

**NUTRITION KNOWLEDGE, DIETARY PRACTICES AND NUTRITION STATUS OF
SECONDARY SCHOOL ADOLESCENTS (13-18 YEARS) IN RUIRU SUB COUNTY,
KENYA**

BY

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OF MASTER OF SCIENCE IN APPLIED HUMAN NUTRITION, DEPARTMENT OF
FOOD SCIENCE, NUTRITION AND TECHNOLOGY, UNIVERSITY OF NAIROBI**

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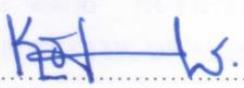
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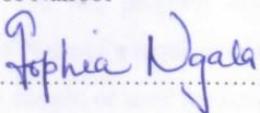
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DEDICATION

This dissertation is dedicated to my dear parents Mr and Mrs Kamanu for the great inspiration and impartation of life values to my life, my husband Gakuo, children Richie, Victor and Shawn Mark and entire Kamanu's family for their prayers and unwavering support in my life too. Philippians 4:13 "I can do all things through Christ who strengthens me".

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LIST OF ABBREVIATIONS

BMI	-	Body mass index
CVD	-	Cardio vascular Disease
CDC	-	Centre of Disease Control Centre and Prevention
DM	-	Diabetes Mellitus
ERC	-	Ethical Research Committee
KNH	-	Kenyatta National Hospital.
KDHS	-	Kenya Demographic Health Survey 2014
LNED	-	Low Nutrient Energy Dense
LMIC	-	Low- Middle Income Countries
MoE	-	Ministry of Education.
MoH	-	Ministry of Health.
NCOSTI	-	National Commission for Science, Technology and Innovation
NCD	-	None Communicable Diseases
SDGs	-	Sustainable Development Goals
SPSS	-	Statistical Package for Social Science
UoN	-	University of Nairobi.
Vit A	-	Vitamin A
Vit C	-	Vitamin C
WHO	-	World Health Organization
WFP	-	World Food Program

OPERATIONAL DEFINATIONS

Adolescent

Adolescents in this study are defined as being between 13 to 18 years of age attending secondary school. Adopted from World Health Organization (WHO), defining adolescent as any person between ages 10 and 19.

Dietary Practice

This study defined optimal dietary practices of Adolescents as those who did not skip meals, consumed three main meals and two healthy snacks per day.

Healthy eating

The study defined, Healthy eating as one where the adolescents achieved energy balance (for basal metabolic rate), while limiting intake of energy dense foods, free sugars, salt and highly processed foods. The diet should also have provided quality and adequate nutrients to meet the increased nutrients requirement among adolescents.

Nutrition knowledge

The nutrition knowledge of the student adolescents was determined by the level of knowledge on food groups, macronutrients, micronutrients, food preparation methods using multiple choices answers. The students got one mark each question for every correct response chosen. Using a marking scheme for nutrition knowledge tests the scores were rated on score percentage using five as the cut off points, the grading was categorized as: Excellent, very good, good, satisfactory and poor.

Nutritional status

Nutrition status of adolescents in the study was determined using Body Mass Index (BMI) in percentiles. Student adolescents with a cut-off of less than 5th percentile were classified as underweight, while normal or healthy between 5th percentile to less than 85th percentile, overweight 85th to less than 95th percentile and obese \geq 95th percentiles.

ABSTRACT

Adolescence is a vulnerable stage of life characterized by rapid growth and development and increased nutrients requirement. Good nutrition is important in promoting health and is dependent on appropriate dietary practices. Nutrition knowledge is critical for forming good eating habits and dietary practices. The dietary practices of adolescents have been described poor because of their busy schedules, peer pressure, imbalance in hormone production and independent nature of their behavior. The objective of this study was to determine socio demographic characteristics and nutrition knowledge, their association with dietary practices and nutrition status of secondary school adolescents. A total of 216 adolescents were enrolled in this cross-sectional study. Semi structured questionnaires were used to collect the data.

The data was analyzed using SPSS software package with p-value for statistical significance being set at $p < 0.05$. Over half (55.1%) of the adolescents had good nutrition knowledge. Nutrition knowledge increased as adolescents advanced in age and girls had slightly higher nutrition knowledge scores than boys. Majority (76.2%) of adolescents got their nutrition knowledge from school. Generally adolescents exhibited optimal dietary practices, majority (74.1%) had more than three meals in a day in reference to recommended 5-6 meals including snacks. Compared with others lunch was the most skipped meal, being missed by three out of ten adolescents. Association between socio-demographic and dietary practice based on gender was significant at p-value 0.005 with female students preferring breakfast as the heaviest meal $p=0.000$, $\chi^2 = 15.63$, skipped meals $p=0.001$, $\chi^2 = 5.12$, took less than two litres of water $p=0.008$, $\chi^2 = 9.66$ and preferred fried foods $p=0.003$, $\chi^2 = 213.95$ comparing with male. Increasing nutrition knowledge had a positive relationship but not significant ($r=0.20$, $p= 0.294$) with

dietary diversity. Nutrition knowledge with number of meals taken had positive relationship but not significant ($r=0.36$, $p=0.495$) and nutrition knowledge with skipping of meals had a positive relationship but not significant ($r=0.39$, $p=0.465$).

Most (77.3%) of adolescent had normal BMI for age with the rest either being overweight (12.5%) and moderately thin (10.3%). The nutrition status did not significantly differ between the gender. Age was significantly associated with nutrition status where more of the older adolescents had normal BMI for age as compared to the younger adolescents at ($p= 0.043$, $\chi^2 = 9.84$). Students who skipped meals were thin compared to those who consumed all meals $p=0.041$, $\chi^2 =9.95$. Students who consumed milk 3-6 times a week were 11 times more likely (OR=11.25) to be on normal nutrition status rather than overweight. Students who used fat and oils every day were six times more likely to have normal nutrition status rather than overweight (OR=5.80).

Conclusion: The study has shown that secondary school adolescents within Ruiru Sub County had good nutrition knowledge. The nutrition knowledge increased as adolescents advanced in age with girls having slightly higher nutritional knowledge scores compared with boys. Diet for adolescents constitute high consumption of cereal based diet and low intake of high biological value protein foods. There was a gap between knowledge and practice. Despite good nutrition knowledge, adolescents, girls especially practice non optimal dietary practices that included skipping of meals particularly lunch and taking less than two litres of water daily. Most of the adolescent student had optimal dietary practices as they eat three meals in a day. Skipping of

meals, especially lunch and snacking constituted the most suboptimal dietary practice by the students.

Recommendations: Interventions and education strategies to promote the intake of high biological value proteins should target school students. Inclusion of lessons on healthy eating and optimal dietary practices (with practical aspects) in the curriculum of High Schools would alleviate the situation. There is also a need for further studies to obtain the views of school children on factors (barriers and promoters) in school which affect their desire to eat healthy foods.

CHAPTER ONE: INTRODUCTION

1.1 Background information

The World Health Organization (WHO) defines adolescents as individuals aged 10–19 years. Adolescent's population has increased to 18% of the world population with 88 % living in developing countries. In Kenya the proportional population of adolescents is 22%. Kenya is a low income country located in sub-Saharan Africa and undergoing rapid urbanization, industrialization and modernization resulting in changing lifestyles, dietary habits and dietary practices (Usman et al., 2017). Adolescent's health has not been a major concern, and consequently, there has been limited research in the area of adolescent nutrition, especially in developing countries Kenya included. Adolescents are known to be less susceptible to diseases and they experience fewer life-threatening conditions than children and adults and also have less mortality and morbidity rates.

Health services in developing countries focus on children and pregnant women and therefore health needs of adolescents are not adequately investigated and addressed (Hamulka et al., 2018). However, the increased prevalence obesity worldwide has drawn attention to the diets of adolescents and children. It has been reported that adolescents are at a higher risk of becoming overweight and obese and prone to life style diseases and chronic diseases because of their unhealthy eating habits (Buxton et al., 2014). During adolescence nutritional care is key because there is increased physical growth, brain development, hormonal changes and increased nutrients requirement for growth and development (Faizi et al., 2017).

Diets consumed by adolescents in developing countries are inadequate in terms of micronutrients, diversity and meal patterns. Some adolescents consume more than adequate amounts of calories and high-energy-dense foods, which contributes to increased occurrence of overweight and obesity. Nutrition behaviors of concern among adolescents are fast food preference, frequent snacking, skipping meals, the risk of eating disorders, the omission of certain foods from diets and occasional dieting (Faizi et al., 2017). Adolescents health has not been a concern and they do not get care that children and adults get. They are believed not to be at risk of health issues but it has been proved that diseases of adulthood are linked to dietary behaviors and practices developed during adolescence (Usman et al., 2017). Under nutrition can start before birth and continue into adolescence, adult life and also continue for generations. Nutrition issues are not well addressed especially among the adolescents. There is a gap in knowledge on nutritional value of food, poor dietary practices and is affecting adolescents negatively (Buxton et al., 2014).

Health and education of adolescents is important in a country because developments, economic prospects future of a country depends on their health and education. At this stage in life adolescents are usually in a state of experimental, identity formation, and also lifelong behavior patterns which are established and mostly determine their future health state and productivity (Usman et al., 2017).

During adolescents there is a chance to teach and equip them with nutrition knowledge and develop positive healthy eating behaviors that can last for life time and hence mitigating the current trends of non-communicable diseases and intergenerational cycle of malnutrition (Miller et al., 2015).

Low and middle-income countries are the most affected by the current increase of non-communicable disease while malnutrition persist and therefore it is important to focus on addressing nutritional issues in adolescents to reverse and correct existing malnutrition through increasing their nutrition knowledge and practice of healthy eating (Abdullah et al., 2015).

1.2. Statement of the problem

Adolescent's nutrition is important for current, future and intergenerational health. Kenya's nutrition situation is characterized by stunting, micronutrients deficiencies and increased prevalence of obesity among adolescents. A formative research to inform Adolescent Programming in Kenya shows that there is prevalence of anemia (5-14 years 16.5%, 15-19 years 13.8%) and zinc deficiency 80% among adolescents (MoH and WFP 2018). Currently the government is focusing on adolescent nutrition in order to achieve the Sustainable Development Goal 2; which advocates for zero hunger and ending malnutrition by 2030 (MoH and WFP 2018). The influx of high dense foods in Kenyan market together with huge change in dietary habits of people has increased the incidence of overweight and obesity among adolescents. Healthy eating is not a priority and therefore there is increased habits of snacking, skipping meals and dieting among adolescents. Snacking interferes with regular meals which are healthier food choices and greater dietary diversity to meet the increased energy and nutrients requirement during this period (Faizi et al., 2017).

Adolescents are considered as low risk group for malnutrition and poor health but as they grow they engage in poor dietary habits and become adults with individual nutrition issues leading to poor health later in life. This translates into inter-generation cycle of malnutrition and development of non-communicable diseases. Under nutrition exposes adolescents to poor health,

poor performance in school and over nutrition exposes them to life style diseases and can affect their self-esteem. Adolescents are more independent in their food choices and highly influenced by peer pressure and tend to ignore healthy eating (Tugault-Laflear et al., 2017).

1.3 Justification

Addressing nutrition issues for adolescent is relevant for current, future and intergenerational health in order to reduce the triple burden of malnutrition and non-communicable diseases later in life. Good nutrition knowledge is one of the few modifiable determinants of dietary behaviors and contributes to strengthen the skills and abilities needed to resist the environmental influences leading to poor dietary habits. This will bring forth a healthy nation, break the tread of intergeneration malnutrition and prevent/delay development of non-communicable diseases in adulthood (Poskitt et al., 2014).

Through this study, gaps in nutrition knowledge, dietary practice and nutrition status of the adolescents will be identified. The respondents will benefit from the study by knowing their nutrition status, those with nutrition problems will be referred to a healthy facility for further management. The school will use research findings in promoting nutrition programs in school and planning healthy menu for the students. The research findings will be useful to the ministry of health in conjunction with ministry of education and non-governmental organizations in coming up with programs to address nutrition and health issues of adolescents.

1.4. Aim of Study

The aim of the study was to contribute towards adoption of healthy eating lifestyle, reduction of malnutrition and non-communicable diseases among adolescents in Ruiru Sub- County.

1.5. Purpose of the study

The study will generate useful information and give a clear picture of nutrition status and nutrition issues related to dietary practice of secondary school adolescents. To come up with areas of improvement on nutrition knowledge and dietary practices among the adolescents.

1.6. Main objective

The main objective of the study was to determine the socio demographic characteristics and nutrition knowledge, their association with dietary practices and nutrition status of secondary school adolescents (13-18) in Ruiru Sub County.

1.6.1 Specific objectives

1. To determine the socio-demographic characteristics of secondary school adolescents.
2. To determine nutrition knowledge of secondary school adolescents.
3. To assess dietary practices of the secondary school adolescents.
4. To determine the nutritional status of the secondary school adolescents.

1.7 Null Hypotheses

1. There is no significant association between dietary practices and gender of secondary school adolescents.
2. There is no significant association between socio-demographic (age and gender) and nutrition status of secondary school adolescents.
3. There is no significant association between nutrition knowledge and dietary practices of secondary school adolescents.
4. There is no significant association between dietary practice and nutrition status of secondary school adolescents.

CHAPTER TWO: LITERATURE REVIEW.

2.1. Overview of adolescent Nutrition

The World Health Organization (WHO) defines adolescents as individuals aged 10–19 years. Adolescent's population has increased to 18% of the world population with 88 % living in developing countries. In Kenya the proportional population of adolescents is 22%. Adolescence is divided into three developmental periods: early adolescence is the first stage (10–14 years), middle adolescence is the second stage (15–17 years) and third stage is late adolescence (18-21 years), (Usman et al., 2017).

Adolescence is a vulnerable stage of life characterized by rapid growth and development and increased nutrients requirement. Adequate nutrition is crucial for achieving full growth potential, and failure to achieve optimal nutrition may lead to delayed and stunted linear growth and impaired organ remodeling. Approximately 50% of adult weight, 45% of the adult skeletal mass and 15% of adult height are gained during adolescence. Poor nutrition during adolescence may have long-term consequences for adult health, and for girls, it can affect the survival, health, and well-being of their children (Leroy et al., 2018).

Body Mass Index (BMI) for age is used as a proxy for nutritional status, with over nutrition manifesting as overweight and obesity and under nutrition manifest as stunting and/or wasting or as nutrient deficiencies. Global nutrition trends in adolescents have been discussed in detail in a companion paper and findings showed that overweight and obesity affect one in every three adolescents worldwide (Das et al., 2017).

Sub-Saharan Africa (SSA) is home to 19% of the global youth population, the region is projected to have the greatest increase burden of NCD compared to any other region by 2030. Research findings has shown increased trend in overweight and obesity overtime among adolescent girls and boys from SSA which suggests early initiation of poor dietary behavior and physical inactivity. In Kenya the prevalence of overweight was documented at 11% among the adolescent girls (Ssewanyan et al., 2018).

Adolescent health and education is important for a country because developments, economic prospects future of a country depends on their health and education. At this stage in life adolescents are in a state of experimental, identity formation, and also formation of lifelong behavior patterns. Dietary practices established in adolescents will mostly determine their nutrition status in adulthood and future health (Usman et al., 2017).

Addressing nutritional problems of adolescent is important as their nutritional status has a negative effect on the future generation especially girls. Nutrition status of adolescents is characterized by stunting underweight and micronutrient deficiencies. This is associated frequent infections in early childhood combined with inadequate dietary intake to meet the increased nutrients requirement for rapid growth and development during adolescence (Deka et al., 2015). Adolescent health has not been a major concern and consequently, there has been limited research in the area of adolescent nutrition, especially in developing countries Kenya included. Adolescents are known to be less susceptible to diseases and they experience fewer life-threatening conditions than children and adults and also have less mortality and morbidity rates. Health services in developing countries focus on children and pregnant women and therefore

health needs of adolescents are not adequately investigated and addressed. However, the increased prevalence obesity worldwide has drawn attention to the diets of adolescents and children. It has been reported that adolescents are at a higher risk of becoming overweight and obese and prone to life style diseases because of consumption of unhealthy eating habits (Buxton et al., 2014).

During adolescents there is an opportunity to teach and equip adolescent with nutrition knowledge and develop positive healthy behaviors that can last for life time. This will help in mitigating the current trends of non-communicable diseases which is increasing every day. (Miller et al., 2015). Low and middle-income countries are the most affected by the current increase of non-communicable disease that are as a result of unhealthy diets. Over nutrition and under nutrition co-exist and therefore it is important to focus on addressing nutritional issues to reverse and correct existing malnutrition through nutrition knowledge and practice of healthy eating. Adolescents are usually independent and left on their own. Their health is not a concern and they do not get care that children and adults get. They are believed not to be at risk of health issues but it has been proved that diseases of adulthood are linked to dietary behaviors and practices developed during adolescent (Abdullah et al., 2015).

2.2. Nutrition knowledge of adolescents

Nutrition knowledge is defined as facts, information, and skills about nutrition and healthy eating acquired by a person through experience or education. Optimal nutrition knowledge has potential to improve ideal dietary habits and lifestyle. Inadequate nutrition knowledge is likely to lead to unhealthy dietary habits and poor nutrition status. Lack of nutrition knowledge can be the onset

of poor dietary practice in adolescence and this can be carried over to adulthood. Promoting nutrition knowledge of adolescent is critical and has the potential to improve their dietary practices and lifestyle and on the other hand reducing incidences of obesity-related lifestyle diseases throughout the whole lifespan. Nutrition knowledge is not sufficient to change dietary habits and therefore there it is important to promote positive attitude toward healthy eating among adolescent (Kigaru et al., 2015).

With the current influx of high energy dense foods in Kenyan market together with huge change in dietary habits, improvement in socioeconomic and increase in televised food advertisements it is important to empower adolescent with nutrition knowledge to help them make healthy food choices. Good nutrition knowledge is one of the few modifiable determinants of dietary behaviors and contributes to strengthen the skills and abilities needed to resist the environmental influences leading to poor dietary habits. This will bring forth a healthy nation, break the tread of intergeneration malnutrition and prevent/delay development of (NCD) non-communicable diseases in adulthood (Poskitt et al., 2014).

Adolescent independence on food choices and preferences gain priority at this stage of life. They divert from nutrition knowledge and optimal dietary practice learned from family and school to unhealthy food choices. Consumption of junk foods that are highly processed, energy dense is on rise among adolescents leading to overweight and obesity (Yusuf et al., 2016). Nutrition knowledge and healthy dietary practices are important at this prime time when health related behaviors, food habits are formed and also an opportunity for attaining optimal growth and

correct any existing malnutrition that could have developed during childhood (Ntwenya et al., 2015).

Nutritional knowledge can be enhanced and optimal dietary practices encouraged by conducting nutrition education programs in schools and at community level (Hamulka et al., 2018). Optimal dietary practice can be retained as they grow up, and also be a role model to their families and peers during school time and during holidays. In Kenya secondary school Students are drawn from different culture, beliefs, social orientation and religion .This makes school a unique place to promote healthy eating and positive healthy behaviors and this information can be passed to their peers ,families and community hence a healthy nation (Usman et al., 2012).

2.3. Dietary practices of adolescents

Dietary practices is defined as preferred food choices by a person in day to day life. Optimal dietary practice in adolescence forms good eating habits, provides increased nutrients required for growth, good health, cognition and educational achievements in adolescents. Adolescence is critical stage of life for establishing good dietary habits and practices that help prevent or delay onset of non-communicable diseases. Eating habits acquired during adolescence can persist to adulthood (Humulka et al., 2018). Adolescents are at risk of nutrients inadequacies because their bodies undergo several physiological, emotional and sociological changes, they are also independent in nature and these factors may affect their eating habits negatively, hence unable to meet increased nutrients requirement (BeLue et al., 2016).

There is nutrition transition and paradigm shift from consuming traditional healthy foods like fruits and vegetables, whole grains, nuts and legumes to foods which are highly processed and energy dense. These foods are predisposing adolescents to overweight and obesity and risk of developing chronic non-communicable diseases that are reflected in adulthood. It is estimated that 20%–30% of adolescents and young adults are living with non-communicable diseases which are undiagnosed especially diabetes and hypertension (WHO, 2014).

Currently, food is associated with life style, economical status as portrayed in commercial advertisement in the media other than source of nourishment and good health. Adolescents are caught in this dilemma of changing world around them and face major challenges making healthy food choices and eating healthy (WHO, 2014). Eating habits and lifestyles have changed and is being accelerated by modern life style of less activities, urbanization, consumption of highly processed foods due to industrialization and economic empowerment. This has a big impact on dietary practices and nutrition status of the adolescents in Kenya (Vaitk et al., 2015).

Healthy dietary practices contribute to healthy life style and optimal nutrition status. Adolescents who have healthy eating habits are more likely to learn normally and perform better academically than those who have unhealthy eating habits. Adolescents are independent to choose what to eat and as they make these choices there is peer pressure, self-efficacy, environmental factors and lack of nutrition knowledge hence poor dietary practices. Therefore there is need to know and understand the eating habits of adolescent (WHO, 2014).

Dietary behaviors and practice are major contributing factors to nutrition related problems that are affecting adults and birth outcomes. Adolescents have habits of skipping meals, snacking, negative attitude towards some foods and dieting. (Lachat, et al., 2012) .Lancet 2012 series on adolescent health highlighted the need to look into adolescent health because they are foundation for the future of a country. Lack of progress indicators of adolescent health may be also a contributing factor to failing to achieve key millennium goals (Ntwenya et al., 2015).

2.4 Nutrition status of adolescents

Nutritional status is the balance between the intake of nutrients by an individual and the expenditure of these in the processes of growth, reproduction, and health maintenance. Body Mass Index (BMI) percentiles is be used to determine nutrition status of adolescents. Nutrition status is categorized as Underweight or thinness (less than 5th percentile), normal or healthy (5th percentile to less than 85th percentile), overweight (85th to less than 95th percentile), obese (equal or greater than 95th percentiles (CDC, 2000). Nutrition status of an individual is interrelated with factors influenced by quality and quantity of food consumed. Anthropometric indices indicate cumulative effect of quality and quantity of food consumption together with health factors (WHO 2014).

Nutrition status of adolescents is characterized by high levels of stunting and micronutrient deficiencies. There is also increased prevalence of obesity especially among the adolescents. The country is planning to make national move towards all health facilities adopting a youth friendly approach. This a positive move and a realistic goal that should be supported as it is likely to have a greater and more sustainable impact. Micronutrients

deficiencies that are affecting children and adolescents are Anemia 16.5% (5-14 years), 13.8% (15-19 years) and Zinc deficiency is at 80% in adolescents. This is a public health concern that calls for urgent action to focus on adolescent nutrition. The situation can be improved by working with schools to sensitize them on optimal nutrition through nutrition education, promoting healthy dietary practice, school feeding programs, supplementation, deworming and monitoring nutrition status of adolescents regularly. Kenyan government is adopting a national health move towards all health facilities adopting a youth friendly approach in achieving sustainable development goal 2 to end hunger and malnutrition by 2025 (MoH and WFP in April 2018).

Addressing the nutritional problems of adolescent is important as their nutritional status has a negative effect on the future generation especially girls. Nutrition status of adolescents is characterized by stunting or underweight, overweight or obesity and micronutrient deficiencies. This is a result of infections in early childhood combined with inadequate dietary intake to meet the increased nutrients requirement for rapid growth and development during and consumption highly processed foods which are energy dense and limited in nutrients (Usman et al., 2017).

Adolescent's health has not been a major concern, and therefore there is little information on their health and nutrition in developing countries, Kenya included. Adolescents are known to be less susceptible to diseases and they experience fewer life-threatening conditions than children and adults and also have less mortality and morbidity rates (Feiz et al., 2017). Health services in developing countries focus on children and pregnant women and therefore health needs of adolescents are not adequately investigated and addressed. However, the increased prevalence of

obesity worldwide has drawn attention to the diets of adolescents and children. It has been reported that adolescents are at a higher risk of becoming overweight and obese and prone to life style diseases because of their unhealthy eating habits (Buxton et al., 2014).

Diets consumed by adolescents in the developing countries are inadequate in terms of micronutrients, diversity and meal patterns are inappropriate, consequently interfering with the distribution of nutrients over the day. Some adolescents consume more than adequate amounts of calories and high-energy-dense foods, which contributes to the increasing occurrence of overweight and obesity. Nutrition behaviors of concern among adolescents are fast food preference; snacking frequently; skipping meals; the risk of eating disorders; the omission of certain foods from diets and occasional dieting. Adolescent optimal health and nutrition status reduce economic expenses in early child survival and development because good nutrition status in girls of child bearing age prevents bad births outcomes and breaks effects of malnutrition cycle (Faizi et al., 2017).

There is increase of diet related non communicable diseases especially in urban areas. This is because of nutrition transition where there is excessive intake of energy dense foods associated with purchased meals and processed foods. There is also reduced physical activity because of modern transport and lack of playing grounds for children in urban areas (Lozano et al., 2013). These changes of eating habits and life style have contributed to development of non-communicable diseases like diabetes, cardiovascular diseases cancer and obesity among the adolescents. Half of admissions in Kenyan hospital are associated with non-communicable diseases (Matheka et al., 2013).

Diet transition experienced in developing countries is related to urbanization, economic development and change of lifestyle. There is reduction of physical activity due to modern transport, engaging in watching television and other media facilities (WHO 2014). Young people are caught in the changing world and encounter major challenges in making health food choices and eating healthfully. Studies are showing that overweight adolescents tend to be overweight in their adulthood (Reilly et al., 2011).

Environmental factors are major contributing factors to increased prevalence of overweight and obesity in developing countries undergoing the nutrition transition, including Kenya. Childhood under nutrition which is common in developing countries may be a predisposing factor to increased obesity and diet related non communicable diseases later in life. Some research finding shows that poor fetal and childhood development including poor intrauterine growth and childhood stunting can lead to obesity and chronic diseases later in life especially when individual changes environment from deprivation to more wealth and abundance. Although it may not be directly affecting adolescents, it can be linked to intergenerational cycle of malnutrition (Suhrcke et al., 2011).

2.4.1 Assessment of adolescents nutrition status

Anthropometric indices indicate cumulative effect of quality and quantity of food consumption together with health factors (WHO 2014). Assessment of nutrition status evaluates the individual's health and helps to identify malnutrition and those at risk. Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. BMI is an inexpensive and easy-to-perform method of screening for weight categories that may lead to

health problem. BMI for adolescence is expressed relative to other adolescence of the same sex and age in percentiles. These percentiles are calculated from the CDC growth charts, which were based on national survey data.

Stunting in adolescence represent long term dietary inadequacy. World health organization defines stunting as a height-for-age less than the 5th percentile. Stunting in adolescents leads to complications during delivery among girls and reduced physical capacity among both sexes. According to WHO BMI-for-age less than 5th percentile is the best indicator for thinness in adolescence. Normal nutrition status is between more than 5th percentiles to less than 85th percentile. Obesity is defined as a BMI at or above the 95th percentile for adolescence of the same age and sex (CDC, 2000).

Table 1: BMI for Age categories and corresponding percentiles (CDC2000)

Weight Status Category	Percentile Range
Underweight	Less than the 5 th percentile
Normal or health weight	5 th percentile to less than the 85 th percentile
Overweight	85 th to less than the 95 th percentile
Obese	Equal to or greater than the 95 th percentile

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1. Study Setting

The study was conducted in two secondary schools located in Ruiru Sub County. Ruiru is a town in Kiambu County located within 3 kilometres off Nairobi's city boundary and about 0.5 km from Kenyatta University Main Campus. Ruiru is a dormitory town for the nation's capital, and is connected by both rail and road. The town covers an area of 292 km² with Kahawa Wendani,

Kahawa Sukari and Mwhoko being part of Ruiru constituency. Ruiru's population stood at 238,858, the rapid population growth being a response to the shortage of available housing in Nairobi. The town has struggled to adapt to the influx of people. Ruiru is also an industrial town with several major factories, including Devki Steel Mills, Super Foam, Spinners & Spinners Garment Factory and Ruiru Feeds. It is well served by banks and shopping malls and currently is enjoying a housing boom, as many coffee estates are converted into residential areas, including an upcoming multi-billion Tatu Estate. It is well connected by road and rail to neighboring towns. Ruiru sub –county is partly urban and partly pre urban area (Kinyua ., 2014). The sub-county has 36 secondary schools of which 19 are boarding schools and 17 day secondary schools. Out of 17 day schools 15 are day mixed schools and 2 are not mixed day school. The study was conducted in 2, day secondary schools namely Ruiru girl’s day secondary school and Ruiru boy’s day secondary school.

3.1.1 Ruiru Girls secondary school

Ruiru Girls secondary school is located in Ruiru Sub County. The school is within Ruiru town and surrounded by a market, primary school, a private hospital and some industries. The school has a total population of 421 students from form one to form four with two streams in every form. The average number of students in every form are 52. Within its boundaries there is staff quarters and a farm. The school has daily cows and small garden with vegetable and fruits.

3.1.2 Ruiru Boys secondary school

Ruiru secondary school is located in Ruiru Sub County. The school is within the town next to Ruiru police station and Ruiru District Hospital. The total population of students were 540 and three streams in every form, from form one to form four. Every class had an average of 45 students. Within the school there are staff quarters and school canteen.

Map of Kenya Counties

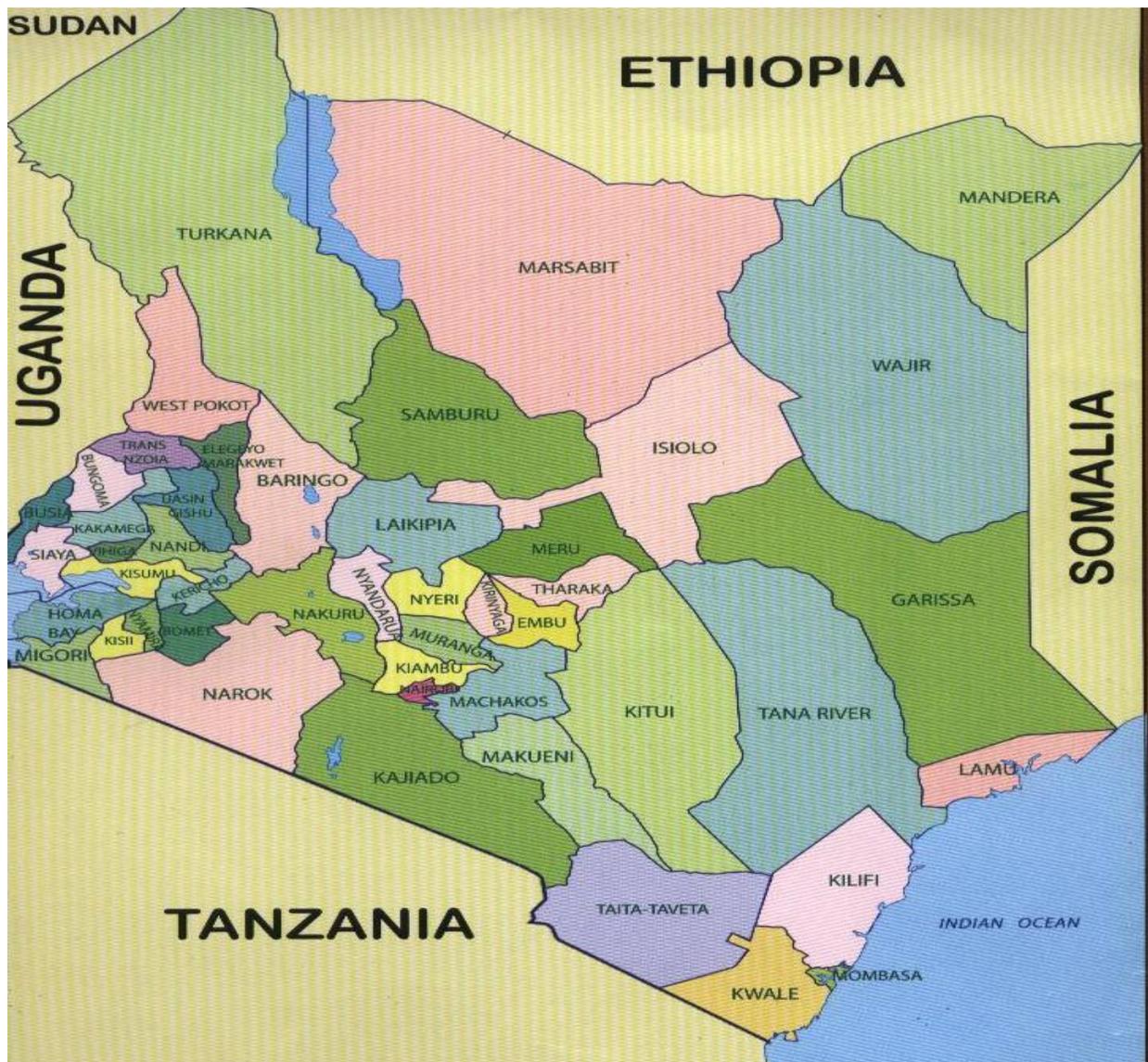


Figure 1: Map of Kenya showing Counties

Map of Ruiru sub-counties

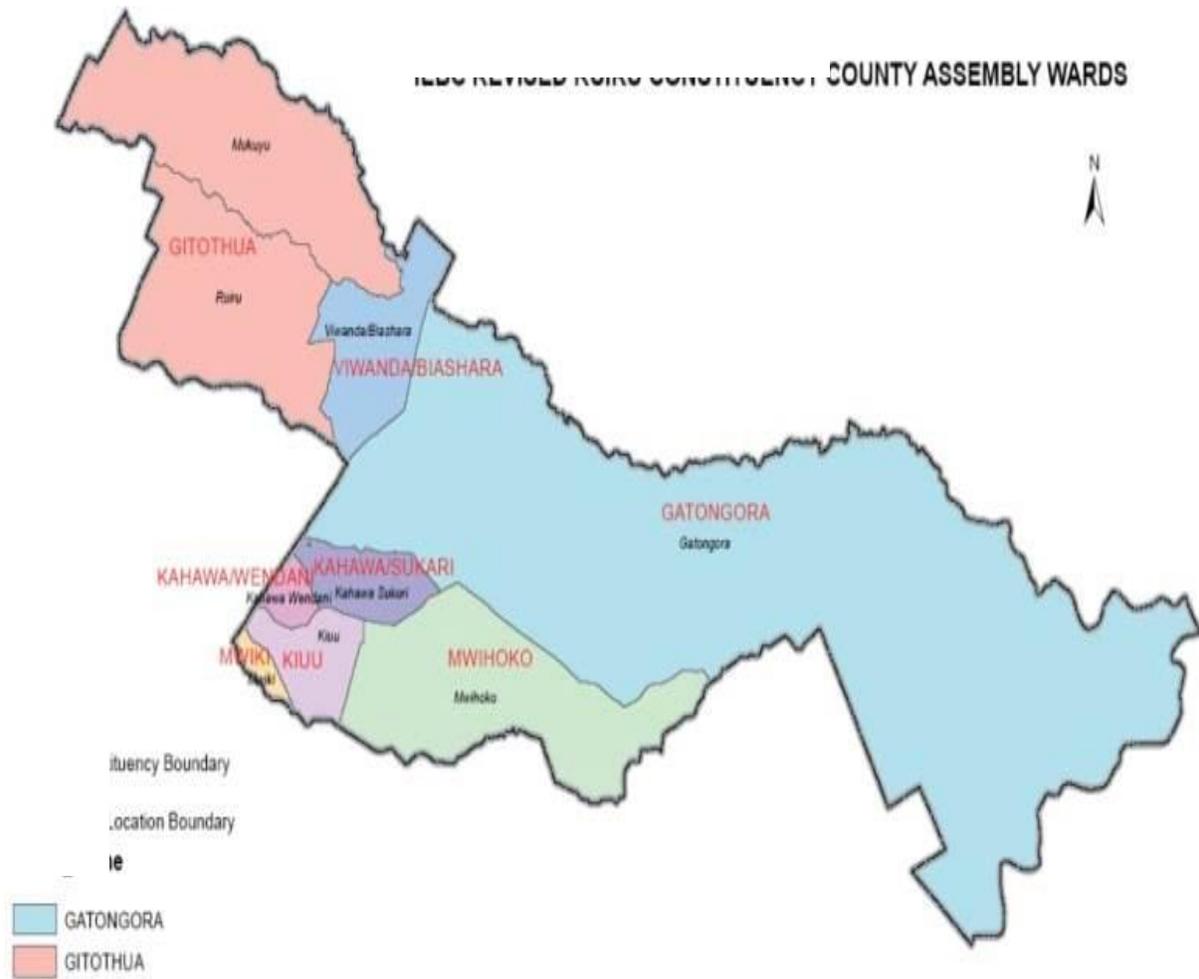


Figure 2: Map showing Ruiru sub-counties

3.2. Study design

A cross-sectional study was carried out with both descriptive and analytical components at Ruiru Girls secondary school and Ruiru Boys secondary school from month February to march 2018.

3.3. Study population

The study sample comprised of students aged 13-18 years attending secondary schools in Ruiru Sub-County. The students were the respondents in the interview because they gave information significant to the research. The students were selected by systematic random sampling consecutively until the sample size was achieved.

3.4. Sampling

3.4.1. Sample Size Determination

The sample size was determined using Fisher formula (Fisher et al, 1991) as the population from which the sample size was drawn was more than 10,000. The strength of this formula is that acceptable degree of accuracy is set.

$$n = \frac{(z^2 pq)}{d^2}$$

Where:

n = the desired sample size

Z = the standard normal deviation at the (95%) =1.96 confidence interval.

P = proportional of the target population estimated to have the characteristics being measured.

A formative research conducted by Ministry of Health and World Food Program reported the prevalence of anemia among girls aged 5-14 years is 16.5 %.

q = Proportion not expected to be suffering from anemia $1-p = (1-0.165)$

d = the level of statistical significant set 0.05

Therefore

$$n = \frac{1.96^2 \times 0.16 \times 0.85}{0.05^2} = 205$$

Considering non response rate (NRR) is 5%

Total sample size (factoring in non-response) = the obtained sample size / (1-Non response rate)

$$N = 205 / (1-0.05) = 216$$

3.4.2. Inclusion criteria

High school adolescent students from Ruiru Boys Secondary School and Ruiru Girls Secondary School aged 13 to 18 years who voluntarily consented to be in the study and whose parents consented.

3.4.3. Exclusion criteria

Those adolescents who qualify under inclusion criteria but they cannot participate because they have chronic illness, absent from school and physically challenged.

3.5 Sampling procedure

Ruiru sub County was purposively selected because it is located near the capital city of Kenya and diversity in terms of people from different regions and culture. Ruiru sub-county is urban and pre urban area. Ruiru sub-county has thirty six secondary schools of which nineteen are boarding secondary schools and seventeen day secondary schools. The seventeen day secondary schools fifteen are mixed boys and girls and two are not mixed day schools. The two schools

were purposively selected because they are the two day schools which are not mixed boys and girls. Fisher formula (Fisher et al, 1991) was used to determine the sample size from the two secondary school. Systematic sampling was used to select the respondents in form one to form four classes using the admission register which has the age indicated on it. This was done by selecting the elements from a target population and also selecting a random starting point with a fixed sampling interval. The interval was calculated by dividing the population size by the desired sample size.

With clearance letter from the KNH-UON ERC the principal investigator visited the selected schools to get consent to carry out the research. A period of 2 weeks was allocated for data collection in each school to ensure ample time with the students. Data collection was carried out after classes between 4pm and 5pm. Data collection was done in individual school at a time to ensure accuracy and also for principal investigator to be present to monitor the process what are you saying?). At the school level, the classes were stratified into Form one to form four. At class level Ruiru boys secondary school, 27 respondents were systematically selected in every form making a total of 108 students in the entire school. At Ruiru girls secondary school, 27 respondents were systematically selected in every form making a total of 108 sample in the entire school.

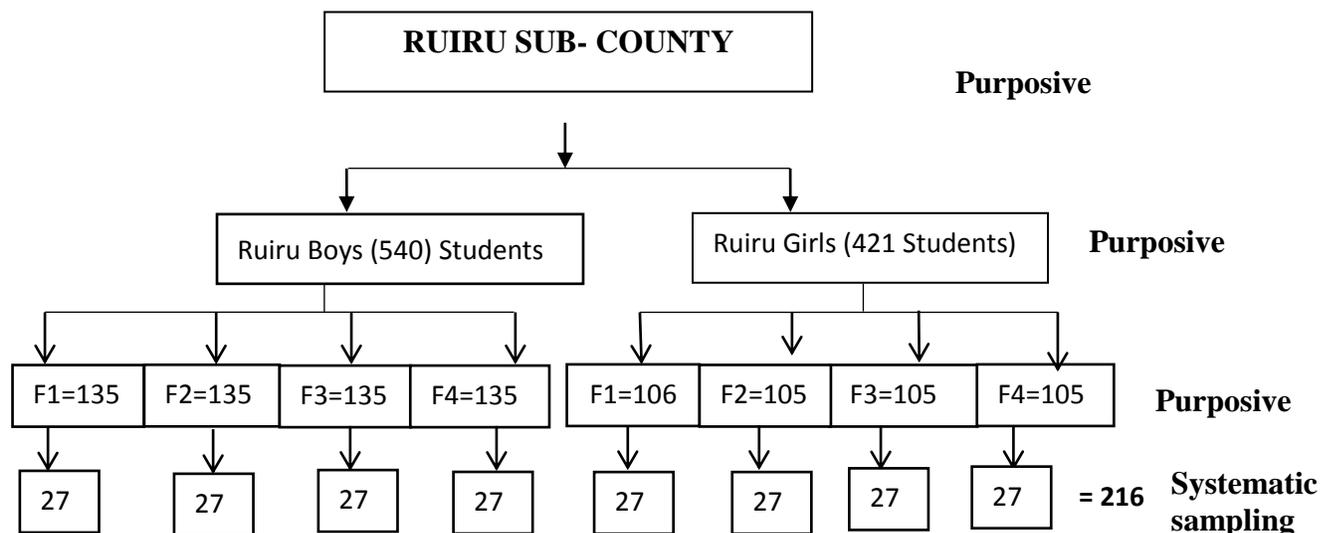


Figure 3: Sampling procedure schema

3.6. Data Collection Methods

3.6.1. Data collection Tools and Materials

The study applied quantitative research approach using Semi structured previously pretested questionnaire. The questionnaire administered gathered information on social demographic characteristics, nutritional knowledge, dietary practices and anthropometric measurements (Appendix 3). The social demographic questionnaire was used to obtain information on: parent and students information. A questionnaire and a marking guide was used for nutrition knowledge. A questionnaire was used to obtain information on student's dietary practices. Anthropometric measurement was carried out using bath room scale manufactured by SECA and

is a floor scale for weighing children as well as adults (Capacity 150 kg). Height was measured by a portable stadiometer (a height measuring equipment) manufactured by SECA.

3.6.2 Study variables

3.6.2.1. Social demographic characteristics

This section collected information on following variables; age and sex of students, parent's level of education, occupation of both parents and place of residence.

3.6.2.2. Nutrition knowledge variables

This section collected information on the following variables; food groups, macronutrients, micronutrients, food preparation, source of recommended oil and fat, iron rich foods to prevent anemia, minerals for bone development and knowledge on diet related diseases using multiple choices answers. Each question had one mark for every correct response chosen. An addition question was added to establish the main source of nutrition information. Using a marking scheme for nutrition knowledge tests (Appendix 5) the scores were rated on score percentage using five cut off points (Table 2). Respondents were graded according to response (Nazni et al., 2010).

Table 2: Knowledge score classification table

Standard score	Classification
>80	Excellent
70-79	Very good
60-69	Good
50-59	Moderate/satisfactory
49 and below	Poor

3.6.2.3. Dietary practices assessment.

Data was collected on number of meals consumed daily based on (5-6) times as recommended by World Health Organization (WHO, 2004), heaviest meal in a day, skipping meals, snacking habits, water intake ,food frequency and dietary diversity.

3.6.2.4. Nutrition status

The height and weight of participants were measured. Weight measurements were made in compliance with WHO recommendations (WHO 2000) with students in light clothing and without shoes. Two readings were taken each time and average of the two reading recorded. If the second reading was found to have a wider variation (+0.1cm), a third reading was taken. Height was taken without shoes using a Standard portable height board (stadiometre SECA model) which was placed against a flat wall and on a flat surface. Two readings were taken and the average of the two readings recorded. If the second reading had a wider variation of (+0.1cm), a third reading was taken. Height was recorded to the nearest 0.1 centimeters .The weight and height of the students measured was used to calculate the BMI (Body mass index) based on World Health Organization criteria (WHO 2000) and interpreted using percentiles

developed by National Center for Health Statistics in collaboration with The National Center for Chronic Disease Prevention and Health Promotion (CDC 2000). The nutritional status of students was assessed as Body Mass Index (BMI)-for-age Percentiles for underweight, normal weight, overweight and obesity.

Table 3: BMI Percentiles

Percentile Ranking	BMI for age (13-18 years)	Weight Status
Less than 5th percentile	< 17	Underweight
5th percentile to less than 85th percentile	17.1 - 25.5	Healthy weight
85th percentile to less than 95th percentile	25 - 29.9	Overweight
Equal to or greater than the 95th percentile	>30	Obese

3.6.3. Recruitment and training of research Assistants.

A number of four research assistant two male and two female were recruited through an internal advert at the University of Nairobi, College of Agriculture and Veterinary Sciences, Upper Kabete Campus based on criteria that they were qualified nutritionist and having previously engaged in data collection. The research assistants were trained for one day on what research involves, administration of consent forms, ensuring confidentiality and safeguarding the information collected (Appendix 4). They were trained on how to take weight and height recording accurately and checking the completeness of a questionnaire. The training topics covered nature of study and its objective, data collection method and materials, code of conduct during data collection, ethical issues and work schedule in the field. During training sample

questionnaire were administered (role play) and any challenges arising were addressed. The lecture, training, role play and demonstrations learning methods were used.

3.6.4. Pre testing questionnaires and calibration of the equipment

Data collection tools and equipment were pretested and validated at Gitothua mixed secondary school. Ten boys and girls were systematically randomly selected for pretest. The information collected was used to modify questions so as to give desired results. Modification of the tools was done based on the pretest and questions which were not well understood corrected and the irrelevant questions omitted. The equipment was tested for accuracy to ensure correct readings were observed.

3.7 Ethical consideration

The research ethical approval was obtained from Kenyatta National Hospital and University of Nairobi Ethical Research Committee. During the data collection the participants were informed on the purpose of the study and their consent obtained. Students were given consent forms to take home for parents to endorse. Consent forms were translated from English to Kiswahili because it is the local language (Appendix 1). This was to ensure that parents understood what the study was about and what they were consenting to. They were given explanation on what the information collected would be used for. They were assured of confidentiality, safe guarding of their identity and how the findings will be disseminated. Data collection was carried out after classes between 4pm and 5pm to ensure that the activity did not interfere with normal classes. Respondents were not required to record their names for the purpose of confidentiality and safe guarding the data. Potential risk of being in the study was loss of privacy. We promised to keep

the information confidential. Also, answering questions in the interview may be uncomfortable. They had a right to withdraw from research at any point during data collection.

3.8 Data quality control and assurance

The research assistants were trained on data collection techniques correct use of equipment and accurate reading and recording of measurement to minimize errors. Calibration of weighing scales was carried out daily by placing a two kilogram weights to obtain an accurate reading. The researcher closely supervised the data collection exercise and addressed any challenges encountered. Information collected during pretesting was used to validate variables and clarity of questionnaires. The questionnaires were cross checked every day for completeness and proper filling of data and proper recording of measurements. Quantitative data was explored to check for outliers. This was done by running frequencies, means and cross tabulation.

3.9 Data management and analysis

After data collection exercise, all data that was not coded was coded before data entry into Statistical Package SPSS version 20 as variables. Anthropometric data was entered in Ms excel to calculate the BMI –for-age and then entered in SPSS. The Statistical Package SPSS version 20 was used to enter the data, clean and analyze. Descriptive statistics were done to provide general characteristics of the data. Quantitative data was explored to check for outliers. This was done by running frequencies, means and cross tabulation. This was done to ensure information entered was correct and extreme values were set at mean value by transformation.

The data was analyzed using SPSS software package with p-value for statistical significance being set at < 0.05 . Pearson's chi square test significance association was checked for dietary practices with age and nutrition status with gender. Pearson's r Correlation was used to test the bivariate relationship between nutrition knowledge and dietary practices. Binary Logistic regression to measure the strength of association was used to test food frequency and nutrition status.

CHAPTER FOUR: RESULTS

This chapter is a presentation of results from the study. The data collected allow the analysis of Ruiru girls and Ruiru boys secondary school adolescents on nutrition knowledge, dietary practices and nutrition status. The results are both quantitative and qualitative. Descriptive results have been presented in narrative tables, graphs, and charts. The study sample was 216 adolescent students.

4.1 Socio-demographic characteristic

Majority 63.4% of respondents were middle age adolescents and older adolescents 36.6% being minority. The average age of the respondents was 16.32 ± 1.48 years. More than three quarters of the respondents came from male headed households (76.3 %), about 2 in every ten households that is 22.7% were female headed, and the rest 1% were under guardians. Employment (43.4%) and businesses (38.2%) served as the main economic activities for fathers and mothers at 37.7% and 26.1% respectively. Majority of the respondents resides in urban setting (89.3%) with only 9.2% coming from rural settings with 1.5% coming from a slum or home. More than half of these household heads attained secondary school education (57.9%), about 2 in every 10 of the

household heads attained university education (19.8%) while the rest only attended primary (21.8%) or had no formal education (0.5%) as shown in **Table 4**.

Table 4: Socio-demographic characteristics of the respondents

Socio-Demographic and Economic Characteristics	Percentage (N=207)
Gender	
Male	50
Female	50
Age	
Middle adolescents (13-16 years)	63.4
Older adolescents (17-18 years)	36.6
Household heads	
Father	76.3
Mother	22.7
Guardian	1.0
Household head Education level	
Primary	19.3
Secondary	56.5
University	22.7
Not educated	0.5
Father's Occupation	
Farmer	3.5
Employed	43.4
Business man	38.2
Unemployed	8.7
Casual Labourers	6.4
Mother's Occupation	
Farmer	6.0
Housewife	9.5
Employed	37.7
Businessmen	26.1
Casual laborers	10.1
Unemployed	10.6
Residence	
Urban	89.3
Rural	9.2
Slum	0.5
Children's home	1.0

4.2 Nutrition knowledge

The respondents demonstrated good knowledge levels though none had excellent. There was good performance in the following areas: importance of eating a balanced diet (64%), energy rich foods (68%). There was moderate nutrition knowledge in fat soluble vitamins (59%) and on prevention of anemia (56%). They also demonstrated poor level of nutrition knowledge on minerals for bone development (29%) as shown in **table 5**.

Table 5: Nutrition knowledge score

Students' nutrition knowledge	N=10	Correct (%)	Incorrect (%)
1. Fruits, grains, daily's vegetables and protein are the recommended five food groups		61	39
2. Chapati, ugali and potatoes are energy rich foods		68	32
3. Liver, milk, eggs and fish are high protein diet		65	35
4. Recommended good fats are mainly found in vegetable oils		51	49
5. Calcium and vitamin D are good minerals for bone development		29	71
6. Orange is a good source of vitamin C		63	37
7. Eating a balance diet is important		64	36
8. To prevent anemia one should eat iron rich foods and vitamin c rich foods		56	44
9. Vitamin A,D,E,K are fat soluble vitamins		59	41
10. Heart diseases can be caused by eating too much fat?		63	37

*>60% Good, 50-59 moderate, <49% poor

4.2.1 Nutrition knowledge of the students for different gender and age-group

The students had higher mean scores in their nutrition knowledge of macronutrients (male 67.86±16.99, female 69.58±17.04) than in micronutrients (male 60.58±24.69, female=62.25±25.04). The nutrition knowledge scores of the students on macronutrients and micronutrients was not significantly different ($p>0.05$) for different gender nor age groups (Tables 6 and 7).

Table 6: Mean scores for nutrition knowledge of the students on macronutrients for different gender and age-group

Socio-demographic characteristics		Mean nutrition knowledge scores (%)	P-Value
Gender	Male (n=108)	67.86±16.99	0.074
	Female (n=108)	69.58±17.04	
Age group	Middle adolescents(n=136)	60.55±18.40	0.290
	Older adolescents (n=80)	66.97±15.82	

Table 7: Mean scores for nutrition knowledge of the students on micronutrients for different age groups and gender

Socio-demographic characteristics		Mean nutrition knowledge scores (%)	P-Value
Gender	Male (n=108)	60.58±24.69	0.105
	Female (n=108)	62.25±25.04	
Age group	Middle adolescents (n=136)	58.00±26.16	0.090
	Older adolescents (n=80)	61.48±24.40	

4.2.2 Distribution of students by nutrition knowledge

The result shows that more than half of students (55.1%) had good knowledge having scored between 60% -69% about 36.2% had moderate nutrition knowledge having scored between 50%-59 and only 8.7% had poor nutrition knowledge with less than 49 % as shown in **Figure 4**.

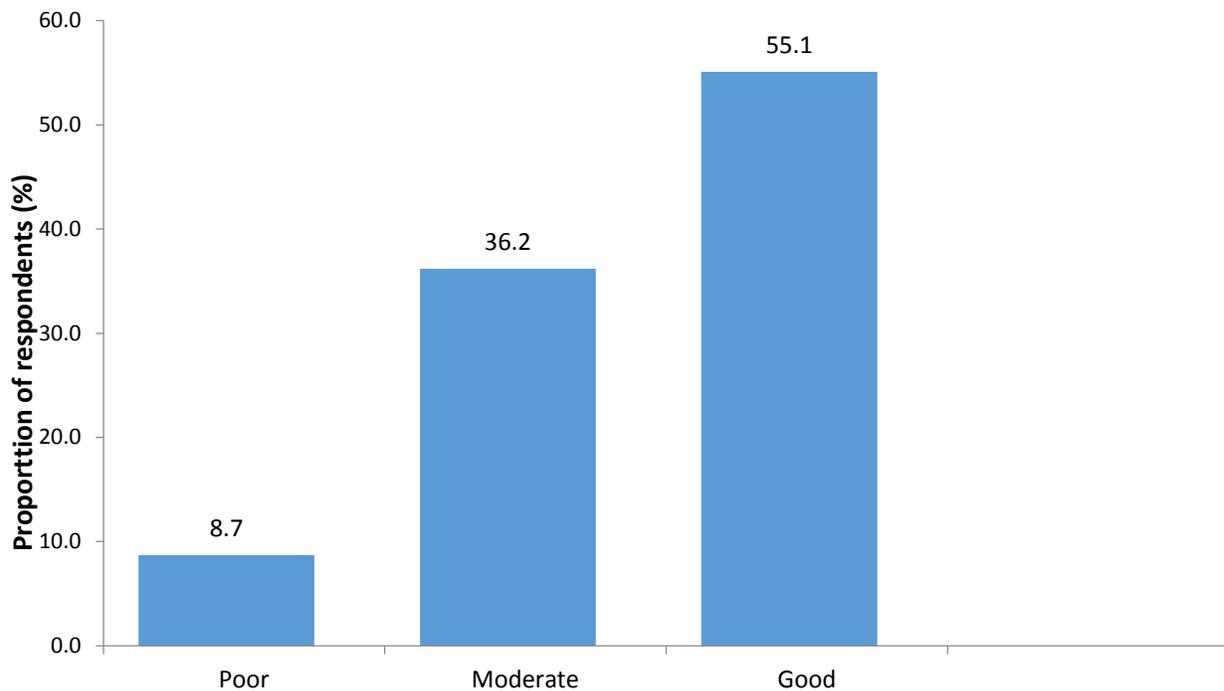


Figure 4: Distribution of students by nutrition knowledge

4.2.3 Nutrition Knowledge by age and gender

The results show that nutrition knowledge increased as adolescents advanced in age. Findings showed that girls had slightly higher nutritional knowledge scores compared with boys as shown in **figure 5**.

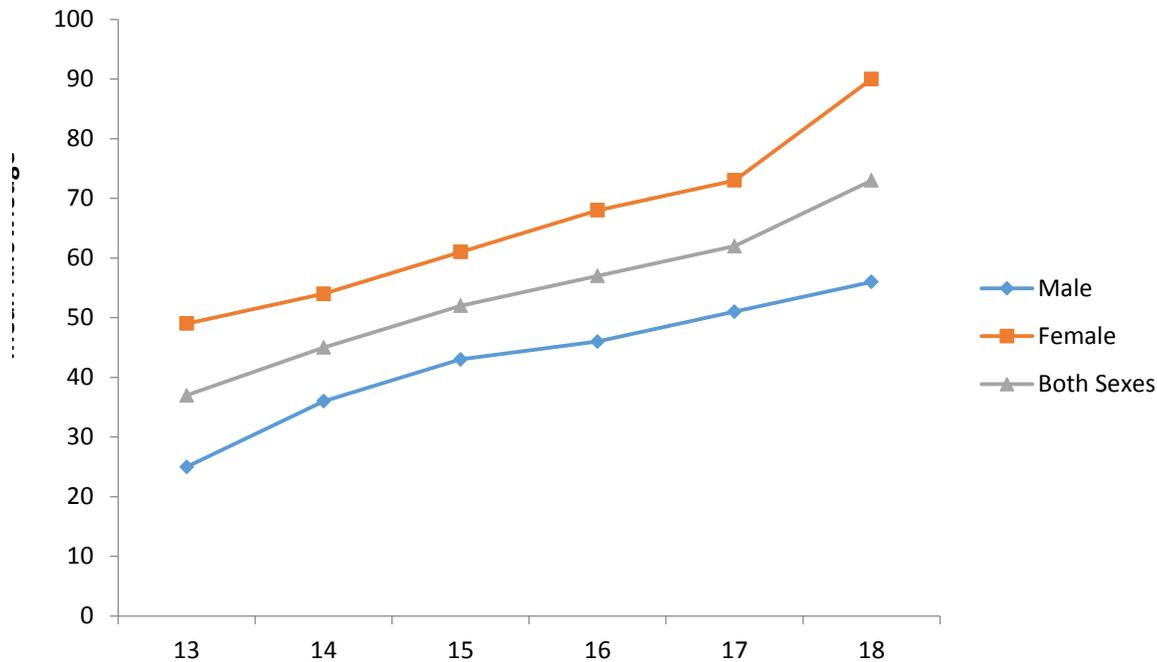


Figure 5: Distribution of adolescent’s nutrition knowledge by age in years

4.3 Dietary Practices

The results given in this section represent the following; meal pattern, skipping of meals, snacking, water intake and food preparation methods as summarized on **table 8**. Most of the respondents ate more than three meals (74.1%), (22.6 %) ate less than three meals a day while the rest (3.3%) missed at least a meal a day. About two thirds took breakfast as the heaviest meal of the day while supper was perceived by the least proportion as the heaviest meal. Of all the meals, the most skipped one was lunch with at least three in every ten of the respondents skipping it, followed by breakfast and supper which were skipped respectively. Over two thirds of the respondents were snacking. Majority of the respondents had a water intake of less than two litres, 27.6% took two litres and 19.2% took more than two litres of water daily. The most preferred foods were fried foods with at least six in every ten of the respondents preferring them whereas only 11.2% and 5.3% preferred baked and steamed foods respectively. At least six in

every ten of the respondents applied the concept of balance diet in their feeding as shown in **table 8.**

Table 8: Dietary practices of the respondents (secondary school adolescents)

Practices	% (n=216)
Number of meals taken	
Above three meals	74.1
Three and below meals	22.6
Misses one meal	3.3
Misses two meals	0.5
Heaviest Meal in a day	
Breakfast	67.3
Lunch	19.5
Supper	13.2
Skipping of meals	
Lunch	30.9
Breakfast	21.7
Supper	17.7
Skips no meal	42.5
Taking of snacks	
Yes	66.7
No	33.3
Food preference based on cooking method	
Boiled	18.9
Fried	64.6
Baked	11.2
Steamed	5.3
Daily Water intake	
Less than 2 litres	53.2
2 litres	27.6
More than 2 litres	19.2
Application of balanced diet in feeding habits	
Yes	61.2
No	38.8

4.3.1 Dietary Diversity Score

Dietary diversity was gauged against the 12 food groups listed on **table 9**. Cereals were the most (91.2%) consumed food group in 24 hours. The least (26.6) consumed food group was the organ meat with only 26.0% of the respondents consuming it.

Table 9: Distribution of Students by food groups consumed

Dietary habit	% (n=216)
Cereals	91.2
Beverages	79.3
Vitamin A rich fruits	78.9
Milk and milk products	73.8
Fats and oils	70.1
Legumes, seeds and nuts	67.7
Vitamin A rich vegetables	67.3
Dark green leafy vegetables	54.0
Animal proteins (fish, chicken, red meat)	41.7
Eggs	41.0
Tubers and roots	26.9
Organ meats	26.0

4.3.2 Dietary diversity score by gender

The individual dietary diversity scores were calculated based on the recommended 12 food groups. The respondents had a mean dietary diversity score of 7.43 ± 2.08 with a maximum of 12 and a minimum of 2 food groups. Females took a more diverse diet than the males as shown in **figure 6**.

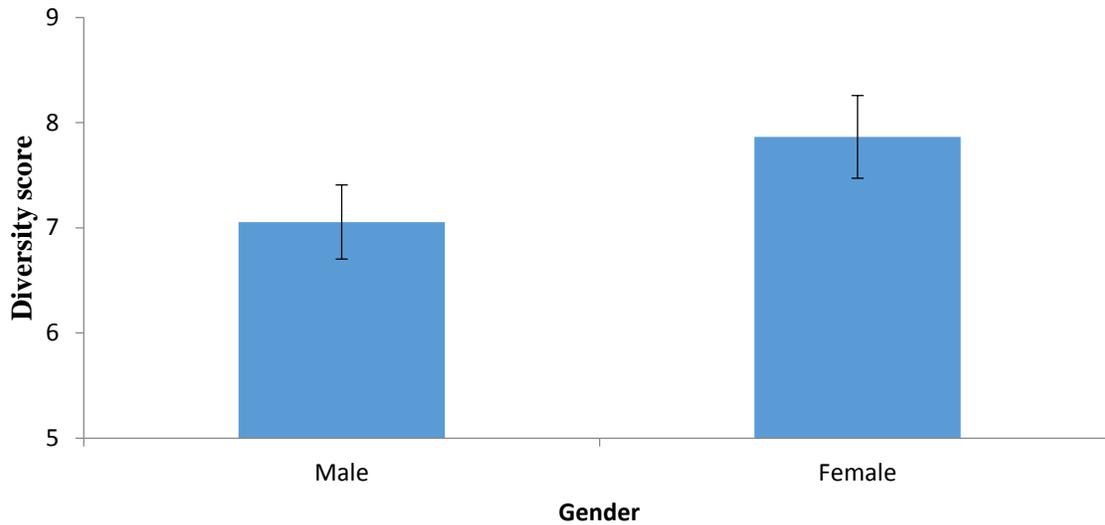


Figure 6: Dietary diversity score based on gender

4.3.3 Food consumption frequency for one week

Sweetened drinks ranked as the most frequently consumed foods daily (77.6%) about eight in every ten of the respondents partook of sweetened beverages every day, followed by fruits and vegetables (76.7%) and cereals, tubers and roots (74.4%) in second and third daily consumptions respectively. The other food groups were consumed by less than half of the respondents on daily basis. Animal proteins ranked as the least consumed product generally with majority (70.7%) consuming it less than twice a week (**Table 10**).

Table 10: Food Frequency consumption by the adolescent secondary school students

Food group	Frequency of intake (%)			
	Everyday	3-6 times a week	1-2 times a week	Never
Cereals, tubers and roots	74.4	0	25.6	0
Milk products	48.5	12.4	30.7	8.4
Animal proteins	23.7	5.3	68.3	2.4
Plant proteins	43.3	11.3	39.9	5.4
Fruits and vegetables	76.7	0	23.3	0
Fats and oils	61.6	8.6	25.3	4.5
Beverages	77.6	1	20.5	1

4.4 Nutrition Status of secondary school adolescents

Weight and height measurements were carried out to determine the BMI for- age of secondary school adolescents. The study showed that Majority (77.3%) of the respondents had a normal BMI for age, underweight (10.7%), overweight and obese (12 %) as shown in **figure 7**.

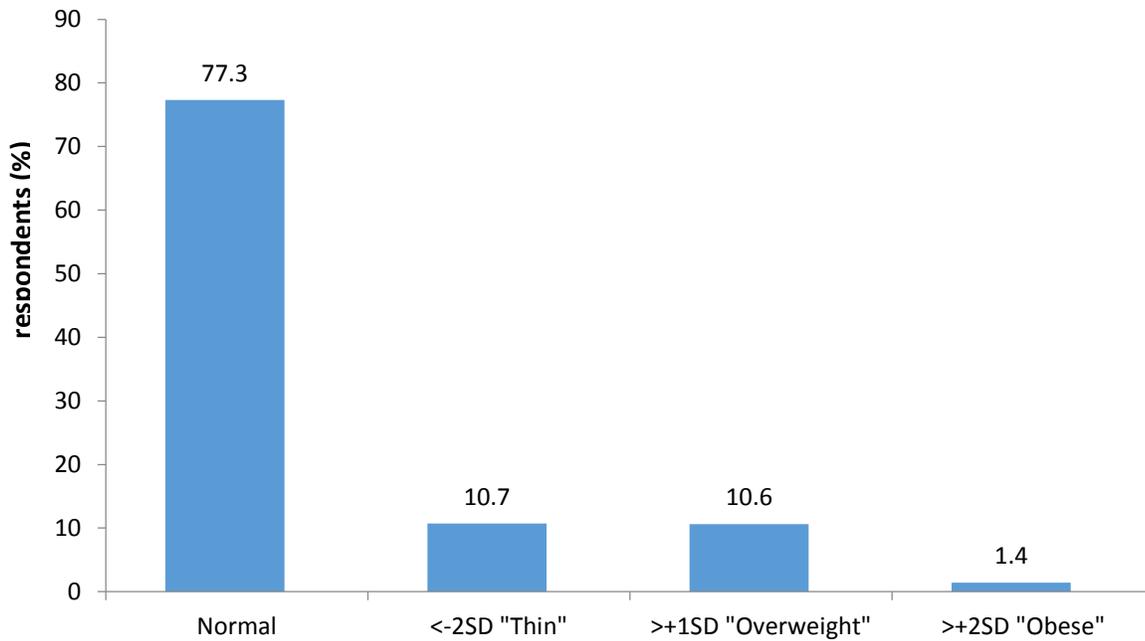


Figure 7: Distribution of adolescents by nutritional Status

4.5 Association of Dietary Practices with Gender

Using Pearson's chi square test showed that there is a significant association of gender and dietary practices. Females preferred breakfast as the heaviest meal compared with males ($p=0.000$, $\chi^2=15.63$), skipping of meals was significant in female compared with males ($p=0.001$, $\chi^2=5.12$), drinking of less than two litres of water daily was significant in female ($P=0.008$, $\chi^2=9.66$) and also preference of fried foods was also significant in female ($p=0.003$, $\chi^2=13.95$) as shown in **table 11**.

Table 11: Association of dietary practices with gender

Dietary practices		Gender		P- Value (χ^2 , df)
		Male (n=108)	Female (n=108)	
Heaviest meal in a day	Breakfast	56.88	79.17	0.000
	Lunch	22.02	16.67	(15.63, 2)
	Supper	21.10	4.17	
Skipping of meals	Yes	49.54	65.26	0.001
	No	50.46	34.74	(5.12, 1)
Daily water intake	< 2 litres	43.12	64.89	0.008
	2 litres	33.02	21.28	(9.66, 2)
	>2 litres	23.85	13.83	
Food preference based on cooking method	Boiled	27.03	9.47	0.003
	Fried	62.16	67.37	(13.95, 3)
	Baked	6.31	16.84	
	Steamed	4.5	6.32	

4.6 Association of nutrition status with socio-demographic (gender and age) and dietary practices

Using Pearson's chi square test, there was no significant difference in nutritional status between the gender ($p=0.120$, $\chi^2 =7.31$). Age was significantly associated with nutrition status where more of the older adolescents had normal BMI for age as compared to the younger adolescents at ($p= 0.043$, $\chi^2 = 9.84$)as shown in **table 12**.

Table 12: Association between gender, age and nutrition status

Gender	Nutrition status				P- Value (χ^2 , df)
	Normal %	Thin %	Overweig ht %	Obese %	
Male (n=108)	82.0	9	8.1	0.9	0.120
Female (n=108)	71.9	7.3	18.8	2.1	(7.31, 4)
Younger adolescents (n=136)	63.6	12.7	20.0	3.6	0.043 (9.84, 4)
Older adolescents (n=80)	82.2	6.6	10.5	0.7	

4.7 Association of Nutrition Knowledge and Dietary Practices

Results of Pearson’s correlation between knowledge and dietary practice showed that increasing nutrition knowledge had positive relationship but not significant ($r=0.20$, $p= 0.294$) with dietary diversity, nutrition knowledge with number of meals taken had positive relationship but not significant ($r=0.36$, $p=0.495$) and nutrition knowledge with skipping of meals had a positive relationship but not significant ($r=0.39$, $p=0.465$).

4.8 Association of dietary practices and nutrition status

Using Pearson’s chi square test result showed that student’s dietary practices in terms of the heaviest meal taken in a day, the number of meals taken in day, snacking and intake of a balanced diet were not significantly associated with nutrition status. However skipping of meals was significantly associated with nutrition status of students ($p=0.041$, $\chi^2 =9.95$) **table 13**.

Table 13: Association of dietary practices and nutrition status

Dietary practices		Nutrition status				P- Value (χ^2 , df)
		Normal	Thin	Overweight	Obese	
Number of daily meals	≥ 3	77.2%	8.7%	12.5%	1.6%	0.967
	< 3	71.4%	0	28.6%	0	(2.39, 8)
Heaviest meal in a day	Breakfast	76.1	14.9	14.5	76.1	0.342
	Lunch	87.5	2.5	10.0%	87.5	(9.00, 8)
	Supper	66.7	18.5	11.1%	66.7	
Skipping of meals	Yes	74.1	6.9	18.1	0.9	0.041
	No	81.8	10.2	5.7	2.3	(9.95, 4)
Taking of snacks	Yes	78.5	7.4	12.6	1.5	0.995
	No	75.0	8.8	14.7	1.5	(1.82, 8)
Intake of a balanced diet	Yes	78.0	7.3	13.8	0.8	0.784
	No	76.9	1.9	12.8	1.3	(1.74, 4)

4.9. Predictability of food frequency on nutrition status

Students who consumed milk 1-2 times a week were two and a half times more likely to have normal nutrition status rather than overweight compared to those who did not (OR=2.51). Students who consumed milk 3-6 times a week were eleven times more likely to be thin rather than overweight compared to those who did not (OR= 11.25). Students who consumed fats and oils every day of the week were six times more likely to have normal nutrition status rather than overweight compared who did not (OR = 5.80) as shown in **table 14**.

Table 14: Predictability of food frequency on nutrition status

Food group	Frequency of intake	Odds in comparison with overweight	
		Normal (odds)	Thin (odds)
Cereals, tubers and roots	Everyday	1.566	1.483
	1-2 times a week ^R	-	-
Milk products	Everyday	3.044	0.575
	3-6 times a week	10.580	11.247*
	1-2times a week	2.5118*	1.318
	Never ^R	-	-
Animal proteins	Everyday	2.639E-08	0.209
	3-6 times a week	2.517E-08	0.813
	1-2times a week	1.929E-08	2.369
	Never ^R	-	-
Plant proteins	Everyday	6.556	1.45E+08
	3-6 times a week	2.458	5.31E+08
	1-2times a week	3.598	1.15E+08
	Never ^R	-	-
Fruits and vegetable	Everyday	1.725	3.954
	1-2times a week ^R		
Fats and oils	Everyday	5.801*	0.659
	3-6 times a week	5.273	1.431
	1-2times a week	1.545	0.729
	Never ^R	-	-
Sweetened beverages	Everyday	2.132	3.798
	3-6 times a week	5.371	3.053
	1-2times a week	2.574	1.51E+16
	Never ^R	-	-

*-significant at $p < 0.05$. R-reference group.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter presents the discussion of the study findings of Demographic characteristics, Nutrition knowledge, Dietary practice and Nutrition status of adolescents participants from two secondary schools.

5.2 Demographic and socio-economic characteristics

The study showed that majority of the respondents were young adolescents (63.4%) compared to older adolescents (36.6%). The average age of the respondents was 16.32 ± 1.48 years. The observations were similar to study done in Nigeria that showed the study population of high school had more young adolescents than older adolescents (Silva et al., 2017). The higher number of young adolescents in the study was attributed by fact that most of respondents resided in urban area. Most of parents in urban are take their children to school at an early age.

The study established that majority of the respondents came from household whose heads were educated and were employed or run businesses. Majority of respondents lived in urban settings and this attributed by a fact that most of educated people migrate to urban areas in search for employment and ideal set ups to run businesses. This is consistent with a study done in India that showed that educated people migrate to urban areas with their families for employment (Galgamuwa et al., 2017).

5.3 Nutrition knowledge

According to the findings, nutrition knowledge scores were good in both male and female students. This is consistent with a study done in Tehranian that showed that nutrition knowledge is good among high school adolescents compared to primary school children (Mirian et al., 2007). A study done in Nairobi urban primary school showed that children in the study had moderate nutrition knowledge (Kigara et al., 2016). Reasons for increased nutrition knowledge in current findings is attributed to the fact that nutrition and health lessons continues to be offered in secondary schools and also the study was conducted in pre-urban area where respondents are more exposed to a lot of information from media, internet services and other sources. Most of the students had good knowledge on macro-nutrients whereas in micro-nutrient poor knowledge was noted. This can be as result of the emphasis that has been put on macro-nutrients deficiencies in developing countries because of recurrent food insecurity. This is consistent with a study that showed there is limited knowledge on micro-nutrients among the adolescents (Akseer .,2017).

Findings of this study showed that demographic, socio-economic characteristics and gender of respondents was not significance on the nutrition knowledge of the respondents. This could be attributed to fact that the bigger percentage of nutrition knowledge was gained in school rather than from home. This finding was consistent with a study that showed that demographic and socio economic does not influence the level of nutrition knowledge (Alavi et al.,2014).There was no significance relationship between knowledge and dietary practice, results showed that increasing nutrition knowledge had positive relationship with dietary diversity but not significant, nutrition knowledge with number of meals taken had positive relationship but not

significant and nutrition knowledge with skipping of meals had a positive relationship but not significant. The results shows that as nutrition knowledge increases adolescents had more diverse diet and practice optimal dietary practices. These findings contradicts with a studies that showed that nutrition knowledge does not influence dietary practices ((Melaku et al., 2017), (Rathi et al., 2017), (Mrigenet al., 2014). These finding could be attributed by fact that as they advance in education nutrition is increased hence healthy food choices and optimal dietary practices.

5.4 Dietary practices

The finding of this study showed that majority of respondents took breakfast before going to school. This is a good habit because children who take breakfast are able to concentrate in class and perform better than children who skip breakfast (Chen ., 2012). This habit could be contributed by a fact that majority lives in urban area near school and also most of the parents are in employment or business and they can afford to provide breakfast for their children. The finding is in contrast with a study done in Ghana that showed that majority of adolescents did not have breakfast before going to school (Buxton et al., 2014).

The study showed that more females than males took breakfast and this could be as a result of females being more concerned about their diet than males and they could also be involved in breakfast preparation. However findings showed that there was significant association between dietary practices and gender where females preferred breakfast as the heaviest meal compared with males, a study done in Europe had a different finding as more adolescent males took breakfast as compared to females (Moreno et al., 2014).

Most of respondents reported that they consumed sweetened beverages and snacks on daily bases. Consumption of snacks and sugar-sweetened beverages, have a very high energy density due to their high fat and sugar content, which when taken in excessive quantities, can increase one's susceptibility to become overweight or obese. Majority of respondents resides in pre-urban area and they tend to consume more of energy dense foods like sweetened beverages and snacks and this associated with urban life styles, technology advancements and better economic status.

This could be contributed by the fact that there is a school canteen within the school compound, the school is located within the town. Snacks and soft drinks are readily available and sold in attractive manner making it easy for students to access. This is consistent with study done in Ghana that reported high consumption of snacks and sugar sweetened drinks among adolescents (Buxton et al., 2014), also a study done in an urban school in Nairobi that showed that adolescents are in access to numerous fast food outlets, restaurants and supermarkets and this is increasing consumption of energy dense snacks and confectionaries. This is confirming the nutrition transition taking place in Kenya and developing countries. The finding is also consistent with a systemic review done in developing countries that showed that migration to urban area is associated with high consumption of highly processed and energy dense foods (Ochola and Masibo., 2014).

The findings of the study also showed that most respondents consumed fruits and vegetables daily and this is a good indicator for healthy eating. This suggests that fruits and vegetables were always available at home and this can be contributed by the fact that the study area is in pre urban setting next to rural area where farming is practiced and there are fresh farm products in

the market. Also urban families could be practicing kitchen gardening. This contradicts with a study done that found that majority of adolescents are less likely to be involved in healthy eating habit of consuming fruits and vegetables (Buxton et al.,2014).

Dietary diversity is a key component of high-quality diets because consumption of variety of foods across and within different food groups helps ensure adequate levels of essential nutrients. Low dietary diversity place adolescents at increased risk of developing various micronutrient deficiencies. Findings of the study showed that majority of the respondents were consumers of cereal based diets and confectionaries and low consumption of animal source proteins. Similar studies have shown that most of developing countries have a cereal based diet compared to animal source of food (Melaku et al., 2017), (Rathi et al., 2017). This is common problem among poor developing countries where cereals based are cheaper and affordable than protein foods and also food insecure.

5.5 Socio-demographic with dietary practice

In this study more females were reported to consume sweetened drinks on daily basis than males. The increased consumption of sweetened drinks could be associated with urbanization and improved economic status and also a fact that females like sweet drinks. The findings are consistent with a study done in Ethiopia (Melaku et al., 2017) that showed that majority of female adolescents were found to consume sweetened drinks.

The finding of the study showed that respondents whose caretakers were employed or businessmen comprised the majority of those who consumed milk and milk products on a daily

basis. This can be attributed by the fact that study was conducted in a pre-urban area where milk is costly and only those families with a stable income will increase the purchasing power of the household. The study shows that only less than half of the respondents consumed milk daily, this finding is in contrast with study in Pakistan that showed that daily milk consumption was more than 50 % (Przysławski et al., 2011). The findings revealed that the association between dietary practices and habits showed that those who consumed fats and oils daily were comprised mainly of those who ate at least three meals in day. This could be due to the fact that most foods consumed are fried. Majority of those who consumed fats and oils daily had the dietary habit of snacking and those that were snacking largely consumed confectionaries every day. This is consistent with a study done in Kenya capital city which showed that urban adolescent prefers fatty foods and sweetened beverages (Ssewanyana et al., 2018).

The study findings showed that dietary diversity mean score was 7.43 ± 2.08 with a maximum of 9 and a minimum of 2 food groups. This finding is consistent with a study done in India that showed adolescent dietary diversity was maximum of 8 and a minimum of 3 groups (Ntwenya et al., 2015). The study indicated that females took a more diverse diet than the males. This difference could be contributed by health beliefs and dieting where females are more concerned about health have stronger beliefs in the importance of healthy foods, have a stronger desire to look after one's appearance and are more likely to translate their nutrition knowledge to action. Another explanation is that boys have higher energy requirements and thus control their food preferences toward more energy-efficient dense foods. These finding is consistent with a study done in Norway that indicated that female took a more healthy diet than males (Skårdal et al., 2014).

5.6 Nutrition status

Optimal nutrition status is important to promote good health, growth and development, to be able to attain the highest level of education, grow to be productive citizens and have a healthy adulthood life. The findings from this study showed that most of the respondents had a good nutrition status based on BMI percentile for age and sex. However age was significantly associated with nutrition status where older adolescents BMI for age was better than for younger adolescents. This is consistent with a study done in Ethiopia that showed that age was positively associated with BMI for age where thinness reduced as adolescents advances in age (Assefa et al., 2015, Madjdian et al ., 2018).

The findings revealed that the overall prevalence of malnutrition (thinness and overweight) coexists in the study area signifying the double burden of malnutrition. The report goes in line with study done in Ethiopia (Dereje et al., 2018) that reported the prevalence of thinness and overweight among adolescents. The study showed that there is high rate of overweight (12%). Childhood obesity is increasingly becoming a public health problem in the developing world. Consequently the prevalence of non-communicable diseases such as hypertension, cardiovascular diseases, type 2 diabetes and osteoarthritis is becoming a public health concern. This is consistent with the findings of (Omobuwa et al., 2014; Ochola and Masibo., 2014; Faizi et al., 2017), who reported thinness, overweight and obesity among adolescents. These findings are common in developing countries where the double burden of malnutrition is being experienced. This is as a result of industrialization, urbanization, economic development and nutrition transition.

The findings from this study that showed that dietary practices in terms of the heaviest meal taken in a day, the number of meals taken in day, snacking and intake of a balanced diet were not significantly associated with nutrition status. This contradicts with documented studies by (Chen, et al., 2012) and (Deka et al., 2015) where dietary practices has a pivotal role in nutrition status of adolescents. Considering that the children were all school-going, and partake of at least two common meals in school; thus their diets at home may not be of major influence on their nutrition status. However, data showed that skipping of meals was significantly associated with nutrition status students. This is consistent with systematic review of researches done in Sub Saharan Africa where skipping of meals was associated with thinness (Ochola and Malibo., 2014).

Students who consumed milk 1-2 times a week were two and a half times (OR = 2.51) more likely to be of normal nutrition status rather than overweight compared to those who did not consume milk at all in a week. Students who consumed milk 3-6 times a week as compared to those who didn't consume milk at all in a week were eleven and a quarter times (OR = 11.25) more likely to be thin rather than overweight.

Milk and other dairy products provide the most important sources of calcium during adolescence, so a decline in milk consumption may have a serious and detrimental effect on bone health in this age group. Milk consumption during adolescent is important not only for calcium intake but also for nutritional status and physical development. Intake of fats and oils everyday as compared to no intake in a week were six times (OR = 5.80) more likely to have normal nutrition status rather than overweight. It has been shown that intake of fats and oils are usually under-

reported because no quantification is usually done especially in developing countries. The students take common meals at school where they may not be aware of how much oil is put in food during preparation. This finding is consistent with a study that showed the consumers of high fat diet had a normal BMI (body mass index) (Sarah A et al., 2008).

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS.

6.1 Conclusions

The study has shown that secondary school adolescents within Ruiru Sub County had good nutrition knowledge. The nutrition knowledge increased as adolescents advanced in age with girls having slightly higher nutritional knowledge scores compared with boys. There was a gap between knowledge and practice. Despite good nutrition knowledge, adolescents, girls especially practice non optimal dietary practices that included skipping of meals particularly lunch and taking less than two litres of water daily. Most of the adolescent student had optimal dietary practices as they eat three meals in a day. Skipping of meals, especially lunch and snacking constituted the most suboptimal dietary practice by the students.

Most of students had normal nutrition status especially as they advanced in age but a few e suffered underweight and overweight.

6.2 Recommendations

Interventions and education strategies to promote the intake of high biological value proteins should target school students. Inclusion of lessons on healthy eating and optimal dietary practices (with practical aspects) in the curriculum of High Schools would alleviate the situation. There is also a need for further studies to obtain the views of school children on factors (barriers and promoters) in school which affect their desire to eat healthy foods.

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APPENDICES

Appendix 1: Parental Consent in Swahili

Fomu ya Idhini kwa Mzazi

Idhini ya Mzazi kwa ajili ya Kuandikishaji ya Watoto Katika Utafiti.

Ningependa kukujulisha kuhusu utafiti unaofanywa na watafiti waliotajwa hapo juu. Madhumuni ya fomu hii ya idhini ni kukupa taarifa unahitaji kukusaidia kuamua kama mototo wako kuwa mshiriki au kutokuwa mshiriki katika utafiti. Jisikie huru kuuliza maswali yoyote kuhusu madhumuni ya utafiti, kile kinachotokea kama motto wako atashiriki katika utafiti, hatari ya uwezekano na manufaa, haki ya mtoto kama kujitolea, na kitu kingine chochote kuhusu utafiti au fomu hii ambayo si wazi. Baada ya kujibu maswali yako yote na kuridhika, unaweza kuamua mtoto ashiriki katika utafiti au la. Mara baada ya kuelewa na kukubali motto akuwe katika utafiti, nitakuomba utie sahihi na jina lako kwenye fomu hii.

Mzazi kuchapishwa jina: _____

Mzazi sahihi / Kidole muhuri _____ Tarehe _____

Appendix 2: Consent Form For The Students.

Hello, my name is Tabitha Wanja a master student in Applied Human Nutrition at University of Nairobi. It is my pleasure to notify you that you have been identified to participate in this study on **“Association of Nutrition Knowledge, Dietary Practice and Nutrition Status of Secondary School Adolescents Aged 13-18 Years in Ruiru Sub- County”**.

The study aims at investigating the association of nutrition knowledge, dietary practice and nutrition status of the secondary school adolescents. The result of the study will be used to design nutrition intervention programs and strategies targeting adolescents due to their importance in reproductive and productive roles in the society. Your response will be treated as confidential and for research purposes only.

If you agree, please sign the part below.

SignDate.....

THANK YOU

Appendix 3: Students Questionnaire

A. Demographic and social economic data

Code of respondent -----

Code of school -----

Interviewer-----**Date**-----

Tick the appropriate answer in the space provided

1. Who is the head of your family?

- a. Father () b. Mother () c. Any other (specify) _____

2. What is your parents’ level of education?

- a. Primary () b. Secondary () c. University () d. Not educated ()

3. What is your fathers’ occupation?

- a. Farmer () b. Employed () c. Businessmen () d. Casual laborers ()
e. Unemployed ()

4. What is your mothers’ occupation?

- a. Farmer () b. Housewife () c. Employed () d. Businessmen ()
e. Casual laborers () f. Unemployed ()

5. Where do you live?

- a. Urban () b. Rural () c. Slums () d. Camp ()
e. Specify any other.....

B. ANTHROPOMETRY

Name	Age	Weight Nearest 0.5 kg				Height Nearest 0.1cm			
		1	2	3	Average	1	2	3	Average

C. NUTRITION KNOWLEDGE QUESTIONNAIRE

1. What are the five food groups?

- a) Fruits, Grains, Dairy, Vegetables, Protein b) Fruits, Bread, Milk, Vegetables, Protein
c) Fruits, Grains, Sweets, Dairy, Protein d) Fruits Grains, Dairy, Meat

2. Which of the following are **energy rich foods**?

- a) Bread, tea, sausage () b) Rice Beans, Ugali ()
c) chapati, Ugali, potatoes () d) Porridge, Githeri, peas ()

3. Which type of foods listed below provides **high protein diet**?

- a) Peace, avocado, liver () b) Chicken green gram, sausage ()
c) Liver, milk, eggs, fish () d) Nuts, cabbage, beans, pawpaw ()

4. Recommended good fats are mainly found in?

- a) Dairy products () b) Vegetable oils ()
c) Animal fat () d) Not sure ()

5. Which minerals and vitamins are **good** for bone development?

- a) Calcium and vitamin E () b) Selenium and vitamin D ()
c) Calcium and vitamin D () d) Iron and vitamin B ()

6. Which food item is a good source of vitamin C.?

- a) Meat b) Bread c) Orange d) sweet

7. Do you know eating a balance diet is important?

- a. Yes () b. No () c. Not sure ()

8. To prevent anemia one should consume the following mineral and vitamin?

- (a) Calcium and folate (b) Iron and Vitamin C (c) Iron and calcium (d) Iron and Vitamin A

- a. Yes () b. No () c. Not sure ()

9. Which of the following vitamins requires fat for absorption in the body?

- a) vitamin A,B, E b) Vitamin D,C,K c) Vitamin A,B,K d) Vitamin A,D,E,K

10. Do you think heart diseases can be caused by eating too much fat?

- a. Yes () b. No () c. Not sure ()

11. What is the source of nutrition information you have gained so far?

- a. School () b. Parents () c. Peers ()
d. Any other (specify) ()

D. DIETARY PRACTICES QUESTIONNAIRE

1. How many meals do you eat in a day, including snacks?

- a) 1-2 meals in day b) 3-4 meals in a day c) 5-6 meals in a day
d) More than six meals in a day

2. Which meal do you consider should be the heaviest in a day?

- a) Breakfast () b) Lunch () c) Supper ()

3. Do you skip meals?

- a. Yes () b. No () c. If yes, which one and why? _____

4. Do you take any snacks?

- a. Yes () b. No ()

5. Which food do you prefer depending on their preparation method?

- a. Boiled () b. Fried () c. Baked () d. Steamed ()

6. Do you think you apply the concept of balance diet when choosing your food?

- a. Yes () b. No ()

7. Water intake in litres

- a. less than two litres () b. Two litres () c. More than two litres ()

Individual dietary diversity questionnaire

Please describe the foods (meals and snacks) that you ate yesterday during the day and night whether at home or outside the home. Start with the first food eaten in the morning

NO	Food group	Examples	Yes=1 No=0
1	Cereals	Bread, noodles, biscuits, cookies or any other food made from millet, sorghum, maize, rice, wheat + insert local foods e.g ugali, nshime, porridge or pastes or other locally available grains	
2.	Vitamin a rich vegetables and tubers	Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside + other locally available vitamin A rich vegetables	
3.	white tubers and roots	White potatoes, white yams, cassava or foods made from roots	
4.	Dark green leafy vegetables	Sweet pepper, dark green leafy vegetables, including wild ones + locally available vitamin A rich leaves such as cassava leaves a wild vegetables, etc	
5.	Vitamin A rich fruits	Ripe mangoes, papayas + other locally available vitamin A- rich fruits and other fruits	
6.	Organ meat (iron-rich)	Liver, kidney, heart or other organ meats or blood-based foods	
7.	Flesh meats	Beef, pork, lamb, goat, rabbit wild game, chicken, duck or other birds, Fresh or dried fish or shellfish, Eggs	
8.	Legumes, nuts and seeds	Beans, peas, lentils, nuts, seeds or foods made from these	
9.	Milk and milk products	Milk, cheese, yogurt or other milk products	
10.	Oils and fats	Oil, fats or butter added to food or used for cooking	
11	Sweets	Sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candies	
12.	Coffee/tea	Tea (black, green herbal) or coffee	

Food frequency form

Tick the appropriate answer in the space provided

Food	Food frequency per week			
	Every day	1-2 times a week	3-6 times a week	Never consumed
1.Cereals, Roots and tubers				
Ugali				
Rice				
Breakfast cereals				
Chapati				
Sweet potato/Arrow roots				
Bread				
Madazi/Ngumu				
Doughnuts				
Chips				
2. Milk and milk products				
Fresh milk				
Yoghurt/Mala/Lala				
3. Meat, fish and poultry products				
Beef, sheep and goat meat, pork				
Liver				
Fish/omena				
Poultry				
Sausages/ Smokies				
Eggs				
4. Legumes				
Beans, Green grams, peas, Kamande				
6. Nuts and seeds				
Groundnuts/cashew nuts				
Pumpkin, cashew nut seeds				
7. Vitamin A, Zinc and iron rich vegetables				
Dark green leafy vegetables				
Carrots				
Red paper				
8. Vitamin A, Zinc and iron rich fruits				
Mangoes				
Paw paw				
Pumpkin/butternut				
Watermelon				

9. Other fruits				
Oranges/Lemons				
Guavas (mapera)				
Pineapple				
Loguats				
Bananas				
10. Other vegetables				
Sukuma wiki				
Cabbage				
11. Fats/oils				
Fats				
Oils				
Blue band				
12. Snacks sweets and beverages				
Sugar				
Sweets				
Jams				
Honey				
Ice-cream				
Chocolate				
Sugar cane				
Carbonated drinks (sodas)				
Cakes				
Commercial juice				
Fruit juice				
Biscuits/cookie				
Pop corns				
Crisps				
13. Other foods eaten regularly				

Appendix 4: Research Assistants Training Schedule

Time	Topic	Learning aids	Learning methods
8.30am-10.30am	-Nature of study and its objective	-Hand outs	-lecture
BREAK			
11.00an -1.00pm	-Data collection -Review of questionnaire	-Sample questionnaire -Measuring instruments	-Demonstration -Role play
LUNCH			
2.00pm-5.00pm	-Code of conduct during data collection period -Ethics in conducting a research involving minors. -Work schedule	-Handouts on children rights and children protection. -Work schedule	-Lecture

Appendix 5: Nutrition Knowledge Marking Scheme

Questions	Maximum marks for the correct response
1. What are the five food groups? a. Fruits, Grains, Dairy's, Vegetables, Protein.	1
2. Which of the following are energy rich foods ? c) chapati, Ugali, potatoes	1
3. Which type of foods listed below provides high protein diet ? c) Liver, milk, eggs, fish	1
4. Recommended good fats are mainly found in? b) Vegetable oils	1
5. Which minerals and vitamins are good for bone development? c) Calcium and vitamin D	1
6. Which food item is a good source of vitamin C? c) Orange	1
7. Do you know eating a balance diet is important? a. Yes	1
8. To prevent anemia one should consume the following mineral and vitamin? b) Iron and Vitamin c	1
9. Which of the following vitamins requires fat to be absorbed by the body? d) Vitamin A, D, E, K	1
10. Do you think heart diseases can be caused by eating too much fat? a. Yes	1

Appendix 6: Ethical Clearance



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Ref: KNH-ERC/A/233

June 13, 2018

Tabitha W. Kamanu
Reg. No. A56/89220/2016
Dept. of Food Science, Nutrition and Technology
Faculty of Agriculture and Veterinary Sciences
University of Nairobi

Dear Tabitha

RESEARCH PROPOSAL – NUTRITION KNOWLEDGE, DIETARY PRACTICES AND NUTRITION STATUS OF SECONDARY SCHOOL ADOLESCENTS (13-18 YEARS) IN KIAMBU COUNTY (P62/02/2018)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is from 13th June 2018 – 12th June 2019.

This approval is subject to compliance with the following requirements:

- Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH-UoN ERC before implementation.
- Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
- Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
- Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
- Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

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