and vitamin C intake with coefficient of $r = -.128$, $p>0.69$. However the contribution of vitamin C to the total intake and RDA by the SSBs was significant.

5.7.3 Nutritional Status and Caloric intake

The study further sought to establish the relationship between BMI-age-Z score and caloric intake from SSBs by children. There was no significant relationship between BMI-age-Z score and caloric intake from SSBs at coefficient $r = -.042$, $p > .553$. Thus, the nutritional status of majority of the children was mainly due to the variety of foods consumed as shown in the frequency of other foods consumed

outside the SSBs. Table 23 shows the volumes of SSBs consumed by those who were found to be overweight. All the overweight were found to be females.

Table 23: BMI-for-age Z scores and consumption of SSBs

School category	Name of SSB	Quantity of SSB consumed	Kcal in SSB consumed	Sex	BMI-for-age Z scores	Classification
C	Afia	500	240	female	3.0	obese
C	Savannah orange	500	163	female	2.0	overweight
A	Quencher orange	300	99	female	2.6	overweight
A	Quencher lemon	300	144	female	3.3	obese

Although males consumed a higher mean (139.85kcal) of SSBs than females (135.41kcal), the female are at a higher risk of becoming overweight since 39.2% of the female consumed twice the amount (120kcal) if regularly consumed for one year it is likely to make an adolescent whose weight is normal to became obese by gaining an extra 4.5 kg annually after a period of four years (Moynihan and Petersen 2004).

It is important to note that a large proportion (64%) of the school children consumed twice or more of the amount of calories which, if regularly consumed while meeting their RDA for at least four years would lead those who were normal to become overweight. The extent to which these school children may have been consuming these beverages is beyond the scope of the present study. However, it's clearly demonstrated that the reason why these school children are not gaining weight may be attributed to other factors such as daily caloric intake, SES and individual characteristics which are addressed in depth in this study.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The study established that four out of every five children are likely to consume a volume which contributes to sufficient calories that can lead to overweight and obesity if consumed over a period of four year. The SSBs consumption was similar in all the three categories of schools. Males consumed slightly higher levels of SSBs than females although the females were at higher risk of becoming overweight because they were found to have higher BMI.

Many of the SSBs widely consumed did not contain any vitamin C but those that did, contributed significantly to the RDA for this category of children. General nutrition information was, however, lacking from the labels. Peers, parents and media were found to play a dominant role in the choice SSB by the children.

6.2 Recommendations

Policy formulation and implementation on fortification of SSBs with vitamin C needs to be developed.

The nutrition information provided on labels of SSBs needs to declare genuinely the ingredients used and their amounts. The use of disallowed non-nutritive sweeteners in the manufacture and importation of SSBs should be regulated. Policy guidelines on the use of non-nutritive sweeteners such as saccharin that are disallowed (other than for dietetic purposes), should be formulated, if they exist, they should be enforced.

There is need to regulate the contents of advertisements through policy especially in regard to promotion of SSBs. Clear criteria for advertising of food products should be geared towards healthy lifestyles. Regarding the marketing of food and non alcoholic beverages to school children, a code of practice should be developed and implemented.

Consumer awareness on the meaning of terminologies in use such as fruit juice, pure juice, nectars, drinks and blends need to be harmonised into standardized definitions that are easily understood by the consumer.

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APPENDICES

Appendix 1

Questionnaire

This is a survey to find out the consumption of sugar sweetened beverages in school children and its contribution to their dietary intake and nutritional status. It is a requirement as partial fulfilment for an MSc programme in Applied Human Nutrition, Department of Food Science, Nutrition and Technology in University of Nairobi. You are requested to voluntarily answer the questions and be assured that the data will be used for the purpose of this study only and will be treated with confidentiality and care.

Demographic and socioeconomic status

1. Questionnaire number [_ _ _]

2. Name of interviewer.....

3. Name of school.....

4. Category of school [ ]

5. Names of the child[fill two names]
   .....

6. What is the sex of the child? [Fill 1 if male 2 if female]
   Male [ ] female [ ]

7. Date of birth [check diary where available to verify and record]
   dd_ _/mm_ _/yr_ _ _ _

8. How many siblings do you have? [fill appropriately]
   Brother(s) [ ] Sister (s) [ ]

9. How do you come to school? [tick (✓) appropriately]
   By foot [ ] by public transport [ ] by school transport [ ]
   By personal vehicle [ ] other specify.....

10. Who else lives with in your home other than your siblings and parents/or guardian(s)? [Fill appropriately]

11.

Relation to child	Sex	Age

12. What is the occupation of your parent(s) or guardian(s)? [probe to ascertain information given and ask for a description of the occupation]

Mother..... Father.....

Guardian (male)..... Guardian (female) .....

Description.....

13. Does your family own any of the following? [Fill all the responses. Fill 1 if owned and 2 where not owned.]

Item	Owned
Cell phone	
Radio	
Television	
Car	

Consumption of sugar sweetened beverages (SSBs)

14. What is the name of the sugar sweetened beverage (SSB) you carry to school most frequently?[probe for the label name/brand name]

.....

15. When not consuming (13) above what other type of SSB do you carry to school?[probe for the label name/brand name]

.....

16. Where do you buy (13) above from? [tick (✓) appropriately]

Shop near home [ ] Shop on the way to school [ ]

School canteen/tuck shop [ ] other (specify).....

17. What time do you mostly buy the SSB you carry to school? [tick (✓) appropriately]

In the morning when coming to school [ ] During break time when in school [ ]

At lunch time when in school [ ] In the evening when leaving school [ ]

In the evening at home [ ] I don't buy [ ]

Other (specify).....

18. Who decides what SSB you bring to school? [tick (✓) appropriately]

Me [ ] parent/guardian [ ]

Other (specify).....

19. Where did you first learn about 13 above? [tick (✓) appropriately]

T.V. [ ] Radio [ ] school promotion [ ]
Peers [ ] Other (specify).....

20. How much SSB do you usually bring to school? [Fill appropriately]
.....ml

21. Is the SSB bought already diluted (ready to drink) for drinking or is diluted at home? [tick (✓) appropriately]
Ready to drink [ ] Diluted at home [ ]

22. If it is diluted at home, how much SSB and water is used? [Fill appropriately]
SSB.....ml Water.....ml

23. Do you consume all the SSB brought to school? [tick (✓) appropriately]
Yes [ ] No [ ]

24. If no, how much are the leftovers?[Fill appropriately]
.....ml

25. Do you share the SSB with schoolmates? [Tick appropriately]
Yes [ ] No [ ]

26. If yes, approximately how much do you share? [Fill appropriately]
.....ml

27. How many times do you take to consume the 13 above that you bring to school? [tick (✓) appropriately]
Once [ ] twice [ ] thrice [ ] other (specify).....

28. Approximately how much SSB will you consume when not in school in a day? [Fill appropriately]
.....ml

29. Which do you prefer juice (SSB) or fresh fruits? [tick (✓) appropriately]
SSB [ ] Fresh fruit[ ]
Explain why.....

Anthropometric measurements

30. Take the following measurements [Fill the height in cm to the nearest 0.1 cm, weight in kg to the nearest 0.1 kg, Take two measurements. Record]

Anthropometric measurements					
Height			**Weight**		
1st	**2nd**	**Av.**	**1st**	**2nd**	**Av.**

31. Food frequency form

Food eaten	Never consumed	Not frequently consumed		Frequently consumed						
	Never eaten	Once per month	Once per 2 weeks	No. of days per week						
				1	2	3	4	5	6	7
Ugali										
Rice										
Chapati										
Bread										
Cake										
Sweet potatoes										
Irish potatoes										
Beans										
Peas										
French beans										
Meat										
Milk										
Eggs										
Chicken										
Sukumawiki										
Cabbage										
Amaranth										
Oranges										
Mangoes										
Pineapples										
Passion										
Guava										
Fats and oils										

32. 24-hour recall record sheet

Time	Dish	Name of Ingredients Used preparation	Household Measure Used	Amount In H/H Measure [ml or gm]	Amount of ingredients In the dish [ml or gm]	Volume of Complete Dish prepared [ml or gm]	Volume of food served to the child [ml or gm]	Amount Of left over [ml or gm]	Food Consumed by the child [ml or gm]

[Take household measures: teaspoon (tsps), tablespoon(tbsp), cups, mugs, measuring jugs and sufurias and the food ingredients used in the household to show the exact amounts, sizes and units used in food preparation. Request to see the measures, sizes, foods and ingredients in order to practically measure and weigh the used levels].

1=tea spoon (tsp) 2=tablespoon (tbsp) 3=cup (small) 4=cup (medium)

5=cup (large) 7= mug 8= measuring jug 9= sufuria

10=bowl 11=plate 12=pot

Appendix 2

Focus group discussion guide

I Introduction

Introduce team, participants and general purpose of discussion.

II Main discussion

1. What is your favourite SSB?
2. Where did you first learn about it?
3. Who buys it?
4. Why do you prefer SSBs to fruits?
5. If you had money which SSB will you be buying everyday and why?
6. How often do you consume the SSB?
7. Which days do you buy more SSBs?

III Conclusion

Summarize discussion

Thanks participants leave (AED, 2003)

WESTLAND DIVISION MAP