



Hungarian University of Agriculture and Life Sciences

**POLICY DEVELOPMENT FOR HEALTH PROMOTION
THROUGH SCHOOL FEEDING IN KENYA**

DOI: 10.54598/000960

Kevin K. Serrem

Gödöllő, Hungary

2021

Hungarian University of Agriculture and Life Sciences

Name of Doctoral School: Doctoral School of Economic and Regional Sciences

Discipline: Management and Business Administration

Head of Doctoral School: Prof. Dr. H.c. Popp József, DSc
Corresponding member of the Hungarian Academy of Sciences
MATE, Institute of Economic Sciences

Supervisor: Prof. Dr. Illés Bálint Csaba, CSc, Head of Department
MATE, Institute of Economic Sciences,
Department of Business Economics and Management

.....
Approval of Head of Doctoral School

.....
Approval of Supervisor

Contents

| | |
|--|-----------|
| 1. INTRODUCTION..... | 7 |
| 1.1. Problem Statement..... | 9 |
| 1.2. Justification and Significance of the Study..... | 10 |
| 1.3. Main Objective..... | 11 |
| 1.3.1. Research Objectives | 11 |
| 1.3.2. Research Hypothesis..... | 11 |
| 1.4. Limitations of the study..... | 11 |
| 2. LITERATURE REVIEW..... | 13 |
| 2.1.Overview..... | 13 |
| 2.2. Importance of school feeding..... | 14 |
| 2.2.1. School feeding as part of social safety net..... | 14 |
| 2.2.2. Child development through school feeding..... | 15 |
| 2.2.3. Linking school feeding and local agriculture | 16 |
| 2.3. Situation in Kenya | 18 |
| 2.3.1. Challenges faced by Kenya | 18 |
| 2.3.2. Nutritional Considerations..... | 20 |
| 2.4. Food and nutrition policy for School..... | 22 |
| 2.4.1. Designing a food and nutrition policy for school | 23 |
| 2.5. An Outlook on School Feeding Policies | 26 |
| 2.5.1. School Feeding Policies in High Income Country..... | 27 |
| 2.5.2. School Feeding Policy in Middle Income Country | 28 |
| 2.6. Components of food and nutrition policies for schools..... | 31 |
| 2.6.1. Food and nutrition education content taught in school..... | 31 |
| 2.6.2. School environment..... | 33 |
| 2.6.3. School nutrition and health services (Core action group)..... | 38 |
| 2.6.4. Knowledge, Attitude and Practice Model..... | 40 |
| 2.7. Theoretical frame work..... | 45 |
| 2.7.1. Social Ecological Model..... | 45 |
| 2.8. Conceptual Framework | 46 |
| 3. MATERIALS AND METHODS | 49 |
| 3.1. Study Area..... | 49 |
| 3.2. Research Design..... | 50 |
| 3.3. Target Population..... | 50 |

| | |
|--|-----------|
| 3.4. Sampling Procedure | 50 |
| 3.5. Sample Distribution..... | 51 |
| 3.6. Data Types and Sources | 52 |
| 3.6.1. Questionnaires | 52 |
| 3.6.2. Semi- Structured Interview Schedule | 53 |
| 3.6.3. Food Frequency Questioner..... | 53 |
| 3.7. Validity and Reliability | 53 |
| 3.7.1. Reliability | 53 |
| 3.7.2. Validity | 54 |
| 3.8. Data Analysis and Presentation..... | 54 |
| 4. DATA PRESENTATION, ANALYSIS, AND INTERPRETATION..... | 55 |
| 4.1. Results Interpretation (Objective One) | 55 |
| 4.1.1. Food Handlers Demographic Information..... | 55 |
| 4.1.2. Training of Food handlers | 57 |
| 4.1.3. Types of Trainings received by food handlers in Kenyan High schools | 57 |
| 4.1.4. Knowledge on Hazard Analysis and Critical Control Points (HACCP)..... | 58 |
| 4.1.5. Food Handler’s Knowledge of food safety and sanitation | 58 |
| 4.1.6. Attitude assessment of food handler..... | 61 |
| 4.1.7. Assessment of Food handler’s behavior and practice..... | 61 |
| 4.1.8. Food Handler’s demographic characteristics in relation to level of food knowledge | 62 |
| 4.1.9. Food handler demographic in relation to attitude..... | 65 |
| 4.1.10. Barriers to food safety and Sanitation practices in Kenyan High schools..... | 66 |
| 4.1.11. Correlation Results | 66 |
| 4.1.12. Multiple Regression..... | 67 |
| 4.1.13. Hypothesis Testing (Objective 1)..... | 69 |
| 4.2. Results Interpretation (Objective Two)..... | 70 |
| 4.2.1. Kitchen Amenities | 70 |
| 4.2.2. Storage facilities | 71 |
| 4.2.3. Kitchen Equipment | 72 |
| 4.2.4. Availability of Kitchen Amenities in High schools in Kenya | 74 |
| 4.2.5. Tack Shop..... | 75 |
| 4.2.6. Dining facilities in High schools in Kenya..... | 76 |
| 4.3. Results Interpretation (Objective Three) | 77 |
| 4.3.1. Student Knowledge on food nutrition..... | 77 |
| 4.3.2. Knowledge on food safety | 78 |
| 4.3.3. Practice of Sanitation among Student in Kenyan High Schools..... | 79 |

| | | |
|-------------|---|------------|
| 4.3.4. | Other Sources of Food for High School Students in Kenya | 81 |
| 4.3.5. | Number of Times High School Students Fall Ill from Food Borne Diseases..... | 81 |
| 4.3.6. | Students Level of Satisfaction of School Food..... | 82 |
| 4.3.7. | Correlation statistics | 83 |
| 4.3.8. | Regression findings | 83 |
| 4.3.9. | Hypothesis Testing (Objective 3) | 84 |
| 4.4. | Results Interpretation (Objective Four) | 85 |
| 4.4.1. | Mean amount of foods provided daily..... | 85 |
| 4.4.2. | Food Groups consumed by the Different categories of High Schools..... | 87 |
| 4.4.3. | Mean amount of nutrients consumed from the diet | 87 |
| 4.4.4. | Mean amount of nutrients provided from the diet | 88 |
| 4.4.5. | Percentage fulfilment of different nutrients..... | 90 |
| 4.4.6. | Hypothesis Testing (Objective 4) | 91 |
| 5. | DISCUSSION..... | 92 |
| 5.1. | Discussion of Results (Objective One)..... | 92 |
| 5.1.1. | Training of food handlers and Knowledge of HACCP..... | 92 |
| 5.1.2. | Knowledge, attitude and Practice of food handlers | 93 |
| 5.1.3. | Demographics in relation to Knowledge, Attitude and Practice..... | 94 |
| 5.2. | Discussion of Results (Objective Two)..... | 96 |
| 5.2.1. | Kitchen Amenities storage facilities..... | 96 |
| 5.2.2. | Kitchen Equipment and Amenities, and Tuck shops..... | 97 |
| 5.3. | Discussion of Results (Objective Three) | 98 |
| 5.3.1. | Knowledge on food nutrition and food safety | 98 |
| 5.3.2. | Practice of food safety and sanitation | 99 |
| 5.3.3. | Sources of other foods and the number of times students falling ill..... | 100 |
| 5.3.4. | Students' gender in relation to food safety and nutrition Knowledge | 100 |
| 5.4. | Discussion of Results (Objective Four) | 102 |
| 5.4.1. | Diversity of foods consumed | 102 |
| 5.4.2. | Food groups consumed | 102 |
| 5.4.3. | The mean amount of nutrients consumed daily from the total diet | 104 |
| 5.4.4. | Fulfilment of the different nutrients | 105 |
| 6. | NEW AND NOVELSCIENTIFIC RESULTS..... | 108 |
| 7. | CONCLUSIONS AND RECOMMENDATION | 110 |
| 7.1. | Conclusion | 110 |
| 7.2. | Recommendations..... | 112 |

8. SUMMARY..... 115

9. ACKNOWLEDGMENTS 117

APPENDIX 1: REFERENCES 118

APPENDIX 2: LIST OF TABLES AND FIGURES 139

APPENDIX 3: QUESTIONNARE FOR HIGH SCHOOL STUDENTS..... 142

APPENDIX 4: QUESTIONNARE FOR FOOD HANDLERS 146

**APPENDIX 5: QUESTIONER FOR FOOD HANDLING MANAGEMENT
(SCHOOL CATERESS)..... 153**

APPENDIX 6: DATA COLLECTION PICTURES 159

1. INTRODUCTION

In developing countries, the burden of double malnutrition that includes under and over nutrition is an emerging crisis. Children less than five years of age face multiple burdens with 150.8 million stunted, 50.5 million wasted and 38.3 million overweight(EDITH et al., 2016).Stunted growth in, Asia, Latin America and the Caribbean has been on the decline since 2000, from 16.9% to 9.6% and 38.1% to 23.2%, respectively(FANZO et al., 2018). However, though Africa has experienced a reduction in percentage of stunted growth from 38.3% to 30.3% over the same period, the population has grown during the same period, leading to a rise in numbers of stunted growths (FANZO et al., 2018).

School children are among a special category of vulnerable people whose catering should be secured in a healthy manner. Schools cater to children of different ages in nursery, primary and high school (JOMAA et al., 2011) hence countries have adopted policies to ensure appropriate diets are provided for these varying age categories. In order to reverse adverse health effects of overweight and poor eating habits, interventions targeted at healthy nutrition should occur early in childhood and adolescence (ST-ONGE et al., 2003).There is a relatively high physiological need for nutrients, including energy needs during the crucial years of growth and teenage years in children, hence it is important that both young children and adolescents are provided with high quality nutritious diets (STIPANUK et al., 2006). In addition, life skills such as eating habits, lifestyle and behaviour patterns acquired may be carried on thorough out there lives (St-Onge et al., 2003)

According to a review by SUMBERG and SABATES (2011), schools provide a perfect opportunity for prevention, as they provide the best access to a large number of people, who include family and community members, school staff and youth. Evidence suggests healthy food and improved nutrition improve learning ability and concentration leading to better academic performance. Further, in most developed countries, with well established school feeding programs, school meals and school feeding have been used as an effective mechanism for addressing child nutrition, educational enrolment, school retention and hygiene issues. It has also effectively provided income-generation, employment and economic integration benefits to communities in which it has been implemented (MORISSET, 2013).

To guide the operations in school feeding to meet all targets and address issues such as improper food rations, poor nutritional quality, inadequate feeding patterns, and poor food safety and hygiene practices, many countries have well established school feeding policies which address varying aims

(GELLI et al., 2009). For instance, in Japan, emphasis is on increasing nutrition education and healthy eating habits among school children (TANAKA and MIYOSHI, 2012). In Mexico, matters related to the double burden of overweight and under nutrition and better response to diverse local needs by providing locally and culturally preferred foods are emphasized by the Government of Mexico (DRAKE et al., 2016). With the largest school feeding program in the world, India's goal is to ensure that all children pursue lower primary education by increasing enrollment and boosting nutrition status (SWAMINATHAN, and BHAVANI, 2013). In Egypt, programs aim to reduce child labor by increasing the access of quality education of vulnerable children, promote sustainable livelihoods for households of these children and increase access to national social protection programs (ALDERMAN and BUNDY, 2011).

Kenya, like many other countries in Africa lacks an adequate school feeding policy, despite its many advantages. The current school feeding programme geographically targets regions to which free school meals are provided based on set criteria, such as the highest poverty rates, lowest achievement in education or highly marginalized areas. In the rest of the country, school feeding programs are generally unavailable, even to children who have the capacity to pay (FAO and WFP, 2015; SERREM et al., 2020). This is unfortunate because Kenya faces enormous health related social burdens due to acute food insecurity from droughts and/or floods and poverty which cause high malnutrition cases resulting in 30% of child deaths. About, 2.1 million children under 5 years are stunted (KENYA DEMOGRAPHIC and HEALTH SURVEY ,KDHS, 2015) of whom 76% and 74% respectively, are deficient in Vitamin A and iron, These affect cognitive development, lower school performance, limit adult productivity, reduce immunity and eventually contribute to high burden of infant and child morbidity and mortality (KISA, 2014).

To address and guide all the issues related to school feeding such as child nutrition, education enrolment and retention, food safety and hygiene among none geographically targeted schools, Kenya needs a school feeding policy (SERREM et al., 2020). Without it, personnel in Kenyan schools may lack adequate knowledge concerning food with respect to rations, nutritional quality, safety, hygiene and feeding patterns, when catering to young and adolescent school going children (ILLÉS et al., 2021). Consequently, this may jeopardize their health and nutritional status at a critical stage of their lives, when poor foundation of health may lead to lifetime complications (WEINREB et al., 2002). In addition, eating habits, lifestyle and behaviour patterns are developed that may persist throughout adulthood (FISHER et al., 2011). Therefore, the aim of thesis study was to establish the current school feeding situation in Kenyan high schools with reference to school

environments and available facilities, the curriculum, service providers, and nutrition quality of foods served to students. This study proposes a food and nutrition model that schools can implement to ensure a healthy and sustainable environment for children then finally provides direction in sensitizing government on implementing a school feeding policy to aid in alleviating malnutrition and also help attain vision 2030.

1.1. Problem Statement

Nearly all countries in the world have adopted a school feeding policy or have an ongoing school feeding program. This is because school meals and school feeding have been used as an effective mechanism for addressing child nutrition, educational enrolment, school retention and food safety and hygiene issues (ILLÉS et al., 2021). It has also effectively provided income-generation, employment and economic integration benefits to communities in which it has been implemented. Apart from being some of the most important tools to reach out to the most vulnerable, it has also provided economic support to families through the provision of food and contribution to learning by increasing children's access to education and maintaining their nutritional status and overall health.

School meal programs are the most prevalent safety net worldwide (WORLD BANK, 2014). In addition to their contribution to education, they support families and help promote human development (ALDERMAN and BUNDY, 2011). Nutritionally balanced school meals, along with complementary nutrition education and health measures, support child development and hunger reduction through enhanced nutrition and improved learning ability, with short- and long-term effects. When linked to local production, school meal programs also have the potential to benefit local producers and economies and promote long-term food security (BUNDY et al., 2009).

Kenya a middle low income country, has a geographically targeted school feeding program, hence only certain regions of the country are targeted to receive school meals based on a set of criteria, such as the highest poverty rates or the lowest achievement in education and highly marginalized area. All the schools in these regions receive free meals. In the rest of the country, however, the school feeding programs are generally unavailable to children, even if they have capacity to pay World Food Programme (FAO and WFP, 2015;SERREM et al., 2020). Like other sub Saharan countries, Kenya faces a wide range of challenges pertaining to children's health and nutrition issues. Levels of under nutrition are surging, due to frequent droughts and food shortages, while the

levels of over nutrition are also on the rise in urban areas as children have access to high energy dense foods and live sedentary lives.

Lack of an adequate school feeding policy means personnel in Kenyan schools lack adequate knowledge of food in relation to rations, nutritional quality, feeding patterns, proper control and hygiene practices when catering to children and adolescents in schools. Kenyan school personnel seem to provide such services based on acquired knowledge, availability of funds and resources, hence jeopardizing the health and nutritional status of the recipients at a critical stage of life, where poor foundation of health will lead to lifetime complications. Because it has an ongoing school feeding program, Kenya should implement a school feeding policy to ensure a proper, legal, sustainable and uniform way of providing quality nutrition, feeding patterns, proper food control and hygiene practices across schools in Kenya. A school feeding policy will also curb the rising numbers of malnutrition, ensure a healthy population and aid the country attain some of the Sustainable Development Goals (SDG) which will bring it closer to attaining its development agenda, Vision 2030.

1.2. Justification and Significance of the Study

The study was important in articulating the importance and need for the adaptation of a school feeding policy in Kenyan schools in a bid to improve and enhance catering services rendered to students. School feeding policies have been adopted worldwide, not only to enhance catering services rendered to students but also as an effective mechanism for addressing child nutrition, educational enrolment, school retention and hygiene issues. In addition, it effectively provides income-generation, employment and economic integration benefits to communities in which it has been implemented. Lack of a school feeding policy means Kenyan school personnel have inadequate knowledge of food rations, food nutritional quality, feeding patterns, proper food control and hygiene practices when administering food to school going children and adolescents. This may jeopardize these children's health and nutritional status when they are adults. This survey study will help personnel in Kenyan schools realize gaps in their provision of catering services to students in high schools and evoke government involvement and assistance in spearheading a remedy and control of the challenges faced during provision of catering services.

This is fundamental in enhancing the body of knowledge on school feeding policy formation and implementation in provision of food to school going children and adolescents. Recommendations from the study will assist future development and implementation of school feeding policies to

ensure healthy and safe food catering services are offered to school going children and adolescents in the country.

1.3. Main Objective

To promote a healthy safe and conducive environment for students in Kenyan schools through policy development and implementation on school feeding.

1.3.1. Research Objectives

This research focused on the following specific objectives:

1. To determine food handler's knowledge, attitude and practice in providing adequate food safety and sanitation services to students.
2. To find out the extent to which the current school environment (facilities, equipment, and tuck shop) enhances food safety and health among students during consumption.
3. To investigate the extent to which the current curriculum enhances adequate food safety and nutrition knowledge and practice among students.
4. To analyze the nutritional quality of meals served to students in relation to dietary requirements.

1.3.2. Research Hypothesis

The main hypotheses in this research were as follows:

Ho₁. Food handlers lack significant knowledge, attitude, and practice, to ensure proper food safety and sanitation services to students.

Ho₂. The current school environment (facilities, equipment, tuck shop) does not significantly enhance food safety and health among students during consumption.

Ho₃. The current curriculum significantly enhances adequate food and nutrition knowledge and practice among students.

Ho₄. Quality nutritious foods are always served to students which are in line with their dietary requirement.

1.4. Limitations of the study

Lack of adequate data and literature from other African countries was a setback as few African countries have created and implemented successful school feeding policies. Also inadequate data on Kenyan school feeding, types of menus served in schools, health and safety practices, and school medical reports were limited.

The research was summarized in Figure 1 below.

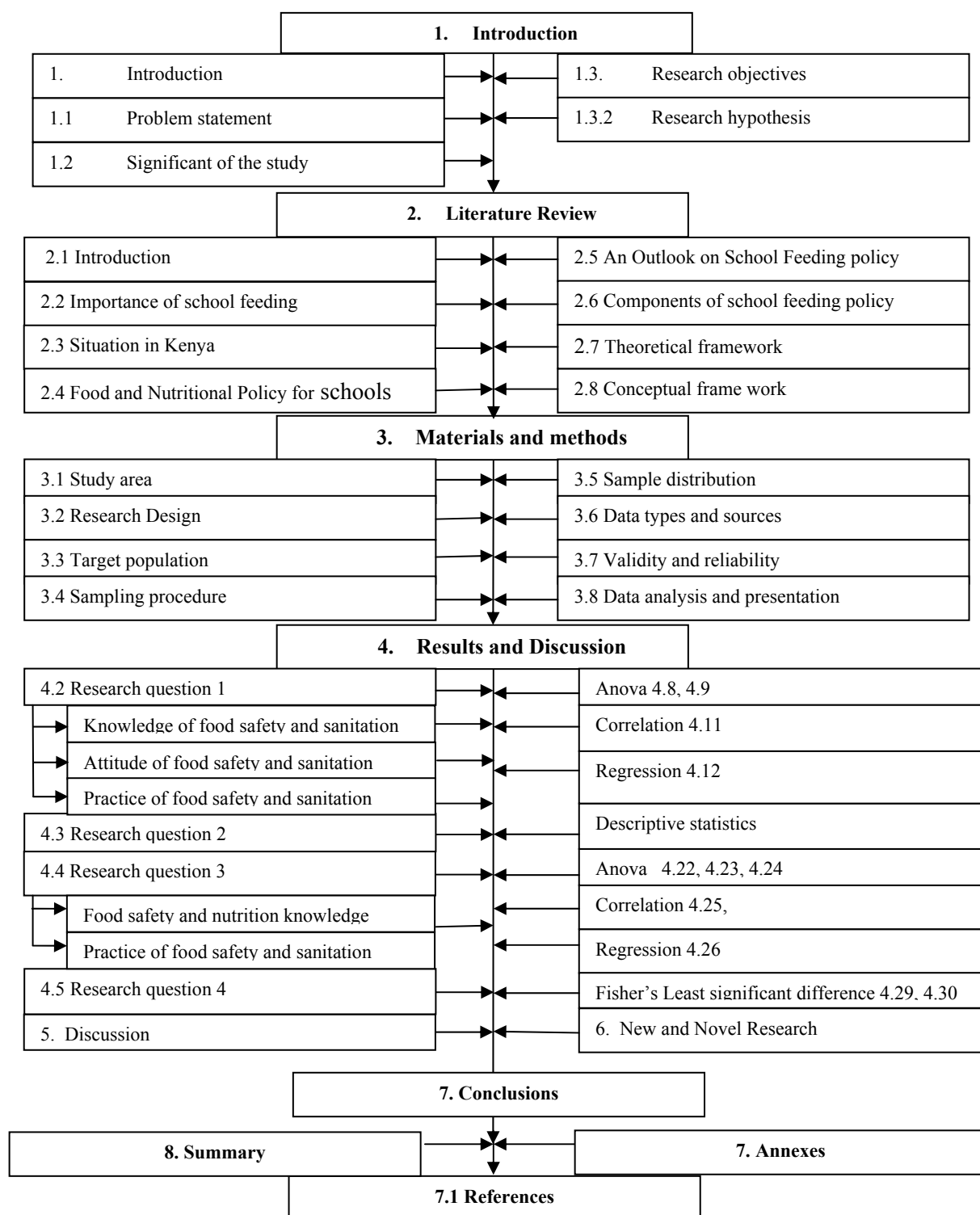


Figure 1: Process model reflecting the structure of the research study

Source: Author's own compilation

2. LITERATURE REVIEW

2.1. Overview

According to a review by World Food Programme (FAO and WFP, 2014), school feeding is the provision of food to school going children. Schools' feeding policies and programs have been used as a tool for coping with child nutrition, educational enrolment, school retention and sanitation issues. In communities where proper and effective implementation has taken place, these communities enjoy benefits such as employment, economic integration and income-generation. There are different variations of school feeding programs, based on modalities such as in-school feeding, where children are fed in school and take-home rations, where families are given food if their children attend school. Based on various circumstances, in some countries, vulnerable students such as girls and HIV infected and affected children are provide with take home rations, as well as their normal in-school meals. This is done in a bid to reduce social inequalities and increase school enrolment and retention rates.

Currently, an estimated 368 million children worldwide who receive food through school feeding programs include pre-primary, primary and high school students FAD and FAO (2013). One of the biggest programs includes India (114 million), Brazil (47 million), the United States of America (45 million) and China (26 million). Regions with the highest number of receptions are South Asia followed by Latin America then the Caribbean island. The global annual investment on school feeding is estimated to lie between US\$47 billion and US\$75 billion annually mostly funded by governments (IFAD and FAO, 2013). From a global perspective, external development assistance accounts for less than two percent of the entire expenditure. In developed and middle level income countries school feeding programs are almost exclusively self reliant, as they are entirely funded by internal revenue such as taxes and other sources (WORLD BANK DEVELOPMENT INDICATORS, 2010). In contrast, programs in developing countries depend entirely on donors, estimated to cover up to 83%of needs.

School feeding programs have an important role to play in the fight against hunger and malnutrition. When appropriately designed, they have the potential to improve the diets and nutrition knowledge and practices of millions of school going children and their adjacent communities (IFAD and FAO, 2013). Following the food fuel and financial crises of 2008, the demand for school feeding programs worldwide grew substantially. This is after Governments clearly understood the various potentials and multiple benefits these programs offered (FAO and WFP, 2014)

Apart from being some of the most vital mechanisms to reach out to the most susceptible, school feeding programs also maintain children's nutritional status and overall health through the provision of food (JOMAA et al., 2011). Contribution to learning is achieved by increasing children's access to education, also doubling up as income support to the families. School meal programs are the most prevalent safety net worldwide (WORLD BANK, 2016). In addition to their contribution to education, they support families and help promote human development (ALDERMAN and BUNDY, 2011). Nutritionally balanced school meals, along with complementary nutrition education and health measures, support child development and hunger reduction through enhanced nutrition and improved learning ability, with short- and long-term effects. When linked to local production, school meal programs also have the potential to benefit local producers and economies and promote long-term food security (BUNDY et al., 2009).

2.2. Importance of school feeding

Historically, targeted school meals programs were framed as food assistance, with two main objectives. First, to provide assistance to schoolchildren suffering from hunger and poverty, secondly, incentivize school enrolment, regular attendance and reduce dropouts for primary education (WFP, 2017). School meal programs have evolving both globally and regionally, where they are increasingly being considered as flagship safety nets within broader national social protection systems and an instrument to realize the rights to food and education (WFP, 2017). Food security and nutrition are becoming increasingly important objectives in most countries. Many countries clearly link education and nutritional objectives, recognizing that education outcomes are critically dependent upon schoolchildren's health and nutrition (WFP, 2017). For instance, Cuba and Panama's main focus is on nutrition.

2.2.1. School feeding as part of social safety net

School feeding programs are the most widespread social protection instruments worldwide (WORLD BANK, 2016). It is widely acknowledged that school meals are a conditional safety net that contributes towards addressing the immediate food needs of school going children while promoting long-term child development, and acting as an indirect income transfer to their families. Providing a revenue footing through the provision of school meals enhances households' ability to withstand shocks, reduces the incidence of negative coping mechanisms, and contributes to the protection of livelihoods and building resilience (GULLBERG, 2006). They best act as social

protection instruments when integrated in the broader national social protection systems and linked to other programs such as targeted conditional cash transfers (WORLD BANK, 2016).

The rationale behind introducing free school meals was multifaceted. First, as a promotion of social equity, through the provision of similar foods to all school going children and second, gender equity, which sets women free to work outside their homes by lessening their domestic task burdens of lunch box preparation (GELLI et al., 2009). The introduction of school meals was also a way of curbing poor eating habits and fighting against malnutrition by serving nutritious meals (ALDERMAN, 2011). Hence, schools were tasked with fostering healthy citizens by providing adequate teaching and knowledge, sharing the responsibility of children upbringing to the society as a whole and not just leaving it to parents (GULLBERG, 2006). School feeding often integrates in to a broader welfare system (ALDERMAN, 2011) in various ways such as, ensuring the poorest and most venerable in society get the most benefit which in turn contributes to the promotion of equity. By benchmarking and keeping track of costs, due to the availability of financial information pertaining to school feeding expenditure, many countries can stream line and increase transparency levels of their programs (ALDERMAN, 2011).

2.2.2. Child development through school feeding

School feeding is an intervention that increases the access of children to education in areas where education is a challenge and boosts children's nutrition status and ability to learn, hence takes care of children (IFAD and FAO, 2013). Based on previous findings, school feeding has always played the role of an incentive whereby it enhances enrolment, keeps children and adolescents in school and minimizes cases of absenteeism. This has been experienced especially in countries where gender disparities are a challenge. Once in school, feeding programs contribute immensely, to the improvement of children's nutrition status, cognitive abilities, and hunger avoidance (SERREM et al., 2020). However, all these are dependent on the quality of the food basket, whether or not it is providing appropriate and adequate micronutrients needed by the child to learn and develop.

Educational achievement, physical development, learning and cognitive potential, health and consequently school attendance greatly depend on the nutritional status of school going children (FAO and WFP, 2015). Implying that school feeding programs must be nutrition oriented, MORGANET al.,(2008)suggests that, common deficiencies among school going children, such as lack of vitamin A or iron, which affect learning ability, can be tackled through micronutrient

fortification and bio fortification of food. Exercises such as de-worming may also be carried out along side school feeding programs

School feeding programs in addition to ensuring adequate nutrition for children also ensures that girls are well prepared for child bearing age. This is achieved by providing essential micronutrients; iron and folate hence reduce immediate vulnerability and promotes preparedness for reproductive age (RUEL and ALDERMAN, 2013). These researchers further propose that school feeding should also provide a favorable and safe environment for learning and protection of children's health by providing drinkable water and sanitation, health and nutrition education and periodic health screenings. School feeding is part of a wider education system (ILLÉS et al., 2021). It partly contributes to major element, which has a bigger impact on learning such as presence and quality of teachers, suitable textbooks, an appropriate curriculum and a general environment that is conducive to learning. Without these major elements, the impact of school feeding on learning will be nonexistent.

2.2.3. Linking school feeding and local agriculture

Currently there is a paradigm shift in the manner in which school feeding programs source for food. One suggestion is that school feeding programs should source for food locally or at least within the boundaries of a country (FAO and WFP, 2014). These in turn would give additional benefits to the children involved, local farmers, communities and economies. Various countries in the world are looking for ways of turning this into reality, particularly buying from small holder farmers and creating a stable market for their products to potentially increase their incomes (FAO and WFP, 2014).

According to (FAO and WFP, 2014), the creation of a link between school feeding programs and local agricultural production is viewed as a way of ascertaining sustainability and taking full advantage of the potential benefits. In a bid to involve the local community in managing resources and decision making, the school level committees are being empowered to purchase food closer to the schools (ADELMAN, 2008). For example, local procurement has a bigger chance to provide a wide range of food, both fresh and unprocessed, such as the provision of cereal quinoa in the Andes and several types of banana in Asia that are closer to what children may consume at home. Advantages of these include an increase in the quality of the food basket, easier processes of fortifying products such as rice with beans, and an increase of food with high levels of micronutrients, to make food more nutritious (ADELMAN, 2008)

Developed countries have adopted this approach, and are quickly realizing its multiplier effect in other sectors of the economy beyond those that produce and consume school meals (MORGAN, 2008). Numerous numbers of middle and lower income countries are attempting to transform existing school feeding program and some have been successful. For instance, Brazil is best known for, the most successful programs, providing stable markets to family farms (IFAD and FAO, 2013). Other countries such as Ecuador, Honduras, Namibia and Peru are also in the process of linking their programs to local production. In Africa countries such as Côte d'Ivoire, Ghana, Kenya and Mozambique, have started implementing the home grown school feeding program through the assistance of the Comprehensive African Agricultural Development Programs (CAADP).

Key elements have to be addressed for the home school feeding program to be successful, such as adequate investment in the production and post-harvest management of food, fully supported by the government through the agriculture sector (MORGANET al., 2008). Therefore, farmers require access to high quality seed, fertilizer and other necessary inputs, as well as credit and technical assistance to improve quality control processes and storage. Brazil's a successful example of the agriculture ministry supporting and matching and supporting farmers to access the available markets in the educational sector (MORGANET al., 2008). In many countries procurement legislation bars or imposes such high requirements that the local small scale famers find it impossible to supply their produce to institutions. As a way of supporting local farmers countries such as the UK have amended their regulations concerning procurement of food by institutions to allow small scale farmers and companies to tender at a smaller scale (GROSHET al., 2008)

Design and implementation issues need to be taken into consideration. Choosing the appropriate method of implementation is based on the situation and what best works for various countries or regions to integrate local agricultural production into the food basket. For instance, governments in countries such as Kenya send money to schools to procure food themselves from their local markets (IFAD and FAO, 2013). In Brazil, resources are sent to districts or counties which carry out local procurement for schools in the region (MORGANET al., 2008), while Ghana, uses catering companies to provide schools with food (MORGANET al., 2008). According to WFP (2017) each model has some form of tradeoff to be considered. The most fundamental ones are ensuring a stable supply of food to schools all year round, enhancing the nutritional quality and ensuring safety of the food, maintaining overall program costs at reasonable levels while benefiting local farmers and having a contingency plan for when food is not available in the country because of drought, flood or any other disaster. Of importance in reference to these is that in arid and semi arid areas, food

may not be available locally and local capacities to process or fortify food may be limited (WFP, 2017).

2.3. Situation in Kenya

Kenya a sub Saharan country in East Africa occupies an area of 582,646 square kilometers and has a population of about 44.2 million with approximately 8 million people living in urban areas (WORLD BANK, 2016). Population growth rate is estimated at 2.6% per annum. Agriculture is the dominant sector of the economy. Kenya has approximately 9.6 million children and adolescents in over 10,000 schools countrywide, 21.3 percent of whom are primary school students (WORLD BANK, 2016). In 2013 Kenya became middle level income country as its per capita earning grew to 1,165 USD (WORLD BANK, 2016). The country holds a strategic development plan called Vision 2030, whose aim is to transform Kenya into a newly industrialized, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment (WORLD BANK, 2016). The Vision comprises three key pillars, economic, social and political. The economic pillar aims to achieve an average economic growth rate of 10 per cent per annum and sustain the same until 2030. The social pillar seeks to engender just, cohesive and equitable social development in a clean and secure environment, while the political pillar aims to realize an issue-based, people-centered, result-oriented and accountable democratic system.

2.3.1. Challenges faced by Kenya

According to GROSHET al., (2008) seventy-four percent of the schools feeding programs of countries in the lower middle income group geographically target certain regions. For example, in Kenya schools are targeted to receive school meals based on a set of criteria, such as the highest poverty rates or the lowest achievement in education and highly marginalized areas FAO and WFP (2015) All the schools in these regions receive free meals. In the rest of the country, however, the school feeding programs are generally unavailable to children, even if they have the capacity to pay FAO and WFP (2015). Hence Kenya lacks an active school feeding policy that can be used as an effective mechanism to address child nutrition, education enrolment and retention, food control and hygiene issues among non-geographically targeted schools.

Kenya is a food-deficit country with less than 20 percent of its land suitable for successful cultivation. Seasonal food insecurity affects households in rural areas before the start of the harvest (LANGINGER, 2011). Kenya is also plagued by acute food insecurity primarily from droughts

and/or floods that threaten the lives and livelihoods of the most vulnerable groups of the population, particularly in the semi-arid and arid regions (LANGINGER, 2011).

According to LANGINGER (2011), the arid and semi arid parts of Kenya, which include the Eastern and Northern regions of Kenya, are home to approximately 30 percent of the Kenyan population. These regions are known to suffer through crippling social effects of current intensified droughts, floods and food shortages. Further, among the most vulnerable, are the school-aged population who are most negatively impacted. To fight against social pressures that were a hindrance to educational opportunities for vulnerable students such as girls, the Kenya government began a school-feeding program in 1980 (REGNAULT, 2008) whose aim was to increase primary school enrollment and alleviate the health and developmental consequences of childhood malnutrition. The initiative, significantly backed by WFP's funds and management is one of the largest and longest-standing school feeding partnerships of its kind (LANGINGER, 2011). By 2008, the program had served 1.2 million children in 3,600 schools, nearly 21.3 percent of all primary school students in Kenya (GUENTHER et al., 2010).

The school-feeding program has increased student enrollment rates, attendance, and exam scores. For example, between the year 2002 and 2007, 15% and 12% increase in urban and ASAL school enrolment, respectively, were attributed to the feeding programme (FINAN, 2010). However, rural districts have exhibited only modest gains in completion rates, a mean of 34% in arid and 57 percent in semi-arid districts, respectively, showing that even with the presence of school meals, regional disparities in education persist. Further, among poor children and girls, these numbers were far below the standards Kenya needed to achieve the Millennium Development Goals by 2015 (MINISTRY OF EDUCATION (MoE, 2004).

The Kenyan government has decided to expand the role of the "Education for All" developmental targets by Implementing School feeding programs nationwide (MOE 2003). Through Homegrown School Feeding, Kenyan policymakers are identifying means to better integrate and promote goals in education, agriculture, and rural development through inter sectoral cooperation and progressive policy changes. Over time, the Kenyan ministries of Education and Agriculture seek to limit the role of external players in order to transform the program into a more sustainable and independent national enterprise (MOE 2003).

2.3.2. Nutritional Considerations

While data on nutritional deficiencies and hunger among school-age children in Kenya is poorly documented, levels of chronic and acute malnutrition remain unacceptably high (ONSOMU et al., 2015). About 30% of child deaths in Kenya are attributed to under-nutrition. An estimated, 2.1 million Kenyan children under the age of 5 years are stunted, limiting the realization of their full physical and mental potential (ONSOMU et al., 2015). Malnutrition leads to death and/or disease which in turn reduce the country's productivity. In Kenya, malnutrition causes substantial losses in social capital related to disease and death in children. Poor households bear the highest burden of chronic malnutrition with 44% and 39% of children being in the first and second lowest wealth quintile respectively. Chronic malnutrition also affects the richest households with 25% of children in the highest wealth quintile being stunted (KNBS, 2010).

In 2008 KDHS showed a reduction in both infant, and under-five mortality and these figures for chronic under nutrition have not improved over the past 20 years. One third of children under the age of 5 years are stunted. Micronutrient deficiencies of vitamin A and iron are unacceptably high among young children in Kenya affecting about 76% and 74% of pre-school children, respectively (LANGINGER, 2011). This affects cognitive development, lowers school performance, limits adult productivity, reduces immunity and eventually contributes to high burden of infant and child morbidity and mortality (REGNAULT, 2008).

According to UNICEF (2010), 21% of children in Kenya under five suffer from moderate to severe underweight, 6% moderate to severe wasting, 35% moderate to severe stunting, 84% are vitamin A deficient, 37% iodine deficient and 69% are anemic. to the same author further asserts that some of the major factors contributing to such high levels of malnutrition include childcare and feeding practices, low access to nutrition knowledge and services and diseases. Other underlying factors are poor hygiene, poor dietary diversity and access to fortified foods. Inadequate quantities of food also contribute to high levels of malnutrition. There is also widespread promotion and use of inappropriately constituted cereal and legume mixes (WORLD HEALTH ORGANIZATION, 2011).

2.3.3. Home grown school feeding program in Kenya

In 2003, African governments included locally-sourced school feeding programs in the Comprehensive Africa Agriculture Development Programme (CAADP). Together with the New Partnerships for Africa's Development (NEPAD), WFP and the Millennium Hunger Task Force

apilot Home Grown School Feeding and Health Program (HGSFHP) designed to link school feeding to agricultural development through the purchase and use of locally and domestically produced food was launched (NABUDERE, 2003).The Government of Kenya further developed two different HGSF models namely *Njaa Marufuku* Kenya meaning eradicate hunger in Kenya in the Swahili language, and Home Grown School Meals (HGSM) aimed at meeting the Sustainable Development Goals(ALIYAR et al., 2015). The two programs have received broad-based support from both government and development partners. The Ministry of Agriculture-led programme NMK initiated in 2005, targets high poverty areas with potential to grow food and areas having high levels of school drop-out and malnutrition and poor primary school performance(ALIYAR et al., 2015)

Currently, 44,229 children in 66 schools are being targeted across 6 provinces. With the momentum for HGSF in Kenya building, in July 2009 the Ministry of Education launched the HGSM programme with a beneficiary level of 538,000 children in 1,777 schools in 66 semi-arid districts (ALIYAR et al., 2015). In 2011, the programme had reached a beneficiary level of 592,638 children in approximately 1,800 schools located in 72 semi-arid districts. The HGSM programme is now also looking to strengthen links with smallholder farmers to enhance local agricultural production.

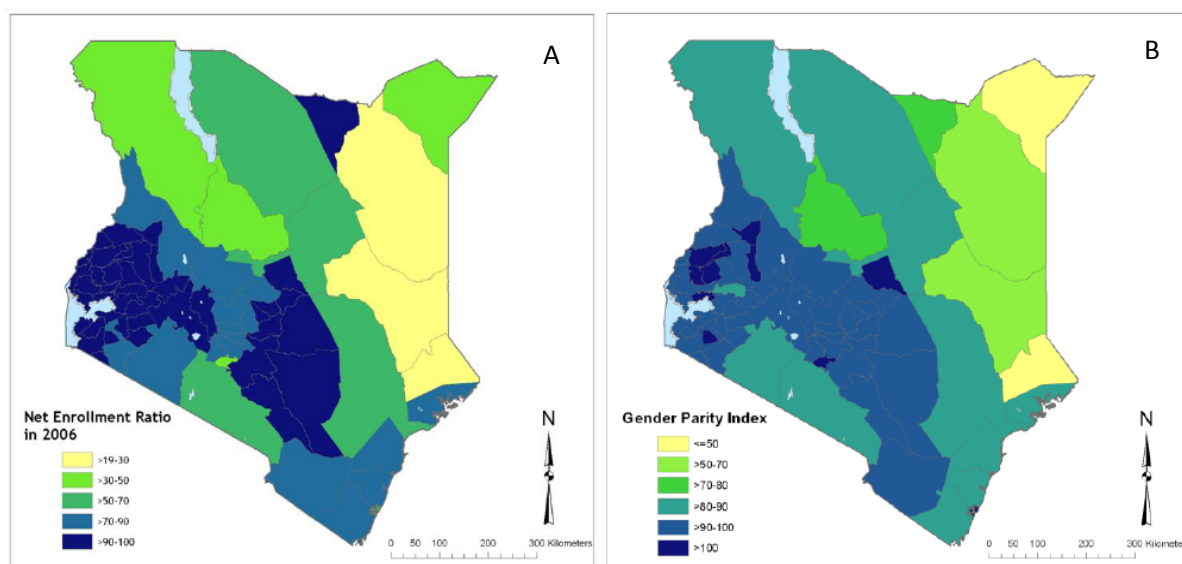


Figure 2: Home Grown School Feeding Program in Kenya,
A: Net Enrollment Ratio; B: Gender Parity Index
Source: Republic of Kenya (2006, p. 71-81)

Currently Kenya lacks an implemented school feeding policy that governs the provision of food to school going children and adolescents (IFAD and FAO 2013). This means Kenyan school

personnel lack adequate knowledge of food rations, food nutritional quality, feeding patterns, proper food control and hygiene practices when administering food to school going children and adolescents. Feeding services to children and adolescents are based on acquired knowledge and availability of funds and resources, jeopardising the health and nutritional status of children and adolescents at a critical stage of their lives, where a poor foundation of health will lead to lifetime complications (IFAD and FAO 2013). Hence, a diet of high nutritional quality is important. Also, eating habits, lifestyle and behaviour patterns are developed that may persist throughout adulthood (MINISTRY OF EDUCATION KENYA, 2016). In 2016, the ministry of education in collaboration with the Ministries of Agriculture and public health created a strategic implementation plan for a food policy in Kenya called “School Nutrition and Meal Strategy for Kenya”(MINISTRY OF EDUCATION KENYA, 2016). The plan was one of the goals of Kenya’s Vision 2030, and part of The Social Pillar that seeks a gender just, cohesive and equitable social development in a clean and secure environment (MINISTRY OF EDUCATION KENYA, 2016). Some of the main objectives of the strategic plan include, increased intake and awareness of adequate, culturally appropriate nutritious meals amongst school age children, improve enrolment, attendance, retention, completion and learning of school age children with equity, develop mechanisms for a nationally-owned and sustainable programme, promote economic, social and agricultural development; To strengthen governance and multi-sectoral coordination mechanisms for the school nutrition and meals programme (Ministry of Education Kenya, 2016).

2.4. Food and nutrition policy for School

Children’s lifestyles depend on activities conducted in a school setting for improvement. Additionally, to reverse the adverse effects of overweight and poor eating habits (ST- ONGE, KELLER & HEYMSFIELD, 2003) there is need for healthy nutrition targeted interventions to be implemented early in childhood and adolescence. The physiological requirements for nutrients are high relative to energy needs during childhood and adolescence, making this a critical period in human development (STIPANUK et al., 2006). High nutritional quality diets are therefore particularly important. Notably, the lifestyle, behaviour patterns and most importantly the eating habits, developed during this period may persist throughout adulthood. Therefore, because schools effectively reach large numbers of people, including youth, school staff, families and community members, they provide an important opportunity for prevention SUMBERG and SABATES (2011). This calls for every school agenda to highly prioritize healthy food and nutrition due to the positive effect on child well-being. Previous studies have demonstrated that improved nutrition

through consumption of healthy food improves learning ability, resulting in better academic performance (WHO, 2006, DIETITIANS OF CANADA 2003, BROWN et al., 2004.).

2.4.1. Designing a food and nutrition policy for school

The Global School Health Initiative launched in 1995 by the World Health Organization's was mandated to use schools as a means of promoting health and education activities at local, national, regional and global levels, to improve the health of students, families and all members of the community (WHO, 2006). The term 'health promoting schools' was developed to acknowledge educational institutions which "constantly strengthens its capacity as a healthy setting for living, learning and working" (BUZBY et al., 2006). However, coherent action in the school setting intended to tackle nutrition issues in childhood requires the school setting, to prevent the hierarchical culture inhibiting achievement and empowerment (BROWN et al., 2004). Development of food and nutrition policy is key in achieving school health. The way forward should be a situational analysis specific to the context and agreed upon by all the different stakeholders involved to produce a written policy document should produced based on a situational analysis specific to the context and agreed upon by all the different stakeholders involved SUMBERG and SABATES (2011).

The concept of health promotion in school is based on a social model of health, which emphasizes the needs of the individual at the centre of the entire organization (BARNEKOW et al., 2006). A supportive setting can be created to influence the perceptions and actions of all involved with the school including parents, caterers and food providers using a holistic approach. When addressing child nutrition and health, as all stakeholders involved in the provision of school food influence the overall nutritional quality and therefore diets of young consumers, the process explained earlier is of great importance. The ENHPS which operates within the European region integrates healthy promotion of school policy into wider health and educational sectors. Working at school, national and international level, it recognizes that schools are ideally placed to promote child health, and that of the wider community through the curriculum, school environment, community and nutrition and health service (BARNEKOW et al., 2006).

Other than, the involvement of shareholders, it is paramount that policy acquires a nutritional guideline to achieve a personality of its own. School feeding programs vary from country to country based on various aspects such as the aim of the school feeding program, and economic position of the country (FAO, 2019). School feeding policies and programs are formulated to address nutritional and educational challenges facing toddlers, children and adolescents in a variety

of countries. For instance, in high income countries school feeding policies aim to tackle the rising levels of childhood overweight and obesity, while in emerging economies, in the short-term, it aims to alleviate hunger, a social safety net for households with very low income and to increase enrolment of children into schools (JOMAA et al., 2011). Further, in the longer-term, policies aim to improve the nutritional status, attendance, cognitive development and retention of schoolchildren. Studies under taken reveal those most emerging economies such as middle and low level income countries fail to have nutritional guide lines, hence fizzling the effort or the true purpose of the feeding program (JOMAA et al., 2011)

The provision of meals alone does not necessarily translate into improved nutrition. Complementary actions, such as food and nutrition education and health measures need to be in place (FAO, 2019). Most importantly, the quality, quantity and composition of the meals and snacks provided, and thus the NGS, must be coherent with the intended objectives, target audience’s nutrition priorities and context of the programme. A vital aspect of dietary guideline is the Recommended Dietary Allowance (RDA) which is the daily nutritional intake appropriate for individuals in an age or sex specific population. It is measured for, macronutrients and micronutrients. Macronutrients are energy giving foods and are required by the body for essential body functions. They include carbohydrates, proteins and fats. Therefore, recommended energy dietary intakes for a population result in an accepted level of healthy population. Despite these there are minor situational differences within a population such as an active adolescent in the rural area in comparison to a less active adolescent in the urban areas who might require slightly different requirements (*WHO/FAO 2004*)

Table 1: Macronutrient Recommended ranges of nutrient intakes for WHO?

| Dietary Component | Goal expressed as % of total energy |
|--------------------------|--|
| Total carbohydrates | 55-75% |
| Total fat | 15-30% |
| Proteins | 10-15% |
| Free sugars | <10% |

Source: WHO/FAO (2004)

Furthermore, there are slight variations in energy requirements between boys and girls, which advances with age, 5% for boys aged 6 and upward of 15% for 14 year olds. Macronutrient requirement of toddlers are estimated at 70% of the requirements for primary school children, while for adolescents needs are % higher than those of primary schools

Table 2: Estimates of daily macronutrient requirements for children and adolescents

| Age groups/education level | Age | Daily energy requirements | | Estimates of daily RNI | | |
|----------------------------|-------------------------|---------------------------|--------|------------------------|---------------------------------------|---------------------------------------|
| | | Boys | Girls | Energy | Protein | Fat |
| | | (Kcal) | (Kcal) | Boys and girls (Kcal) | Boys and girls (10–15% of energy) (g) | Boys and girls (15–30% of energy) (g) |
| Pre-primary/ECD | 3–4 | 1252 | 1156 | | | |
| | 4–5 | 1360 | 1241 | 1300 | 33–49 | 22–43 |
| | 5–6 | 1467 | 1330 | | | |
| | Average for 3–6 years | 1360 | 1240 | | | |
| Primary | 6–7 | 1573 | 1428 | | | |
| | 7–8 | 1692 | 1554 | | | |
| | 8–9 | 1830 | 1698 | | | |
| | 9–10 | 1978 | 1854 | 1850 | 46–69 | 35–62 |
| | 10–11 | 2150 | 2006 | | | |
| | 11–12 | 2341 | 2149 | | | |
| | Average for 6–12 years | 1930 | 1780 | | | |
| Lower Secondary | 12–13 | 2548 | 2276 | | | |
| | 13–14 | 2770 | 2379 | | | |
| | 14–15 | 2990 | 2449 | 2600 | 65–98 | 44–88 |
| | 15–16 | 3178 | 2491 | | | |
| | Average for 12–16 years | 2870 | 2400 | | | |

Source: FAO/WHO/UNU (2004)

Micronutrients assist in the moderation of growth, activity and development, functioning of the reproductive and immune system (FAO, 2019). They are constituted of minerals and vitamins which are needed in minimal quantities. There are minor disparities with regard to the level of nutrients

given to various age categories of adolescents. For instance, recommended Iron intake for menstruating adolescents are higher in cases of low Iron Biodiversity. Recommended level is 32.7mg/day as compared to 14.0mg/day for non menstruating adolescents (WHO, 2017). In addition, school feeding guideline should ensure the inclusion of Iron, Iodine and Vitamin A, as they are the major cause of deficiencies in developing countries (FAO, 2019)

Table 3: Recommended micronutrient intakes

| Age groups (years) | Recommended safe level of intake | | | | Estimates of daily RNI for planning daily rations | | |
|--------------------------|--|-------------------------|----------------|----------------------|---|-----------|-----------------|
| | Iron based on bioavailability mg/day a | based on iodine µg/dayb | iodine µg/dayb | vitamin A µg Re/dayc | iron mg | iodine µg | vitamin A µg Re |
| | Low | very low | | | | | |
| Pre-primary | | | | | | | |
| 1–3 | 5.8 | 11.6 | 90 | 400 | 12 (6) | 90 | 450 |
| 4–6 | 6.3 | 12.6 | 90 | 450 | | | |
| Primary | | | | | | | |
| 7–10 | 8.9 | 18.8 | 120 | 500 | 17.8 (9) | 120 | 500 |
| Lower secondary | | | | | | | |
| 10–18 | | | | | | | |
| Females: 11–14 | 14 | 28 | 150 | 600 | 29 (15) | 150 | 600 |
| Males: 11–14 | 14.6 | 29.2 | | | | | |

Source: FAO/WHO/UNU (2004)

2.5. An Outlook on School Feeding Policies

A concrete policy and legal framework is key to achieving food and nutrition goals in schools. Factors, such as political will, human and financial resources and adequate frame work for implementation contribute to a successful school feeding program (ALLENET al., 2019). Legislation on the other hand plays an essential role in the successful running and implementation

of a school feeding policy. It achieves this through, defining clear institutional responsibilities, recognizing access to food as a legal right, establishing and coordinating mechanisms among different stakeholders involved, giving concrete basis for budget allocation and the provision of an appropriate framework for enforcement, monitoring transparency and accountability (FAO, 2019). High income countries such as Finland, United Kingdom and United States, have made significant strides in improving the quality of their school meals and in-school consumption patterns by children, by enforcing NGS (HAWKES, 2013; SPENCE *et al.*, 2013; COHEN *et al.*, 2014).

2.5.1. School Feeding Policies in High Income Country

School feeding programs are quite different between regions and countries especially with middle and low income level countries. Table 4 highlights the various policies, aims, objectives and costs per meal. In France the ministry of education is responsible for at least 50% of funding towards school meals while the rest is remunerated by parents based on level of employment (WYATT *et al.*, 2005). The local council in collaboration with private caterers provides meals to various schools (GORARD, 2012). The entire student population in France has their meals in school. Most schools operate a canteen styled service and largely serve a three to four course menu (HARPER *et al.*, 2008).

England's school feeding is provided by contracted private caterers in collaboration with the schools or the local authority (NICOLAS *et al.*, 2013). School meals are free for children from humble backgrounds (HARPER *et al.*, 2008). Canteen styled service is largely used in schools as students are also allowed to bring packed lunches from home. The Italian government invests heavily on ingredients for the school feeding menu, approximately 60% of which is purchased by the local authorities due to the promotion of organic foods which are certified under specified regulations (PEARCE *et al.*, 2005). Genetically modified foods are restricted from schools. The Italian food culture and healthy eating habits are emphasized, in the school meals dining experience. Children ranging from (2-14) sit at round tables with table clothes and silverware and are presented with a three course meal (PEARCE *et al.*, 2005). Meals are often free for the poorest families.

The United States Department of Agriculture (USDA) authorizes both the national school breakfast and lunch program and the state agency operate the program at the local level (MURPHY, 2012). Meals are largely served using the Canteen style of service (MCCLINTOCK *et al.*, 2012). Free meals or subsidies are offered to low income families.

Table 4: School meal provision frame work table for high-income countries

| (High income) | England | France | Italy | USA |
|---------------------|---|--|---|---|
| Aims and objectives | “Promoting education and health of children and young people by improving the quality of food supplied and consumed in schools” | To ensure that schoolchildren receive essential and high-quality nutrients; current school lunches found to be often high in fat and protein and low in dairy products, fruits, and vegetables | Great emphasis on organic food and sustainability; promotion of Italian farming practices and the Italian diet and food culture | Improving the health and well-being of the schoolchildren |
| Policy | The School Food Trust (SFT) was set up by the DfES in 2005 to achieve above-mentioned aim | Ministry of National Education and Minister for Research have set out non-compulsory nutrient and food-based guidelines | The Finance Law 488 ensures that regional and organic sourced foods are promoted | National School Lunch Act passed to achieve above-mentioned aim |
| Cost | \$ 2.58 for Primary and 2.78 for High school per meal per student | Between \$5.54 and \$7.12 per meal per student | \$ 4.68 per meal per student. 20% discount for more than one child, Free for the poor | \$1.55 per meal per student and free for low income families |

Source: FAO/WHO/UNU, (2004)

2.5.2. School Feeding Policy in Middle Income Country

According to FISHER (2007), the Ghanaian school feeding program was started in 1958 by the Catholic Relief Service and WFP. Initially food aid imported from other countries was used, but recently, WFP began to purchase supplies, such as, corn, salt and palm oil locally to boost the local economy. Ghana has now developed a national school feeding program, capable of catering to over 405,000 primary and kindergarten children in the poorest regions (FISHER, 2007). School feeding programs are authorized at the national level, which formulates policies and establishes institutional structure. At the regional level, the program is implemented through the District Implementation Committee, whose duty is to procure food stuff and ensure the smooth running of the program. At

the school level the school implementation Committee (SIC), sets the menu, employs the cooks and ensures cooking and the provision of food to students.

Brazil, through the zero hunger project (Fome Zero), has upheld food security at the core of its social policy (KLEINEET al., 2011). As part of the project, Bolsa Familia is an initiative that donates money to children from low-income households to enable them to take their children to school. A total of \$7.41 is donated per child per month to households that earn an income less than \$59 per capita, while \$25 is donated to households that earn less than \$30 per capita. Known as the world's largest conditional cash transfer, the initiative gives support to over 30 million poor people. Concern has been raised about the nutritional content of the food served in the school feeding program as over 40% of the Brazilian population is considered overweight.

In South Africa, the National School Nutrition Programme (NSNP) was established in 1994 by President Mandela. It is financed through the central budget and is absolutely dependent on international food donation, the department of education is in charge of the operations of the NSNP (KALLMAN, 2005). The departments of Health and education formulate 22 different menus to be adopted by the various provinces depending on the social acceptability, accountability and cost (BASTIA, 2007). Individual provinces implement the school feeding policy and guidelines received from the national coordinator (KALLMAN, 2005). The South African diet is very reflective in respective menus. The School feeding program is only available to children who are registered in the program, while unregistered students are required to bring packed lunches from home. Food is not allowed to leave the school premises (BASTIA, 2007).

The school feeding program in India also known as the Mid Day Meal program (MDM) is a reflection of the Right of Children to Free & Compulsory Education Act that was passed in 2009. The MDM program is steered by both the Department of School Education and Literacy and the Ministry of Human Resources Development (CHETTIPARAMBIL-RAJAN, 2007). At the district level the Monitoring Committees (SMCs) at the state and district ensure seamless coordination and implementation of the program. On the ground in various schools, the responsibility of supplies and cooking is relegated to the local organisations such as women and youth groups (CHETTIPARAMBIL-RAJAN, 2007).

Table 5: School meal provision framework table for middle-income countries

| (High income) | Ghana | Brazil | India | South Africa |
|----------------------|--|---|--|--|
| Aims and objectives | To tackle poverty and improve nutritional status of communities To increase enrollment and attendance | To reduce the number of malnourished children and improve the rates of school enrollment To address the levels of overweight and obesity | To improve the nutritional status of schoolchildren and improve enrollment and retention | To contribute to the quality of teaching and learning through the provision of a nutritious meal to learners |
| Policy | Provide a nutritious hot meal daily prepared using local produce to all primary and kindergarten schoolchildren in the poorest areas | The Zero Hunger Project (Fome Zero) and Bolsa Familia conditional cash transfer program address food security as social policy | Part of policy of the Department of School Education and Literacy and the Ministry of Human Resources Development through the National Steering and Monitoring Committee | Policy and guidelines formulated by the Department of Education. The Conditional Grant Framework (CGF) spells out the conditions for financing, the targeting criteria, and the meal composition |
| Cost per Meal | Only caters to the poor, and it is Free | Donation of \$7.41 for families that earn less than \$59 per month and Donations of \$25 for families that earn less than \$30 per month | It is Free | \$ 0.32 per meal per day |

Source: FAO/WHO/UNU, (2004)

2.6. Components of food and nutrition policies for schools

The various Components of food and nutrition policies include, Food and nutrition education content taught in school a School environment, the School nutrition and health services (Core action group) and the Knowledge, Attitude and Practice of food handlers as discussed below.

2.6.1. Food and nutrition education content taught in school

There are two fundamental constructs that influence food and nutrition education taught in schools. They include the curriculum and Life skills as discussed below

2.6.1.1. Curriculum

To develop healthy, responsible and sustainable lifestyle habits in children, education in good nutrition and personal health including economical and ecological food preparation, consumer rights and understanding food labels, is crucial (WHO, 2006). Healthy eating patterns in childhood and adolescence promote optimal childhood health, growth and intellectual development, prevent immediate health problems, such as childhood obesity, non-insulin dependent diabetes, elevated serum cholesterol, iron deficiency anemia, eating disorders, dental caries and may prevent long-term health problems, such as coronary heart disease, cancer, and stroke, adult obesity, hypertension and osteoporosis (TREUHAF and KARPYN, 2010). Nutrition education should be part of a comprehensive integrative, interdisciplinary curriculum that focuses on understanding the relationship between personal behavior, individual health and the environmental impact of food choices (TREUHAF and KARPYN, 2010)

According to DIXEY et al., (1999) qualified teachers and adequate resources are required to teach modern food skills and healthy eating. To improve the quality of food available in schools, there is need for specialized teachers to teach nutrition education and cooking classes to both girls and boys, as compulsory disciplines. As a subject, Home economics should be promoted and marketed as a contemporary and future oriented subject. The curriculum also needs to be a vital and effective tool for educating children, by precisely containing topics such as nutrition, personal health, food production, processing, distribution, preparation, preservation storage and sustainability, consumer awareness and rights and media literacy, food and emotional development, sustainability and ecology, eating habits and socio cultural influences (DIXEY et al., 1999)

Basic food preparation and cooking skills are essential for children who need to learn how to cook as their parents often do not have the skills to teach them (WHO, 2006). Nutrition education should also encourage children to read nutrient content tables on packaging, in an effort to develop an understanding of the variation in nutrient content and energy density of foods, as well as of their own daily requirements. In addition to practical applications. For example, adolescents should be familiar with and be able to interpret terms such as “only 10% fat”, “low in sugar” on food labels (WHO, 2006). Furthermore, Linking nutrition and physical activity is particularly important because of the rising proportion of overweight among children and Nutrition education lessons shall stress the importance of combining regular physical activity with sound nutrition as part of an overall healthy lifestyle. Physical education classes, in turn, shall include guidance in food selection. Seychelles is an example of a country that has based Dietary Guidelines (SDG), content and messages of nutrition education within the school curriculum that reflect the principles of healthy eating (AURINO et al., 2018). It is mandatory for all Seychelles schools to ensure nutrition education is incorporated and taught within the curriculum either through Social and Personal Education or other subjects. It is a requirement to review Nutrition Education within the school curriculum periodically, to ensure that messages are consistent and relevant to national dietary guidelines and further development in nutrition (STETTLER, 2002). In addition, all nutrition education IEC materials developed for schools need to be in line with the Seychelles Dietary Guidelines. Also, Education materials adopted at international level for use locally, should be relevant and in line with the local guidelines. Messages that target attitude as well as behaviour needs to be also be integrated.

2.6.1.2. Life skills

Life skills are abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands of everyday life (WHO, 2003b). Psycho-social and interpersonal competences that enable informed decisions, problem solving, critical, creative thinking, effective communication, healthy relationships, empathy, general health and productivity form the Life skills (WHO, 2003b). The Pupils need to acquire healthy life skills specific to nutrition that include adequate communication skills to persuade parents and friends to make healthy food choices, refusal skills to social pressures in the adoption of unhealthy eating practices, advocacy skills to present messages of healthy nutrition to others and gain support influential adults, ability to make appropriate decisions towards nutritious snacks and critical thinking skills to recognize aggressive marketing and evaluate nutritional claims in advertising and news stories (WHO, 2003b).

2.6.2. School environment

2.6.2.1. School Meals

Globally, childhood health and well-being is an important topic of interest. For instance, recent data from the 2004 Canadian Community Health Survey (CCHS) indicated that 70% of children aged 4 to 8 were not meeting the minimum daily servings of fruit and vegetables, and that 37% of children aged 4 to 9 were not having the two recommended daily servings of milk products, all while the consumption of processed foods increased (HEALTH CANADA, 1999). It is now recognized that individual factors of personal food choice such as taste preferences, physiological state, or nutritional knowledge are only a small piece of the puzzle when it comes to understanding and explaining people's eating behaviors (MINISTER OF PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, 1997). The 'food environment' is gaining more attention as numerous agencies including the World Health Organization, Institute of Medicine, and Centers for Disease Control have acknowledged that environmental and policy interventions are the most hopeful strategies for creating significant improvements in the population's eating, physical activity, and health status (CENTERS FOR DISEASE CONTROL AND PREVENTION, 1996).

Throughout the European school system, different provisions of school meals exist. Lunch must be provided daily in schools in Finland, France, Sweden and the UK, whereas in Austria, Ireland and Norway individual schools choose whether to offer lunch or not (CENTERS FOR DISEASE CONTROL AND PREVENTION, 1996). For example, in Scotland, hot school meals are provided daily on school days while in Denmark, Greece and the Netherlands students carry a packed lunch from home (DIXEY et al., 1999).

School meal services do not always have a good reputation among parents, the general public or pupils. The two most common complaints are attributed to long queues and cramped, overcrowded dining areas (HOBBS et al., 2004, LEHOTA et al., 2015). Unfriendly eating environments have major consequences on eating behaviour. Plate waste increases drastically, in overcrowded (KJØRSTAD, 2005) and noisy (SANCHEZ and CONTRERAS, 2003) lunchrooms. In addition to direct economic loss, children may not fully benefit from all the nutrients offered (GUTHRIE and BUZBY, 2002) or the food. Also, pupils who have not fed well at lunchtime are encouraged to consume unhealthy snacks or fast food.

According to EDWARDS (2000), a handicap concerning public meals is that they are eaten by necessity and are characterized by a lack of personal choice. Traditionally, public meals are regarded as second-class consisting of heavy food served by unprofessional and uninspired staff in

poor surroundings (LUNDMARK'S, 2002). Ideally, public meals are intended to nourish and refuel its consumers, a contrast to the commercial sector, where the paying customer eats out for pleasure as a social event or eats out at work for business reasons. Additionally, a review by POPPENDIECK (2014) reports that school meals are often associated with boring and disgusting food as well as with a noisy meal environment.

CARDELLO, BELL and CRAMER (1996) showed in a series of studies the negative attitude people have toward institutional foods, classified as stereotypes. Edwards et al. (2003) further demonstrated the acceptability of identically prepared foods varied against eating location and found that expensive restaurants received higher scores than institutional settings. These negative preconceived ideas towards institutional meals constitute a phenomenon labeled “Institutional stereotyping“(EDWARDS & HARTWELL, 2002, LEHOTA et al., 2015). Factors causing negative attitudes towards institutional foods are probably lack of variety, food presentation and physical dining setting supported by the media as a contributing source to negative attitudes (CARDELLO et al., 1996). Hence, institutional foodservices should address the causes and solutions to these attitudes rather than try to improve the quality of foods, which may already be good.

Limited financing, a problem that affects the quality meals poses a challenge to institutions. When looking at the quality of meals there are several aspects that need to be included. LUNDMARK al.,(2002) created a model of meal quality consisting of a pyramid divided into three parts: *base quality*, including energy/nutrients, hygiene and sensory aspects at the bottom, *added value*, including service and surroundings/settings in the middle and the *golden edge*, signifying general good characteristics of the meal, at the top of the pyramid. The whole pyramid has to be taken into account to create a positive meal experience. LUNDMARK (2003), further states that in Sweden, only the base of the pyramid has traditionally been considered in relation to the school meal, with the special focus being on nutrition. The present guidelines for school meals still have a major focus on nutrition, although other aspects are now also included (ENGHARDT et al., 2007).

There are major concerns with the short time available for meals in many schools. The Partnership to Promote Healthy Eating in Schools formulated by the USDA, found that providing enough time for pupils to choose meals and socialize with friends was important for the development of healthy eating habits (MEYER et al., 2002). Studies in Wales have indicated that children have an average of 3–18 seconds to choose lunchtime meals (FAIRCHILD and COLLINS, 2011). Lunch breaks provide an interval in the daily routine and allow students to return to class refreshed (CONKLIN et al., 2005). Children want to use lunch breaks for play and physical activity, but long queues and

poor service reduce the available time, leading to skipping lunch or buying unhealthy food outside the school. To enjoy their lunch in a relaxed and social atmosphere, schools should permit pupils at least twenty minutes eating time after they arrive at the table with food (CONKLIN et al., 2005). According to the MEYER et al., (2002), healthy school meals eaten in a friendly atmosphere can grant children from underprivileged families an assurance of at least one balanced meal per day. Such children also have an opportunity to learn how to enjoy food, eating, practice healthy eating behaviour, experiment with new foods and to practice social skills.

2.6.2.2. School canteens / Tuck shops / Vending Machines

School canteens, tuck shops, and vending machines have been criticized for promoting unhealthy snack foods and soft drinks, characterized as low nutrient, high calorie foods, often available to children and adolescents during lesson breaks (HARNACK et al., 1999). Soft drinks provide empty calories and are ultimately, the primary source of added sugar in children's and adolescent's daily energy intake (JAMES et al., 2004, NESTLE, 2002). For Instance, when a child drinks one regular (265 ml) carbonated drink/day; she/he ingests about 10% more total energy than a non-consumer (LUDWIG et al., 2001). These researchers further suggest that canteens can attract students using carefully planned menus with a variety of healthy and attractive foods. Additionally, such menus should offer several items that remain the same to students, with variety provided by specials for sale only at specific times, or selected days of the week. Fruits that are in season should always be available, whole or cut into appropriate sized pieces (TÓTH et al., 2017).

Though it is very difficult for schools to avoid canteens, tuck shops or vending machines stocked with high-sugar or high-fat products, they could stock healthier options like water, milks, juices and low-fat snacks (HARVEY, 2004). A study by (HARVEY, 2004) investigated the economic viability of selling healthier drinks such as bottled water, pure juices, flavoured milk and semi-skimmed milk from vending machines in 12 schools. The nine schools that completed the project demonstrated that children bought a range of healthier products from vending machines when available even though they were not the usual brand products.

Children are more likely to gain excess weight consume large quantities of drinks rich in sugar (RABEN et al., 2002). Unfortunately, soft drinks have replaced milk and could possibly lead to calcium deficiency, with the accompanied risk of osteoporosis and fractures, in adulthood. In addition, soft drinks pose a risk of dental caries due to their high sugar content as well as enamel erosion because of their acidity as they are also the single greatest source of caffeine in child's diet

(MOYNIHAN and PETERSEN, 2004). Hence, vending machines containing soft and fruit flavored drinks should not be allowed for young children in schools.

In Seychelles because a majority of the students attending school do not have breakfast every day, the high fat and sugar snacks that most of them eat mid morning from the tuck shops are often the first foods they consume every day(FANZO et al., 2018). It is therefore necessary that the school tuck shop sells healthier food choices. Children should be supplied with a good mix of foods that will provide sufficient amount of nutrients to satisfy their nutritional requirements (STETTLER et al., 2002). Having healthy tuck shops on school premises provides a good reason to encourage children to buy healthier snacks in the tuck shops rather than at shops on the way to school. Healthier snacks taken from home should not be discouraged as they can also be a useful way of ensuring that children choose the right options (FANZO et al., 2018).

According to the BOVET et al., (2008), school tuck shop should ensure that children are aware of the importance of making good food choices through relevant nutrition education, classroom activities and IEC materials, have access and availability to healthy snacks in the tick shop and entire school by having set service times and adequate number of tuck shops (TÓTH et al., 2017). Third, is the controlled accessibility and quality of snacks available, where by maximum of two tuck shops per school is allowed and lastly, that the snacks should be available. Guidelines for school tuck shops by NSNP (2008) further state that tuck shops in Seychelles should have foods of high nutritional value (vegetable, meat, fish, egg and milk based foods such as cheese and yogurt based foods), moderate nutritional value and low nutritional value foods.

2.6.2.3. School facilities (Kitchen, and Service)

Cafeteria and lunch room settings influence children's eating behavior related to factors such as the display and description of food and beverages, pricing and methods of payment, and the time of day and length of time made available to eat (NESTLE and MARION, 2002;DUNAYet al., 2015). Studies have shown that these factors can promote healthy food choices. The arrangement of some schools' meal service may discourage low-income children, from taking advantage of school meals, hence undermining the impact of improvements in the nutritional quality of those meals (NESTLE and MARION, 2002). For example, one survey found that one-third of high schools had separate lines or rooms for the school lunch program and competitive foods (HEALTH CANADA, 1999). In such schools, most students standing in the lunch line were low income. Marketing of food and beverages within schools has also grown substantially in recent years, and may influence food

choices in ways that do not contribute to good health. School facilities are considered a major determinant of the food and beverages offered to students. Descriptions of school food facilities, including storage, preparation, service and dining space, as well as available equipment (fridges, freezers, stoves, microwaves) varied significantly among those interviewed (RUSSELL et al.,2003). The description of facilities ranged from full-service, contracted cafeterias providing a large variety of food items to the absence of on-site facilities, necessitating that food be brought in daily from local fast-food or family-style restaurants. The logistics of serving food within older school facilities (the lack of dedicated space for storage, preparation and delivery) designed at a time when most children returned home for lunch (RUSSELL et al., 2003; DUNAY et al., 2015). In contrast, newer schools built with food services and dining areas were described as comparatively better equipped to offer a variety of healthy options. In some cases newly- built food services failed to meet the present space requirements of the student population. The lack of dining space for students was mentioned as a particularly troublesome issue. Many schools had been forced to split their lunch periods, which often resulted in very little time for students to eat (10 or 15 minutes in some cases) (L.MACDONALD, 2003).

According to (RUSSELL et al., 2003), in Canada, School food facilities were bound by guidelines for provincial commercial food service establishments. Many of the schools admitted to not having proper commercial equipment and facilities required to serve food. Schools that had been inspected and directed to upgrade their spaces to meet the terms of food safety and service regulations often were not able to comply or had to fund-raise in order to do so (WHO, 2016). School board program directors confirmed that school boards were not allocated funds for school food service facilities or equipment.

2.6.2.4. Access to water

Water is an essential nutrient, and drinking water has been shown to improve students' readiness to learn by increasing hydration and cognitive function (EDMONDS and JEFFES, 2009). Encouraging water consumption may reduce consumption of sugar-sweetened beverages (SSBs) such as sodas and help limit excess weight gain. School policies and programs should play an important role in water consumption among children and adolescents because children spend most of their day at school (STORY et al., 2009). Making drinking water available in schools provides a healthy alternative to the SSBs that are widely available in various schools. Unfortunately, free drinking water is not always readily accessible in schools, inhibiting barriers may include concerns such safety and quality of drinking water.

An example of water supplied to school children can be depicted by the action of the Welsh government. In its school policy this government encourages schools to provide a constant supply of drinking water, free of charge, on the premises of any functional school. Schools are advised to facilitate easy access of fresh drinking water particularly during breakfast sessions and lunchtimes (TABER et al., 2013). Mineral water both still carbonated is permitted under the Healthy Eating Regulations. However, water with added sweeteners, sugars, honey, coloring or flavoring is not permitted. Schools are also required to post signs at water stations throughout the school, provide younger children with a cup or glass of water or allow children to carry water bottles (LEHOTA et al., 2015, GUIDANCE ON WATER IN SCHOOLS, 2016). Where water bottles are used, schools should ensure dining room supervisors lead children to available water sources at lunchtime, promote water availability throughout the school, enhance pupil's awareness that taps in toilet areas are not an appropriate source of drinking water, allow pupils to drink water freely throughout the day by promoting water on desks (GUIDANCE ON WATER IN SCHOOLS, 2016; DUNAY et al., 2015)

2.6.3. School nutrition and health services (Core action group)

2.6.3.1. Parents

Children are known to emulate their parents, especially when it comes to food consumption (HAINES et al., 2019). To have a lasting effect on pupils' health, parents and care givers must be involved in school-based initiatives targeted at food and nutrition. According to MÜLLER et al. (2001) prevention of obesity in children (KOPS), considerable improvements in health-related behaviors after a combined school and family-based intervention performed better than an exclusive school based intervention. Including parents in school food and nutrition programs is beneficial for several reasons. Children need backing from their parents to implement nutrition knowledge learnt in school. Changes in positive eating behaviour last longer if interventions are aimed at family attitudes and habits rather than individuals alone. Furthermore, parents can also benefit from the information to improve their own health and nutrition behaviour (CROCKETT et al., 1988). The effectiveness of programs enhanced by parental involvement in enhanced in effectiveness of programs by stimulating awareness about food and nutrition so that the variety in the diet and the availability of healthy foods at home can be increased (PEREZ and ARANCETA, 2001).

WHO (2013), recommends the development of interventions that provide information to parents concerning meal content, size and timing as well as details about the potentially damaging

influence of coercive feeding practices. As, attitudes about food are embedded within a complex set of emotions removed from hunger and satiety, and the use of food to bribe children may detach food further from the hunger response and may promote an unhealthy relationship with eating. It further emphasizes that it should be explained how children learn and tend to be copy their parents healthy eating habits is crucial, hence providing a good role model and good examples of healthy eating may be more effective in forming healthy eating habits in children.

2.6.3.3. School caterer/ Food handlers

According to TÓTH et al., (2014), School catering service is nowadays by far in the centre of interest all over the world. The effect of catering services on health is determined not only by the quality of raw materials but also by the appropriate environment, technology and practice of food handling and consuming. Food intolerance and food allergy affecting more and more children and the growing number of food-borne diseases claims for an increased attention from the actors involved in the sector(ILLÉS et al., 2018). Development of food-borne illnesses is significant and may have determining consequences in public health and economy. The rapidly changing world of food preparation and food consumption, coupled with the introduction of new technologies, new equipment and services such as; cook-chill, sous-vide, take a ways and home deliveries, means that a larger number of people could simultaneously be exposed to toxic or hazardous foods (SZEITZNEÉ et al.,2005, ILLÉS et al., 2018). One such development is mass catering, commonly used in school catering, has a major influence on the safety of the end products, as large varieties of raw materials are used, various methods of food storage and preparation and microbial load could easily lead to food borne outbreaks that would impact severely due to the huge number of consumers exposed (SZEITZNEÉ et al., 2005)

According to food and nutrition in HERNANDEZ et al., (2015), there are serious concerns about the lack of food safety, nutrition knowledge and training of school food service staff. Such School-based staff or volunteers have very little in terms of formal training in nutrition, menu-planning or safe food handling. Most staff employed by contracted food services have no safe food handling training at a minimum as most school boards do not fund food handlers training for school staff and volunteers (SIBANYONIET al., 2017, ILLÉS et al., 2018). Therefore, a number of informants were concerned about liability issues for food service staff and volunteers. While it is also common to find that most school caterer operated without liability Insurance by the inability to pay food service staff adequately for their work done due to a lack of funds. Because, school boards, schools nor individuals can ill afford the annual fees for personal liability insurance required of paid food

service workers in the school setting, many operated without it (NOVA SCOTIA, 2015). This placed individuals and schools in potential legal jeopardy by the inability to pay food service staff adequately for the work done due to a lack of funds distressed a majority of the caterers (GIRITLIOGLU et al., 2010).

Significant threats to health and nutrition status are posed during the consumption of poisonous or unsafe foods. This is experienced especially with vulnerable groups such like school children. Often, school feeding programs adopt the risk and content approach which are commonly in line with various countries' food and safety regulations (GIRITLIOGLU et al., 2010, TÓTH et al., 2014). Despite these, various school feeding policies are asked to embrace the internationally agreed standards CODEX Alimentarius (FAO, 2018d). "The core actors" at the school levels are ones tasked with duty of ensuring that the relevant departments adequately manage factors that contribute to food hygiene and safety. Hurdles such as insufficient allocation of resources, inadequate legal framework, insufficient control processes, lack of appropriate infrastructure and equipment, inadequate capacity development of relevant actors at different levels (food service staff, volunteer cooks, parents, directors, greatly hamper, low and middle level income countries by posing as challenges and prevent proper implementation of policy, (SIBANYONIET al., 2017).

2.6.4. Knowledge, Attitude and Practice Model

Focused on disseminating information, the KAP model remains a favorite choice when using traditional methods of training, despite the more appreciated theory based training programs that are believed to yield better results (BITTSÁNSZKY et al., 2015). According to RENNIE,(1995), knowledge is dependent on individual behaviour and performance and the provision of knowledge will directly lead to a change in attitude and practice. Equipping individuals with knowledge through education and training is key in its dissemination. However, It is not given that it will necessarily translate to knowledge, for instance in food handling (CLAYTON & GRIFFITH, 2008). It is paramount that research is carried out to affirm food handlers' knowledge levels concerning safe food handling practices and practices that take place in the work environment, so as to best equip them with adequate skill that will assist in the prevention of food borne diseases, as inadequate knowledge of a food handler greatly contributes to the prevalence of food borne diseases (WHO, 2000)

2.6.4.1. Knowledge and Practice of the Food Handlers

A significant role in food contamination has been attributed to human handling error by food handlers, such as school cooks and cateresses, who are responsible for numerous outbreaks of food poisoning (COMPOS et al 2009, BITTSÁNSZKY et al., 2015). Foods have a higher chance of being mishandled and contaminated during preparation, processing or storage than during consumption (MEDERIOS et al., 2001). Various authors acknowledge that, knowledge transfer, or adequate training, bridges the gap between theoretical requirements and the actual practice of health, safety and sanitation.

A study conducted by MARTINS et al., (2012) strongly recommended hands on training, as a form of employee knowledge acquisition, on matters relating to health and sanitation. This was after carrying out a cross sectional study on 102 food handlers on critical food safety areas such as temperature control, personal hygiene, surface and utensil hygiene, contamination/ high risk foods and food storage. It was found that temperature control scores were extremely lower than the average score of the entire questionnaire ($p < 0.001$). The discovery was alarming as proper or adequate temperature holding is significant in controlling microbial growth in food, severely improper holding temperatures have been linked to food borne disease outbreak (JAY, LOESSNER, & GOLDEN, 2005). Similar results were also revealed on food handlers' knowledge on contamination/ high risk foods, as food handlers identified organoleptic means as an identifier of contamination in food. On the other hand, the food handler scores highly on surface and utensils hygiene and food storage.

According to (WANDOLO et al., 2001), Knowledge imparted on food handlers is not sufficient to foster positive attitude and safe behaviour; attitude is also a vital aspect that could not be ignored if food borne illnesses were to be eliminated. A similar view was shared by FLICKET al., (2008), who after carrying out a study concluded that there existed a significant relationship between positive behaviour (attitude) and continued education of food handlers towards the sustenance of food safety handling. Similarly, RICHARDSON and STEVENS (2003), after carrying out studies in England, on ready to eat foods in retails, confirmed that, there was a great possibility of contamination of food by infectious discharges, respiratory drippings, pus and infected extracts, if members of staff practiced poor personal hygiene. These allegations demonstrated that food handlers were the major source of contamination either through poor hygiene practices or carrier of pathogens The study further concluded that it is essential for the staff to revisit their basic hygiene

principles to prevent the contamination of food, water supply and equipment used during the processing of food.

A study conducted by JIANU and CHIS (2012), concluded, that there was a need to retrain food handlers using different training programs from the commonly used, knowledge based training programs that were used to train food handlers. This was after conducting a cross sectional study on the knowledge levels of food handler in Romanian small and medium sized companies, the study was geared towards obtaining their levels of knowledge on aspects such as, cross contamination, food poisoning, and personal hygiene. The study included a range of industries such as catering, dairy, retail traders and baking, in total 211 participants who particularly had implemented HACCP systems. It was found that there was no significant difference in knowledge levels based on age, gender and professional experience, despite there being a significant difference between educational levels and the greater scores achieved. Production staff portrayed higher levels of knowledge on aspect such personal hygiene, cross contamination, food poisoning, and time temperature control.

2.6.4.2. Training on food safety and hygiene practices

Food handlers play a vital link in the chain from kitchen to fork, hence permitting to either provide consumers with safe tasty foods or be a source of compromised contaminated foods, (DUDEJA, 2018). Food handlers are a major link of transfer of microorganisms to food, as they can unknowingly transfer pathogens from their bodies, body secretions and fluids to food while cooking. In addition to this, common mistakes such as inadequate cooking, inappropriate heating and reheating of food, coupled with inappropriate storage behaviours, makes untrained food handlers a lethal weapon in the kitchen and an enabler of food born diseases, (AL-KANDARI, 2019). According to WHO, (2007) training of food handlers is one of the most indispensable interventions in the prevention of food borne diseases. Not only does education and training allow the trainee to be informed but also be able to perform given tasks effectively and with understanding.

Regrettably, many at times food hygiene training rarely translates in to positive food handling behaviour (GREEN et al., 2007). Food handling activities require long term positive behaviour; it is a necessity to include reinforcement messages and such like techniques to encourage continuous participation (TONES et al., 1990). In order to make food hygiene education more effective and offer better outcomes, keen interests have to be considered on various stages in the training process

such as the evaluation stages, managerial components and overall performance measurements (SEAMAN, 2009). The evaluation stage includes first the (training needs assessment), where by businesses should keep record of their employees' capabilities and training requirement, which in turn will assist ensure employee are trained for their duties are work practice(BILLSBOROUGH, 1999).

Second is the evaluation stage, also as knowledge testing, where the food handlers are assessed on the how much knowledge they managed to retain after training. Deficiencies in knowledge should be brought to the attention of the food handlers so that necessary actions such as extra teaching are done to ensure compliance with training (KIRKPATRICKET al., 1967). Lastly, evaluation of training programs, where the food handlers assess particular training programs, with regards to how beneficial and relevant they were in meeting their needs (WORSFOLD et al., 2004).

Furthermore, the overall performance measure further accesses the effect of the food hygiene training on both the employee and the organisation. The organizational impact of food hygiene training can be measured through various ways such as, environmental health inspection report and a consumer satisfaction survey. After extensive studies WORSFOLD et al., (2004), affirmed that the factors that that influence the type of food hygiene training included convenience and financial costs. Majority of the training that was provided was due to legal obligation. The effectiveness of training has been shown to predicted by the relevance of the course chosen (BALDWIN and FORD, 1988). A rise in doubts, suitability, irrelevance and perceived usefulness of an accredited course, in food hygiene results in the devaluing of the training (WORSFOLD et al., 2004). Food hygiene course should be short in nature and consumer oriented hence, focusing on the needs of the user. To better pass on skills to the user, food and hygiene courses should be provided in adequate physical and social environments that support the application of appropriate food handling behavior

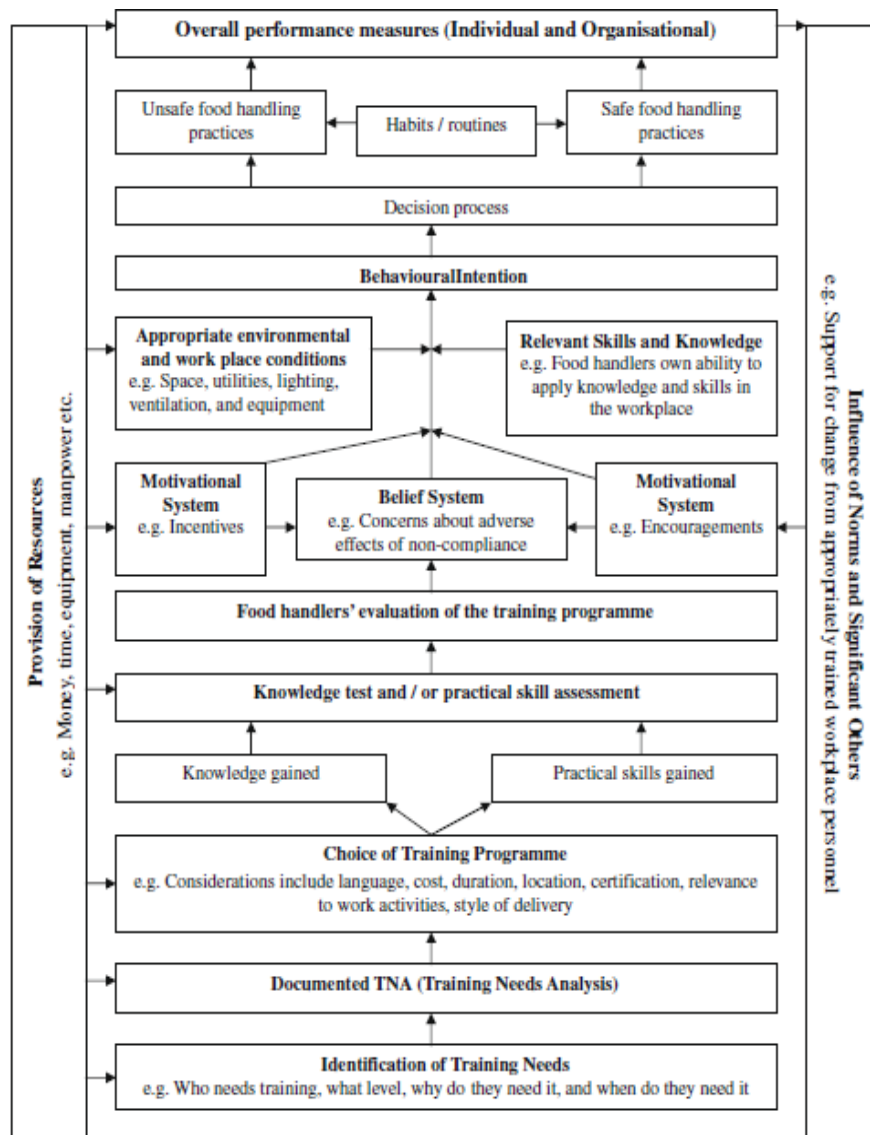


Figure 3: Food Hygiene Training model

Source: Seaman, (2009, p. 381)

It is vital that all school personnel are trained in the principles of healthy eating to allow for the effective implementation of the school nutrition policy, such training must provide basic knowledge of nutrition combined with instructional techniques and strategies designed to promote healthy eating habits (WORSFOLD et al., 2004). All school catering and dining room supervisory staff should receive appropriate training to ensure effective management of the school tuck shops and the school dining room. All teachers being trained at the NIE should receive appropriate training in basic nutrition, all in line with the SDG. Personnel responsible for nutrition education through the PSE curriculum should also be continually trained to effectively deliver the nutrition education as planned (NATIONAL SCHOOL and NUTRITION POLICY, 2008)

2.7. Theoretical frame work

2.7.1. Social Ecological Model

The major focus for this study is to evaluate the impact of lack of adequate policies governing school feeding in Kenya on the health of High school going adolescents. The study tends to be multi-faceted as it touches on various groups of people associated with the day to day running of a school as an institution, such as teachers, parents, school caterers, the community, the school administration, and other aspects such as the school environment. This analogy can be best explained by the Social Ecological theory. The Social Ecological theory is a theory-based framework for understanding the multifaceted and interactive effects of personal and environmental factors that determine behaviors, and for identifying behavioral and organizational leverage points and intermediaries for health promotion within organizations. The Social Ecological Model is made five nested hierarchical levels which include: Individual, interpersonal, community, organizational, and policy/enabling environment as shown the figure below.



Figure 4: The Social Ecological Model

Source: Center for Diseases Control, (2017, p. 23)

The first nest entails, individuals, Characteristics of an individual that influence behaviour change, including knowledge, attitudes, behavior, self-efficacy, developmental history, gender, age,

religious identity, racial/ethnic identity, sexual orientation, economic status, financial resources, values, goals, expectations, literacy, stigma, and others. Second nest is made up of Interpersonal, which is Formal (and informal) social networks and social support systems that can influence individual behaviours, including family, friends, peers, co-workers, religious networks, customs or traditions. Third is the Community, it's the Formal (and informal) social networks and social support systems that can influence individual behaviours, including family, friends, peers, co-workers, religious networks, customs or traditions. Fourth the organisation, Organizations or social institutions with rules and regulations for operations that affect how, or how well, for example, MNCH services are provided to an individual or group. Lastly policy/ enabling environment local, state, national and global laws and policies

The theory is ideal for the study whereby Since individuals exist in a social ecological system, changing individual-level behaviors and creating new social norms requires creating an enabling environment, that is, facilitating change and removing bottlenecks that inhibit change at the household, community, organizational, and policy levels. For instance, in order for adolescents to consume healthier and more nutritious meals in schools, parents and care givers must understand why it is important for their children to consume healthier, and be motivated to seek and demand for healthier eating conditions for their children. Parents and care givers should have avenues to state their concerns such as social networks and social support systems, the school administrations, teachers, caterers and famers must receive adequate training, and be in an enabled school environment to facilitate healthier food consumption to school going children and adolescents. The community must embrace and own the importance of healthy eating, demand healthy environments in schools and create social norms around healthy eating

2.8. Conceptual Framework

Figure 5 shows the conceptual framework adopted from Sustain 2005, but modified to suit the study, the conceptual; frame work portrays the multi faceted nature of the study as it touches on various groups of people associated with the day to day running of schools as institutions, such as teachers, parents, school caterers, the community, the school administration, and other aspects such as the school environment. The conceptual frame work is made of four independent variables which include; The Core Action Group, Community Collaboration, Nutrition Education, and The School Environment. It also includes one dependant variable which is Healthy school environment.

The core action group contains parties relevant to the provision of healthy services to school going adolescents they include; Teachers, Caterers, Pupils, Schools administration, and Governing bodies. The Nutritional educational variable contains the educative aspect where by students are not only educated on the importance and need of healthy food consumption but also acquire lifelong skills such as assessing the nutrient content of various foods and cooking skills to ensure a life of healthy food consumptions. The school environment variable contains the facilities that are vital in allowing health food consumption in schools, they include; Access to Water, School Canteens, Dinning facilities and food serving equipment and School Meals. Lastly, the Community Collaboration variable contains aspects of external influence to schools such as the local retailers, parents and care givers and health professionals.

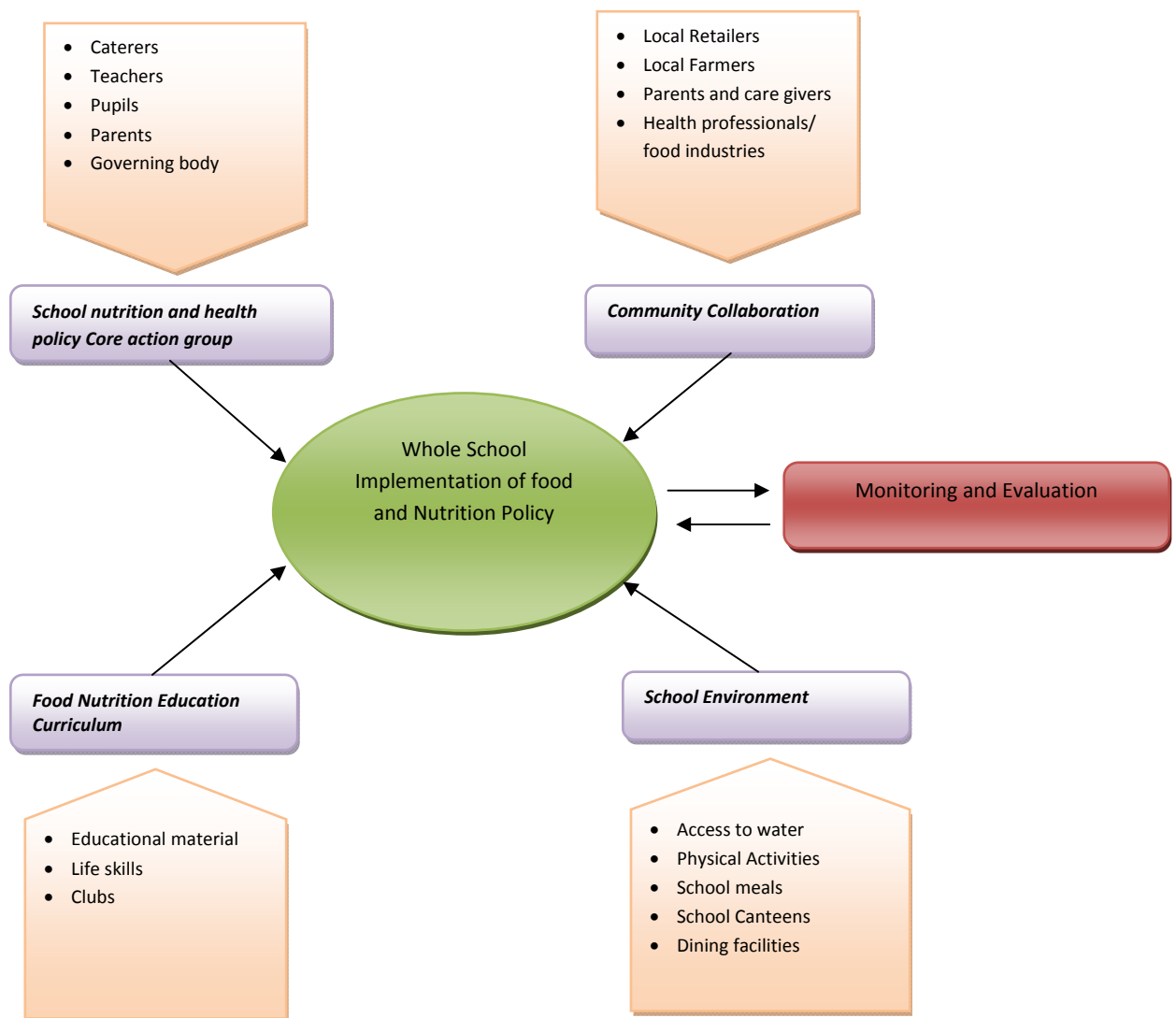


Figure 5: Food and nutrition policy for schools

Source: Adapted from W.H.O, 2006 and Modified

3. MATERIALS AND METHODS

3.1. Study Area

Kenya lies on both sides of the equator on the east coast of Africa. It borders Somalia, Ethiopia and Sudan to the north, Uganda to the west, Tanzania to the south and the Indian Ocean to the east. Its population is estimated at about 46 million (estimated in 2019); with approximately 10 million people living in the urban areas, population growth rate is estimated at 2.6% per annum. The country Kenya boasts of a wide array of learning institutions such as universities and tertiary colleges and over of 8,500 high schools country wide, admitting over 2 million students annually country wide.

Out of the 47 counties found in country, 9 counties were chosen for the study. They included, first, Uasin Gishu County which is situated in the mid west of Kenya's Rift Valley and shares common borders with counties such as Trans Nzoia County to the North and Elgeyo Marakwet County to the East (NDIVO, 2020), it is estimated to have a population of 1.2 million and about 158 high schools. Second was Kisumu County, also known as the third largest city in the country and home to a population of 968,909 people. It is adjacent to the largest fresh water body in Africa, Lake Victoria; additionally it enjoys a wide array of education institutions including 173 high schools (NDIVO, OKECH, 2020). Third was Nandi County, which is situated in the heart of the Kenyan highlands, and home to a population of 800,000 residences. Furthermore, it boasts of decent number of learning institutions particularly, 155 high schools (OGUTU, 2014). Fourth County was Elgeyo Marakwet which is located at the edge of Kerio valley with stunning views of the rift valley, Kerio valley National reserve and the scenic Cherengany hills (NDIVO, Okech, 2020). It is home to close to 500,000 thousand people and 75 high schools (OGUTU, 2014).

Fifth County chosen for the study was Kakamega County, famous for the equatorial rain forests in the country, the weeping stone and age old tradition of bull fighting. It boasts of a population of over 200,000 residents and 145 high schools (OGUTU, 2014). Sixth is the county of Nairobi which also host to the capital city. Known as the financial and economic hub for the larger east Africa region Nairobi is home to a population of over 3 million individuals, and has a wide array of learning institution ranging from universities to basic education institutions Primaries and high schools (OKECH, 2020). The seventh county was of Nakuru, the fourth largest urban center in the country with a population estimated to be 1.6 million inhabitants. It is famous for Lake Nakuru and the countless birds that inhabit the lake; additionally it has 334 high schools. Lastly Likiep County

was also chosen for the study, it is the 25th largest county in the country in terms of land mass and home to 96 high schools (OGUTU, 2014)

3.2. Research Design

The study employed a descriptive cross sectional survey design, as it allowed the researcher to examine various cohorts of a population who differ in various key characteristics at a specific point in time (CHERRY, 2018). It also allowed respondents to give their opinions and perceptions on the development and implementation of policy to ensure food safety and health food consumption in Kenyan high schools, as the researcher collected data from members of a sample population from selected secondary schools in various counties in Kenya.

3.3. Target Population

The target population comprised of School Administrations, pupils, School cooks and cateresses, in various counties in Kenya. These counties included; Nairobi, Uasin Gishu, Kakamega, Kisumu, Nandi, Nakuru, Laikipia and Elgeyo Marakwet. Additionally, various categories of schools were considered were appropriate, these included of both private and the public secondary schools. For public school the study considered the four sub categories of schools, National, Extra county, County and Sub County secondary schools. The chosen target populations were vital for this study as they were the key determinants of a safe and healthy food environment in schools. According to the BASIC EDUCATION STATISTICS, (2014), Nairobi has a total of 774 high Schools, Uasin Gishu a total of 158 high schools, Kisumu 173 high schools, Nandi 155 high schools, Elgeyo Marakwet 75 high schools, Kakamega 145 high schools, Nakuru 334 high schools and Likipia 96 high schools. These schools enroll an average of more than 482,000 students annually (MINISTRY OF EDUCATION, 2014). These figures will serve as the target population for the study.

3.4. Sampling Procedure

According to WEGNER (2010) sampling is the process of selecting a representative subset of observation from a population to determine the characteristics of the random variable under the study. Several sample designs were used for the study; Stratified sampling technique was used by the researcher to classify the various categories of secondary schools especially public schools, into National, Extra County, County and Sub County Secondary Schools. Purposive Judgmental sampling technique was used by the researcher to select particular High schools in various counties

in Kenya. This was done based on the researcher's knowledge of the various secondary schools in various counties. Finally, systematic random sampling technique was used to select particular respondents in various secondary schools.

3.5. Sample Distribution

A sample should be drawn from the target population total which is estimated at 2,955. The sample size will be determined by using a formula proposed by MUGENDA and MUGENDA (2003)

$$n = \frac{Z^2 p (1-p)}{d^2}$$

Where:

n = the desired sample size.

Z = the z score at the required confidence level = 0.05 ($Z= 1.96$).

P = the proportion in the target population estimated to have characteristics being measured.

d = permissible marginal error (the level of statistical significance set at 0.005)

$$n = \frac{(1.96)^2 \times 0.5 (1-0.5)}{0.05^2}$$

$$n = 384$$

To get a large sample size (relative to the size of the target population), this value can be doubled to get a sample size of 768 ($384 \times 2= 768$)

According to KOTHARI, (2004), the researcher should usually follow the method of proportional allocation under the sizes of the samples from the different strata keeping them proportional to the sizes of the strata. That is, if P_i represents the proportion of population included in stratum i , and n represents the total sample size, the number of elements selected from stratum i is $n \cdot P_i$. We specify the sample of size to be drawn from the population of size N which is divided into strata of different sizes. Adopting proportional allocation, the researcher got the sample sizes as under for the different strata

Table 6: Distribution of Samples

| School Categories | Number of schools | Head Teachers | Pupils | School Caterers | Head Caterer | Total |
|--------------------------|--------------------------|----------------------|---------------|------------------------|---------------------|--------------|
| Private Schools | 4 | 2 | 30 | 6 | 1 | 36 |
| Public Schools | | | | | | |
| National Schools | 4 | 2 | 30 | 6 | 1 | 36 |
| Extra County Schools | 4 | 2 | 30 | 6 | 1 | 36 |
| County Schools | 4 | 2 | 30 | 6 | 1 | 36 |
| Sub County Schools | 4 | 2 | 30 | 6 | 1 | 36 |
| Total | 20 | 40 | 600 | 120 | 20 | 780 |

Source: Author's Own Compilation

3.6. Data Types and Sources

This research study were obtained from two types of data sources, primary and secondary data. Primary data was collected by the use of questionnaires, while secondary data was gathered from a variety of sources including an analysis of archival material, evaluation of original and existing case studies, reviewing websites, books and journals, The Kenya Food Composition Tables, All with regards to policy implementation as a way of ensuring health in Kenyan schools

3.6.1. Questionnaires

Questionnaires are a collection of items to which a respondent is expected to react to usually in writing (KOTHARI, 2004). The questionnaire were self administered and in some cases the questionnaire were researcher administered, especially in situations where respondents did not understand what was required of them. Questionnaires were both structured (closed-ended) and unstructured (open-ended) Data collected was directly obtained from the respondents and will represent the respondent's perception. Closed-ended questions in the questionnaire will be used to

standardize qualify responses from the research. Open-ended questions in the questionnaire were used to ensure that in-depth responses of the respondents were taken in to account.

3.6.2. Semi- Structured Interview Schedule

Semi-structured interview schedule were used on school head teachers and principals and were based on themes highlighted in the study variables. Interview schedules were used since they allow the collection of in-depth information that would not be captured by other instruments while also increasing the reliability of the findings. Interviews will be used to capture the meanings beyond words.

3.6.3. Food Frequency Questioner

Food frequency questioners were used on the schools Cateresses, in the collection of dietary information. This information was based on the various types of foods that were offered to the students on both daily and weekly bases, the frequency in which foods were offered to student and the portion sizes of the various meals offered to students all based on the school menus. This was important as it allowed the researcher to have an in-depth view of the types of meals offered in various High schools, frequency and portion sizes served to student, in comparison to WHO set guidelines.

3.7. Validity and Reliability

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials, (MUGENDA and MUGENDA, 1999). Validity is the extent to which differences found with a measuring tool reflect true differences among the respondents being tested (KOTHARI, 2004).

3.7.1. Reliability

Reliability, which entails the accuracy and precision of the measurement procedure, was carried out using the Cronbach's alpha test. Cronbach's alpha generally increases as the inter-correlations among test items increase, and is thus known as an internal consistency estimate of reliability of test scores. Because inter-correlations among test items are maximized when all items measure the same construct, that is, the higher the coefficients, the better the measuring instrument

(ZINBARG *et al.*, 2005). Cronbach's alpha is widely believed to indirectly indicate the degree to which a set of items measures a single uni-dimensional latent construct.

3.7.2. Validity

To test for validity of the instrument, a pilot study was carried out in one of the day high schools in Eldoret town, Uasin Gishu County. This was done by researcher to verify whether the research instruments (questionnaires) were set out to collect relevant data that was suitable for the study. Additionally, it was carried out to familiarity the researcher with the research instruments, improve the clarity of the questions and enhance comprehensiveness of the respondents.

3.8. Data Analysis and Presentation

The data collected was analyzed using descriptive statistics, correlation, step-wise and multiple linear regression and T-test techniques with the help of Statistical Package of Social Sciences (SPSS) version 23. The study also employed the use Nutri survey Software, to analyze the nutrient composition of foods various meals offered to students. Minitab version 18 was used to carry out ANOVA tests on the dietary data, using Fisher's Least significant difference at 5% statistical significance. Descriptive and inferential statistics were performed. Descriptive statistics included frequencies and percentages and enabled the researcher to meaningfully describe distribution of measurements using a few indices or statistics.

4. DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

The following section provides information on data analysis and findings pertaining to food handler's knowledge, attitude and practice, school facilities and equipment that enhance food safety and health, students' food safety knowledge and practice, and an analysis on the nutritional quality of meals served to students. It focused on the demographic information of the respondents, presentation and interpretation of the findings. The presentation of findings was done based on the research questions and the hypothesis of the study.

4.1. Results Interpretation (Objective One)

Determine food handler's knowledge, attitude and practice in providing adequate food safety and sanitation services to students

4.1.1. Food Handlers Demographic Information

The background information of the food handlers lays a basic foundation on which the interpretations of the study are based. The emphasis of the background information is on their age, highest education level, years as food handler and work experience in food service. Table 7 highlights these findings.

Table 7: Food Handlers Demographic Characteristics

| Variable | | Frequency | Percent |
|--|----------------------|------------------|----------------|
| Gender | Male | 158 | 77.5 |
| | Female | 46 | 22.5 |
| | Total | 204 | 100 |
| Age | 25-35 years | 78 | 38.2 |
| | 36-45 years | 81 | 39.7 |
| | 46-55 years | 28 | 13.7 |
| | 56-65 years | 8 | 3.9 |
| | over 65 years of age | 9 | 4.4 |
| | Total | 204 | 100 |
| highest educational level | primary school level | 93 | 45.6 |
| | high school level | 96 | 47.1 |
| | college | 14 | 6.9 |
| | bachelors degree | 1 | 0.5 |
| | Total | 204 | 100 |
| Years as food handler | less than one year | 15 | 7.4 |
| | One | 34 | 16.7 |
| | Two | 16 | 7.8 |
| | Three | 16 | 7.8 |
| | Four | 123 | 60.3 |
| | Total | 204 | 100 |
| work experience in food service | Yes | 84 | 41.2 |
| | No | 120 | 58.8 |
| | Total | 204 | 100 |

Source: *Author's own compilation*

The study sought to establish demographic characteristics of the respondents. As illustrated in table 4.1, of the 204 respondents who participated in the study, a majority were men (76%), while women were only 24%. Majority 39.7% (81) were between 36 to 45 years of age, 38.2% (78) were between 25 to 35 years, 13.7% (28) were between 46 to 55 years and 3.9% (8) of them are between 56 to 65 years. Individuals in the age range of 56 to 65 years were the least represented in the study while those between 25 and 45 years were most represented.

In terms of highest level of education of the food handlers, 47.1% (96) of them have the high school level of education, 45.6% (93) primary school level of education and 0.5% (1) bachelor's degree. The results indicated that majority of the food handlers' highest level of education was primary and secondary.

With regard to experience, 16.7% (34) of the respondents had been food handlers for a year, 7.8% (16), 2 years 7.4% (15), less than a year and 7.8% (16) of them 3 years. However, 58.8% (120) confirmed that they do not have work experience in food service with only 41.2% (84) of them stating that they have work experience in food service.

4.1.2. Training of Food handlers

The study established whether the food handlers had undergone regular training on healthy food preparation, food safety and sanitation. The findings presented in table 8 indicate, 47.5% (97) of the food handlers confirmed that they had undergone training. Out of this number, 12.7% stated that they underwent training at least once every school term while 10.8% stated that they were trained at least twice. However, over half 52.5% (107) of the respondents had never undergone training hence posed a risk, to the safe delivery of hygienic foods to students.

Table 8: Training on healthy food preparation, food safety and hygiene

| | Provision of training | | | Frequency of training | |
|--------------|-----------------------|------------|--------------------------|-----------------------|-------------|
| | Frequency | Percent | | Frequency | Percent |
| Yes | 97 | 47.5 | At least once every term | 26 | 12.7 |
| | | | at least every twice | 22 | 10.8 |
| | | | Others | 49 | 24 |
| | | | Total | 97 | 47.5 |
| No | 107 | 52.5 | | | |
| Total | 204 | 100 | | | |

Source: Authors own compilation

4.1.3. Types of Trainings received by food handlers in Kenyan High schools

The study also established the various types of training food handlers had received (Table 9). Of the total number of respondents, 56.9% (116) had been trained on personal hygiene while 43.1% (88) had not. Further, 51.5% (105) of the respondents had received training on purchase procedures, 49.5% (101) on food control, whereas 50.5% (103) stated not having received any training on pest control. In addition, 52.5% (107) of the respondents confirmed they had received training on equipment cleaning procedure, 55.9% (114) on kitchen operation policies and 58.3% (119) on food safety. A further 50.5% (103) of the respondents were trained on food allergy procedure. Finally, 46.6 % (95) of the food handlers were trained on healthy cooking practices, but 53.4% (104) of them had not received such training.

Table 9: Types of training

| Trainings | | Frequency | Percent |
|------------------------------|-----|------------------|----------------|
| Personal hygiene | yes | 116 | 56.9 |
| | no | 88 | 43.1 |
| Purchase procedures | yes | 105 | 51.5 |
| | no | 93 | 48.5 |
| Pest control | yes | 101 | 49.5 |
| | no | 103 | 50.5 |
| Equipment cleaning procedure | yes | 107 | 52.5 |
| | no | 97 | 47.5 |
| Kitchen operations polices | yes | 114 | 55.9 |
| | no | 90 | 44.1 |
| Food safety training | yes | 119 | 58.3 |
| | no | 85 | 41.7 |
| Food allergy procedure | yes | 103 | 50.5 |
| | no | 101 | 49.5 |
| Healthy cooking practices | yes | 95 | 46.6 |
| | no | 109 | 53.4 |

Source: Author's own compilation

4.1.4. Knowledge on Hazard Analysis and Critical Control Points (HACCP)

The study sought to establish if the food handlers have knowledge on HACCP. From the findings in table 10, 83.3% (170) of them confirmed having no knowledge of HACCP. It is only 16.7% (34) that are aware of HACCP. This was further corroborated by the fact that 85.3% (174) of the food handlers denied the application of HACCP procedures in the various institutions they work for

Table 10: Hazard Analysis and Critical Control Points (HACCP)

| | | Frequency | Percent |
|----------------------------------|--------------|------------------|----------------|
| Food handlers knowledge on HACCP | yes | 34 | 16.7 |
| | no | 170 | 83.3 |
| | Total | 204 | 100 |
| use of HACCP program I school | yes | 30 | 14.7 |
| | no | 174 | 85.3 |
| | Total | 204 | 100 |

Source: Authors own compilation

4.1.5. Food Handler's Knowledge of food safety and sanitation

The frequencies of knowledge scores for the 3 knowledge constructs namely, transmission of food borne diseases, personal hygiene and cross contamination are highlighted in table 11. It was observed that food handlers scored highest on questions pertaining to food contamination, with a mean of 80%, closely followed by transmission of food borne diseases and finally personal hygiene

with scores of 74% and 70%, respectively. With regard to transmission of food borne diseases, food handlers were extremely certain (93%) that you could ascertain whether food was fit for consumption by smelling, tasting and looking at the food. Food handlers were also quite confident (90%) that vegetables and raw salads could be a media for transmission of harmful microbes. On the other hand, food handlers were doubtful (62%) whether food prepared too long in advance might give microbes time to grow. On the contrary, (63%) of the food handlers were not certain the HIV virus can be spread through food. Likewise, it was not certain (67%) among participants that healthy people can cause illness by carrying germs to food. Generally, the food handlers lack adequate knowledge on the transmission of food borne diseases. Specifically, lack of adequate knowledge on how cholera is transmitted, whether food that has been cooked well has germs and if HIV virus can be spread through food. The implication is that the food handlers are not well versed on food borne diseases.

With regards to food hygiene, food handlers were extremely confident on items such as, hands should be properly washed after sneezing or blowing your nose (93%), and the checking of expiry dates before using food items (90%). Nevertheless, more than half (52%) of the food handlers disagreed to the fact that wearing gloves while handling food protects food service staff from infection. Similarly, over a half (52%) of the food handlers disagreed to wearing a cap or chef's hat when touching or distributing foods to learners. Furthermore, only 37% of the food handlers disagreed to the fact that it's okay to prepare food with a wound on your hand if the wound is covered with a bandage. Moreover, 63% of the food handlers were unsure; whether hands could be washed in the kitchen sink after using the bathroom. In relation to food contamination, food handlers scored highly on knowledge items such as, foods could be contaminated with microbes by coming in to contact with unsafe foods (93%), and meat cutting boards, slicers and knives should always be sterilized after use (85%). Besides, there was doubt among 64% of the food handlers on whether ready to eat foods could be prepared on the same cutting boards that were used to prepare meat. Likewise, foods prepared with many steps increases handling and possibility of food contamination (73%)

Table 11: Food safety and sanitation Knowledge

| Variables | Description | Agree % | Disagree % | I don't know % |
|---|--|---------------------------|-------------------|-----------------------|
| Transmission of food born diseases | Well cooked foods do not have germs | 68 (139) | 32 (65) | |
| | Cholera can be spread through food | 77 (156) | 24(48) | |
| | Healthy people can cause illness by carrying germs to food | 67(137) | 33(67) | |
| | Vegetables and raw salads may be a media for transmitting harmful microbes | 90(184) | 10(20) | |
| | The HIV virus can be spread through food | 29(60) | 63(129) | 3(5) |
| | You can tell if food is unfit for consumption by smell, taste and look | 93(189) | 3(5) | 3(5) |
| | Food prepared too long in advance might give microbes time to grow | 62(126) | 40(63) | 5(10) |
| | Fresh meat always has microbes on the surface | 72(147) | 20(41) | 8(16) |
| | Food Transmission Diseases | 74 | 32 (65) | |
| Personal health and hygiene | Hands can be washed with water alone before handling raw meat | 17(35) | 80(164) | 3(5) |
| | You can prepare food with a wound on your hand if the wound is covered with a bandage | 63(128) | 37(76) | |
| | It is not necessary to wash hands so as to handle food that is already cooked | 15(31) | 85(173) | |
| | Hands should be properly washed after sneezing or blowing your nose | 93(189) | 7(15) | |
| | Wearing gloves while handling food protects food service staff from infection | 35(72) | 46(97) | 17(35) |
| | After using the bathroom, hands can be washed in the kitchen sink | 37(75) | 63(129) | |
| | you should always change your foot wear when you leave the kitchen and go out | 53(108) | 42(85) | 3(5) |
| | Do you always check the use by dates of food before using them | 90(184) | 7(15) | 3(5) |
| | Do you wear a cap or chef's hat when touching or distributing foods to learners | 48(100) | 52(104) | |
| | Does the school provide you with adequate food handling uniform | 79(162) | 21(42) | |
| | Personal Health and Hygiene | 70 | | |
| Food Contamination | Foods prepared with many steps increases handling and possibility of food contamination | 73(149) | 27(55) | |
| | Food preparation surfaces can contaminate food | 83(169) | 17(35) | |
| | Food borne diseases can result from storing raw meat and cooked foods in the same refrigerator | 82(168) | 18(36) | |
| | Ready to eat foods can be prepared on the same cutting boards that were used to prepare meat | 36(73) | 64(131) | |
| | Foods can be contaminated with microbes by coming in to contact with unsafe foods | 93(189) | 8(15) | |
| | Meat cutting boards, slicers and knives should always be sterilized after use | 85(174) | 15(30) | |
| | | Food Contamination | 80 | |

Source: Authors own compilation

4.1.6. Attitude assessment of food handler

The study sought to find out, the perception of attitude among food handlers in Kenyan schools. As highlighted in table 12, generally food handlers had a high level of positive attitude towards food safety and sanitation, which was displayed with a mean of (4.274). Food handlers strongly, found it their responsibility to offer safe hygienic foods to customers (mean = 4.640, SD = 1.101). They were overwhelmingly supportive of the opinion that hand washing before touching food decreases food poisoning (mean = 4.665, SD = 1.056) and that raw and cooked foods must be handled separately (mean = 4.695, SD =0.993). There were however doubtful weather disinfected water proof gloves could decrease food poisoning (mean = 2.552, SD = 1.827). They also expressed skepticism on the fact that only the food handling staff in a kitchen should be in charge of decreasing the risk of food poisoning (mean = 3.68, SD = 1.686)

Table 12: Attitude assessment of food handlers

| Attitude Items | Mean | Std. Deviation | Skewness | Kurtosis |
|--|--------------|-----------------------|-----------------|-----------------|
| It is important to study food hygiene Knowledge | 4.414 | 1.381 | -2.051 | 2.315 |
| It is my responsibility to offer safe hygienic foods to customers | 4.640 | 1.101 | -2.802 | 6.079 |
| Hand washing before touching food decreases food poisoning | 4.665 | 1.056 | -3.117 | 8.073 |
| raw and cooked foods must be handled separately | 4.695 | 0.993 | -3.342 | 9.695 |
| disinfected water proof gloves could decrease food poisoning | 2.552 | 1.827 | 0.482 | -1.661 |
| Food handlers should participate in food sanitation workshops as often as possible | 4.320 | 1.476 | -1.742 | 1.095 |
| Only the food handling staff in a kitchen should be in charge of decreasing the risk of food poisoning | 3.680 | 1.686 | -0.725 | -1.229 |
| Taking hygiene classes will improve my hygiene habits | 4.483 | 1.272 | -2.309 | 3.577 |
| It is my responsibility to correctly execute Good Hygiene Practices | 4.586 | 1.133 | -2.599 | 5.113 |
| Participating in food sanitation training is very important to me. | 4.345 | 1.479 | -1.835 | 1.391 |
| I think it is very important for the employee to have proper hygienic habits. | 4.631 | 1.037 | -2.895 | 7.148 |
| Food handlers attitude | 4.274 | 0.691 | -1.345 | 0.491 |

Source: *Author's own compilation*

4.1.7. Assessment of Food handler's behavior and practice

Table 13 shows food handlers' behavior and practice towards food safety and sanitation. Essentially, food handlers' performance of food safety practices was adequate with a mean of 4.008, standard deviation 0.439, skewness -0.855 and kurtosis 0.952. The respondents scored highly on items such as, performance of at least one health check every year (mean = 4.652, SD =

0.932) and, food handler's dispose of any moldy food (mean = 4.750, SD = 0.916). There were however doubts on whether they utilized the three sinks method to wash dishes (mean = 2.848, SD = 1.748). Less than half of the /food handlers used different chopping blocks to deal with the food materials (mean = 2.882, SD = 1.772). Similarly, slightly over a half of the food handlers always wore gloves in some case, they have wounds on their hand (mean = 2.907, SD = 1.916).

Table 13: Food handler's behavior and practice in Kenyan High School kitchens

| Food Practice items | Mean | Std. Dev | Skewness | Kurtosis |
|--|-------------|-----------------|-----------------|-----------------|
| First thing to do upon entering the kitchen is wash my hands. | 4.152 | 1.463 | -1.392 | 0.280 |
| I always wear my tidy uniform prior to beginning work. | 4.064 | 1.652 | -1.267 | -0.320 |
| I wash my hands when I touch the cooked food | 4.598 | 1.094 | -2.725 | 6.035 |
| I will perform at least one health check every year. | 4.652 | 0.932 | -2.793 | 6.895 |
| I don't use cooking tools to taste the food | 4.294 | 1.429 | -1.738 | 1.220 |
| If I have wounds on my hand prior to coming to the kitchen, I will wear gloves | 2.907 | 1.916 | 0.062 | -1.939 |
| I use different chopping blocks to deal with the food materials | 2.882 | 1.772 | 0.153 | -1.768 |
| I dispose of any moldy food. | 4.750 | 0.916 | -3.758 | 12.668 |
| If there are cracks on dishes, I will not use them. | 4.569 | 1.166 | -2.474 | 4.447 |
| I completely disinfect the cutter and chopping block after work every day. | 4.230 | 1.283 | -1.683 | 1.599 |

Source: Author's own compilation

4.1.8. Food Handler's demographic characteristics in relation to level of food knowledge

The analysis of variance (Anova) was conducted to determine correlation between food handlers' knowledge and food safety and hygiene. The results were highlighted in table 14. With regards to gender, in both, knowledge, of food transmission diseases and of food contamination, male food handlers were more knowledgeable compared to their female counterparts with means for the male food handlers standing out at (2.833) and (2.761) respectively while for the female stood at (2.683) and (2.633) respectively. Similarly, in both instances there was a statistically significant difference between food handlers' gender and both knowledge of food transmission diseases and food contamination, (F= 4.411, $\rho=0.037<0.05$) and (F= 19.773, $\rho=0.00<0.05$) respectively.

In relation to age, knowledge of food transmission diseases, indicated that the knowledge on food transmission diseases tended to decline with an increase in the handlers' age with those in the 25 to 35-year age bracket having more knowledge on food transmission diseases (mean = 2.930) while those over 65 years of age the lowest (mean = 2.375). In relation to personal hygiene, food handlers in the 46 to 55-year age range were more knowledgeable on personal health (mean = 2.589) while those over 65 years of age were least knowledgeable on personal health (mean = 2.4). Similarly,

food handlers over 65 years of age were more knowledgeable on food contamination (mean = 2.833) while those between 56 to 65 years were least knowledgeable on food contamination (mean = 2.5). All the constructs of knowledge, food transmission diseases ($F= 5.188, \rho=0.001<0.05$), personal health ($F= 5.188, \rho=0.001<0.05$) and food contamination ($F= 5.188, \rho=0.001<0.05$) registered a statistically significant difference with relation to age.

With regard to education, the study observed that food handlers with collage education were most knowledgeable, particularly, in food transmission diseases and personal health having registered means of (2.893) and (2.778), respectively. All constructs of knowledge, Food transmission diseases, ($F= 2.910, \rho=0.036<0.05$) Personal health ($F= 3.206, \rho=0.024<0.05$) and Food contamination ($F= 0.884, \rho=0.450>0.05$) had a statistically significant difference with relation to education. In respect to job tenure, the study revealed that the longer food handlers worked, the more knowledgeable they are. This was observed with both, Knowledge on food transmission and diseases food contamination scoring means of (2.86) and (2.79) respectively. Similarly, all constructs of knowledge in Food transmission diseases, ($F= 10.988, \rho=0.000<0.05$) Personal health ($F= 18.082, \rho=0.000<0.05$) and Food contamination ($F= 18.666, \rho=0.000<0.05$) had a statistically significant difference with relation to job tenure.

Table 14: Handler's demographic characteristics and level of food knowledge

| | | <i>Food transmission Diseases</i> | | | <i>Personal health</i> | | | <i>Food Contamination</i> | | |
|--------------------------------|--------------------|-----------------------------------|---------------|--------------|-------------------------------|---------------|--------------|-------------------------------|---------------|--------------|
| | | Descriptive statistics | ANOVA | | Descriptive statistics | ANOVA | | Descriptive statistics | ANOVA | |
| | | | Mean(SD) | F | | Sig. | Mean(SD) | | F | Sig. |
| <i>Gender</i> | Female | 2.68(0.47) | 4.411 | 0.037 | 2.51(0.14) | 0.013 | 0.911 | 2.76(0.18) | 19.773 | 0.000 |
| | Male | 2.83(0.14) | | | 2.51(0.13) | | | 2.63(0.18) | | |
| | Total | | | | | | | | | |
| <i>Age</i> | 25-35 years | 2.93(0.61) | 5.188 | 0.001 | 2.47(0.15) | 6.824 | 0.000 | 2.72(0.77) | 4.712 | 0.001 |
| | 36-45 years | 2.74(0.24) | | | 2.53(0.13) | | | 2.75(0.19) | | |
| | 46-55 years | 2.79(0.13) | | | 2.59(0.06) | | | 2.74(0.06) | | |
| | 56-65 years | 2.63(0.00) | | | 2.40(0.00) | | | 2.50(0.00) | | |
| | Above 65 | 2.38(0.00) | | | 2.40(0.00) | | | 2.83(0.00) | | |
| | Total | | | | | | | | | |
| <i>Education levels</i> | Primary | 2.71(0.20) | 2.910 | 0.036 | 2.49(0.12) | 3.206 | 0.024 | 2.74(0.18) | 0.884 | 0.450 |
| | Secondary | 2.88(0.55) | | | 2.52(0.16) | | | 2.73(0.16) | | |
| | College | 2.89(0.44) | | | 2.59(0.02) | | | 2.77(0.25) | | |
| | Degree | 2.50(0.42) | | | 2.60(0.13) | | | 2.50(0.17) | | |
| | Total | | | | | | | | | |
| <i>Experience</i> | Less than one year | 2.48(0.14) | 10.988 | 0.000 | 2.31(0.05) | 18.082 | 0.000 | 2.61(0.13) | 18.666 | 0.000 |
| | One | 3.16(0.87) | | | 2.44(0.10) | | | 2.6(0.14) | | |
| | Two | 2.83(0.14) | | | 2.63(0.06) | | | 2.59(0.11) | | |
| | Three | 2.86(0.01) | | | 2.53(0.05) | | | 2.85(0.17) | | |
| | Four | 2.72(0.19) | | | 2.53(0.14) | | | 2.79(0.16) | | |
| | Total | | | | | | | | | |

Source: Author's own compilation

4.1.9. Food handler demographic in relation to attitude

The analysis of variance (Anova) was conducted to determine average difference between food handlers' knowledge and food safety and hygiene. The results were highlighted in table 15. It was observed that in relation to age, male food handlers had a positive attitude towards food safety and hygiene (mean = 4.345) in comparison to their female counter parts (mean = 4.028). As such, there was a significant difference between handlers' gender and their attitude ($F= 7.663, \rho=0.006<0.05$). In respect to age, food handlers aged 65 and above were most positive (4.727) towards food safety and sanitation, hence proving that increase in attitude went hand in hand with the increase in age. ANOVA yielded a statistically significant difference between the handlers age and their attitude ($F= 19.161, \rho=0.00<0.05$). In terms of education level, it was revealed that there was more positive attitude among food handler with lower education levels such as at the primary level (4.458) compared to food handlers with higher education levels. Likewise, the study yielded a statistically significant difference between the food handlers' education and their attitude ($F= 6.567, \rho=0.00<0.05$). The study also observed a statistically significant difference between food handlers job tenure and attitude ($F= 11.199, \rho=0.000<0.05$

Table 15: Food handler demographic in relation to attitude

| | | Descriptive statistics | | ANOVA | |
|-------------------------|--------------------|------------------------|----------------|---------------|--------------|
| | | Mean | Std. Deviation | F | Sig. |
| Gender | Female | 4.345 | 0.685 | 7.663 | 0.006 |
| | Male | 4.028 | 0.653 | | |
| Age | 25-35 years | 3.892 | 0.862 | 19.161 | 0.000 |
| | 36-45 years | 4.571 | 0.298 | | |
| | 46-55 years | 4.552 | 0.443 | | |
| | 56-65 years | 3.546 | 0.000 | | |
| | Above 65 | 4.727 | 0.000 | | |
| | Total | 4.275 | 0.689 | | |
| Education levels | Primary | 4.458 | 0.503 | 6.567 | 0.000 |
| | Secondary | 4.094 | 0.823 | | |
| | College | 4.416 | 0.150 | | |
| | Degree | 2.818 | . | | |
| | Total | | | | |
| Experience | Less than one year | 3.873 | 0.933 | 11.199 | 0.000 |
| | One | 3.743 | 0.894 | | |
| | Two | 4.625 | 0.045 | | |
| | Three | 4.671 | 0.045 | | |
| | Four | 4.375 | 0.574 | | |
| | Total | 4.275 | 0.689 | | |

Source: Author's own compilation

4.1.10. Barriers to food safety and Sanitation practices in Kenyan High schools

The study sought food handlers' opinion on the barriers to food safety and sanitation. Table 16 highlights the results. Of concern was 55% (112) of the respondents cited finance as one of the major barriers to food safety and sanitation practice. This was one aspect that many schools grappled with and no institution ever seemed to have enough. Likewise, 49.6% (101) of the food handlers stated that the inadequacy of equipment in the school kitchen posed as a barrier to practicing food safety and sanitation. Similarly, majority of the food handlers 56% (115) indicated that one of their biggest huddles in practicing food safety and sanitation was the lack of proper set standards in the institutions. Despite this a large percentage 88.8 % (148) of respondents agreed to the fact that experience was either a small or least of their problem. Furthermore, 77.4%, (158) of the food handlers were confident that they possessed adequate knowledge to diligently carry out appropriate food safety and sanitation duties. An equally large percentage of the respondents (72.5%, 146) were of the opinion that they received adequate Motivation from the learning institutions in which they work to adequately carry out their duties.

Table 16: Barriers to food safety and hygiene practice

| Barrier Items | | worst problem | bad problem | moderate problem | small problem | least problem | Mean | Std. Dev |
|--|------|----------------------|--------------------|-------------------------|----------------------|----------------------|-------------|-----------------|
| Lack of finances | Freq | 100 | 12 | 33 | 6 | 53 | 2.510 | 1.692 |
| | % | 49 | 5.9 | 16.2 | 2.9 | 26 | | |
| Inadequate equipment | Freq | 76 | 25 | 51 | 13 | 39 | 3.304 | 1.536 |
| | % | 37.3 | 12.3 | 25 | 6.4 | 19.1 | | |
| Lack of facilities | Freq | 33 | 18 | 58 | 21 | 74 | 3.417 | 1.458 |
| | % | 16.2 | 8.8 | 28.4 | 10.3 | 36.3 | | |
| Lack of experience | Freq | 11 | 0 | 12 | 13 | 168 | 4.603 | 1.005 |
| | % | 5.4 | 0 | 5.9 | 6.4 | 82.4 | | |
| Lack of motivation | Freq | 35 | 7 | 14 | 26 | 122 | 3.946 | 1.535 |
| | % | 17.2 | 3.4 | 6.9 | 12.7 | 59.8 | | |
| Lack of knowledge | Freq | 9 | 0 | 37 | 26 | 132 | 4.333 | 1.058 |
| | % | 4.4 | 0 | 18.1 | 12.7 | 64.7 | | |
| Lack of set standards in the institution | Freq | 110 | 5 | 18 | 19 | 52 | 3.637 | 1.704 |
| | % | 53.9 | 2.5 | 8.8 | 9.3 | 25.5 | | |

Source: Author's own compilation

4.1.11. Correlation Results

Pearson's product moment correlation analysis was used to assess the correlation between the variables. The results in table 17 indicate that, there is negative and significant correlation between food handlers' knowledge on personal health and their behavior and practice ($r = -0.263$, $p <$

0.01). The findings also showed that food handlers' knowledge on food contamination did have a positive and significant relationship with their behavior and practice ($r = 0.208$, $p < 0.01$).

The results also indicate that there is a positive and significant correlation between food handlers' attitude with their behavior and practice ($r = 0.315$, $p < 0.01$). Finally, the findings indicate that there is a positive and significant correlation between handlers' attitude with their behavior and practice ($r = 0.600$, $p < 0.01$). The findings on table 17 indicate that the highest relationship is found between food handlers' knowledge on food transmission services with their behavior and practice.

Table 17: Correlation Results

| | | Behavior and practice | Personal health | Food Contamination | Handler attitude | Food transmission diseases |
|---|---------------------|------------------------------|------------------------|---------------------------|-------------------------|-----------------------------------|
| Behavior and practice | Pearson Correlation | 1 | | | | |
| | Sig. (2-tailed) | 1 | | | | |
| Personal health | Pearson Correlation | -.263** | 1 | | | |
| | Sig. (2-tailed) | 0.00 | | | | |
| Food Contamination | Pearson Correlation | .208** | 0.133 | 1 | | |
| | Sig. (2-tailed) | 0.003 | 0.058 | | | |
| Handlers attitude | Pearson Correlation | .315** | -0.048 | .215** | 1 | |
| | Sig. (2-tailed) | 0.000 | 0.497 | 0.002 | | |
| Food transmission diseases | Pearson Correlation | .600** | -0.099 | 0.118 | .310** | 1 |
| | Sig. (2-tailed) | 0.000 | 0.158 | 0.092 | 0.000 | |
| ** Correlation is significant at the 0.01 level (2-tailed). | | | | | | |

Source: Author's own compilation

4.1.12. Multiple Regression

Results of multiple regressions, as presented in table 18 revealed that food handlers' knowledge on personal health and hygiene had a negative and significant effect on behavior and practice with a beta value of $\beta_1 = -0.226$ (p -value = 0.000 which is less than $\alpha = 0.05$). The study therefore infers that increase in knowledge on personal health and hygiene by a unit results in declined behavior

and practice by .226 units. Also, the effect of knowledge on personal health and hygiene was stated by the t-test value = 4.197 which implies that the standard error associated with the parameter is less than the effect of the parameter.

The results of table 18 showed that the standardized coefficient beta and p value of knowledge on food contamination were positive and significant (beta = 0.152, $p < 0.05$). Therefore, a unit increase in knowledge on food contamination results in an improvement in behavior and practice by 0.152 units. The effect of knowledge on food contamination is shown by the t-test value of 2.768 which implies that the effect of knowledge on food contamination surpasses that of the error.

Table 18 further shows that food handlers' attitude had no significant effect on their behavior and practice with a beta value of $\beta_3 = 0.108$ (p-value = 0.059 which is more than $\alpha = 0.05$). Consequently, a unit increase in food handlers' attitude would result in no change in their behavior and practice. Finally, study findings showed that food handlers' knowledge on food transmission diseases had coefficients of estimate which was significant basing on $\beta_4 = 0.526$ (p-value = 0.000 which is less than $\alpha = 0.05$). Therefore, a unit increases in food handlers' knowledge on food transmission diseases results in an improvement in behavior and practice by 0.526 units. The effect of food handlers' knowledge on food transmission diseases is shown by the t-test value of 9.367 which implies that the effect of food handlers' knowledge food contamination surpasses that of the error.

Overall, the findings show that the independent variables (knowledge on personal health, knowledge on food contamination, handlers' attitude and knowledge on food transmission diseases) contributed to 43% of the variation in behavior and practice as explained by adjusted R^2 of 0.43 which shows that the model is a good prediction. Further, table 18 reveals that the F-value of 39.235 with a p value of 0.00 significant at 5% indicate that the overall regression model is significant, hence, the joint contribution of the independent variables was significant in predicting behavior and practice.

Table 18: Multiple Regressions

| | Un standardized Coefficients | | Standardized Coefficients | | |
|---|------------------------------|------------|---------------------------|--------|-------|
| | B | Std. Error | Beta | t | Sig. |
| (Constant) | -1.047 | 0.825 | | -1.269 | 0.206 |
| Personal health | -0.368 | 0.088 | -0.226 | -4.197 | 0.000 |
| Food contamination | 0.753 | 0.272 | 0.152 | 2.768 | 0.006 |
| Handlers attitude | 0.419 | 0.220 | 0.108 | 1.903 | 0.059 |
| Food transmission diseases | 0.827 | 0.088 | 0.526 | 9.376 | 0.000 |
| Model Summary Statistics | | | | | |
| R | 0.664 | | | | |
| R Square | 0.441 | | | | |
| Adjusted R Square | 0.430 | | | | |
| Model Fitness Statistics | | | | | |
| F | 39.235 | | | | |
| Sig. | 0.000 | | | | |
| a Dependent Variable: behavior and practice | | | | | |

Source: Author's own compilation

4.1.13. Hypothesis Testing (Objective 1)

Ho1. Food handlers lack significant levels of knowledge, to ensure adequate food safety and sanitation services to students.

From the forgoing, the results testing hypothesis are summarized in table 18. The results indicate the null hypothesis was rejected, as the T tests and p values of the three constructs of knowledge, namely; personal health (T= 4.197, p< 0.000), food contamination (T=2.768, p< 0.006) and food transmission diseases (T= 9.376, p< 0.000), are p< 0.05, signifying that, food handlers possess adequate knowledge to ensure proper food safety and sanitation services to students, hence a **REJECTION** of the Null Hypothesis. With regards to attitude, the results indicate attitude (T= 1.903, p< 0.059) hence P>0.005 further illustrating that food handler's lack significant attitude, to ensure proper food safety and sanitation service to students, hence an **ACCEPTANCE** of Null hypothesis. Further, the findings revealed that Practice (F=39.235, p< 0.000) which signified p<0.05. This indicated that food handlers had significant levels of practice that ensured proper food safety and sanitation services. Hence a **REJECTION** of the Null Hypothesis

4.2. Results Interpretation (Objective Two)

To find out the extent to which the current school environment (facilities, equipment, tuck shop) enhances food safety and health among students during consumption. (Descriptive Data)

4.2.1. Kitchen Amenities

This section of the analysis highlights the findings on the kitchen equipment and amenities. Results illustrated in table 19 highlighted on the school menu, place food prepared, space for cooking and serving and the availability of cleaning tools. Based on the findings, a large majority of the respondents 94.1% (192) confirmed the presence of a school menu in the various institutions (schools) in which they worked. Furthermore, in terms of availability, size and spacing of the various kitchens facilities, 75% (158) of the respondents noted the availability of designated kitchen; while 25% (46) noted that they had a temporary/makeshift kitchen. In addition, 65.7% (134) of the respondents stated that there was adequate space for cooking though 34.3% (70) were in disagreement. Most of the Kitchens were quite old and needed to be modernized.

Furthermore, on the same, 63.7% (130) of the respondents mentioned that there was adequate serving space with 36.3% (74) of them being of a contrary opinion. Finally, majority (82.4%) of the respondents stated that there were adequate cleaning tools in the kitchen such as brooms mops and dusters. Generally, majority of the respondents were in agreement that there is a school menu and kitchen,

Table 19: Kitchen Amenities in High schools in Kenya

| Items | | Frequency | Percent |
|---|---------------------------------|------------------|----------------|
| School menu | Yes | 192 | 94.1 |
| | No | 12 | 5.9 |
| | Total | 204 | 100 |
| Place food prepared | Designated kitchen | 158 | 75 |
| | Temporary/ makeshift kitchen | 46 | 25 |
| | Total | 204 | 100 |
| Adequate space for cooking | Yes | 134 | 65.7 |
| | No | 70 | 34.3 |
| | Total | 204 | 100 |
| Adequate space for serving/ portioning cook food | Yes | 130 | 63.7 |
| | No | 74 | 36.3 |
| Cleaning tools in the kitchen e.g. broom, mop, dusters, sponge | Yes | 168 | 82.4 |
| | No | 36 | 17.6 |
| | Total | 204 | 100 |

Source: Author's own compilation

4.2.2. Storage facilities

The study sought to find out from the cateress the availability of storage facilities, various types of storage facilities and the available storage systems if any, in the various institutions. All the respondents (100%) overwhelmingly agreed to the availability of food storage facilities in schools. These storage facilities were independent of other storage facilities and were only designated for food storage. This was confirmed by a mean of 1.00 and a standard deviation of 0.00. With regard to the type of storage facilities that were available, all the respondents (100%) affirmed the availability of dry stores to store dry food products such as grains and flour. On the contrary all the respondents (100%) denied the availability of a cold room. This was partly because cold rooms were expensive to buy, build and run; hence none of the schools owed or thought of investing in a cold room. Slightly above half of the respondents (57.1%) owned a fridge or a freezer for cold storage. With respect to cleaning of the storage facilities, all respondents agreed to there being a cleaning schedule. A large percentage of respondents (66.7%) ensure that their various storage facilities were cleaned once a week, (19%) ensured cleaning was done once in 2 weeks and a decimal (4.8%) cleaned after a fortnight. The findings were further affirmed by a mean of 1.52 and a standard deviation of 0.873. Of the participants, 90.5% mentioned the availability of a stock rotation system, that ensure a systematic usage of stored items and the prevention of wastage. Majority of the respondents (71.4%) in the study referred to use FIFO, (FIRST IN FIRST OUT),

stock rotation system. While a dismal (4.8%) preferred to use the Expiry system of stock rotation. The findings were corroborated by a mean of 3.55 and a standard deviation of 0.887

Table 20: Kitchen storage facilities in High schools in Kenya

| Items | | Percentage | Frequency | Mean | SD |
|---|--------------------------|------------|-----------|------|-------|
| <i>Availability of storage facilities</i> | Yes | 100 | 21 | 1.00 | 000 |
| | No | | | | |
| | Total | 100% | 21 | | |
| <i>Type of storage : Dry store</i> | Yes | 100 | 21 | 1.00 | 000 |
| | No | 0 | | | |
| <i>Cold room</i> | Yes | 0 | | | |
| | No | 100 | | 2.00 | 000 |
| <i>Fridge/ Freezer</i> | Yes | 57.1 | 12 | 1.43 | 0.507 |
| | No | 42.9 | 9 | | |
| <i>Regular cleaning schedule storage area</i> | Yes | 100 | 21 | 1.00 | 000 |
| | No | | | | |
| | Total | 100% | 21 | | |
| <i>Frequency of storage cleaning</i> | Once a week | 66.7 | 14 | 1.52 | 0.873 |
| | Twice a week | 19 | 4 | | |
| | Three a week | 9.5 | 2 | | |
| | Once a fortnight | 4.8 | 1 | | |
| | Total | 100% | 21 | | |
| <i>Availability of stock rotation system</i> | Yes | 90.5 | 19 | 1.10 | 301 |
| | No | 9.5 | 2 | | |
| | Total | 100% | 21 | | |
| <i>Type of stock rotation system</i> | Delivery dates | 4.8 | 1 | 3.55 | 0.887 |
| | Expiry dates | 9.5 | 2 | | |
| | Correct storage delivery | 9.5 | 2 | | |
| | FIFO | 71.4 | 15 | | |
| | total | 100% | 21 | | |

Source: Author's own compilation

4.2.3. Kitchen Equipment

The study found out the availability of equipment and amenities used in the day to day running of the institutional kitchens and that enable simple HACCP processes to be carried out to ensure food safety and hygiene. From the findings in table 21, slightly over a half of the respondents 58.3% (119) confirmed the availability of hand washing basins in their kitchens. These results were further affirmed by a mean of 1.583 and a standard deviation of 0.494. A vast majority of respondents 76.5% (156) indicated that they did not have refrigerators. Only a mere 23.5% (48) of participants' mention having refrigerators in their facilities, findings being further corroborated by a mean of 1.235 and a standard deviation of 0.425.

In addition, only 51.5% (105) of the respondents mentioned the availability of deep freezers in their facilities. These findings further being summed up with a mean of 1.515 and a standard deviation of 0.501, indicating an inadequacy in the number of deep freezers. Furthermore, 69.6% (142), of participants acknowledge the availability of a hoods and steam extractor, and a further 52.5% (107) confirmed the availability of food warmers. This was also validated by a mean of 1.525 and a standard deviation of 0.501. About three quarters of the population (83.3%) acknowledged the unavailability of steamers in their facilities, indicating the inability of the preparation of healthy foods.

Moreover, slightly below half of the participants, 46.6% (96) confirmed the availability of sanitizers in their facilities, while 53.4% (109) noted a lack of basic kitchen commodities such as sanitizers. These finding were further explained by a mean of 1.466 and standard deviation of 0.5. A vast majority of food handlers (84.3%) explicitly indicated the lack of thermometers in their kitchen, further stating an inability to use them even if they were made available. Also, 82.8% (169) of the respondents ascertained the availability of fire extinguishers. The findings realized a mean of 1.828 and standard deviation of 0.378. Finally, 49% (100) of the respondents stated the availability of deep fat fryers.

Table 21: Equipment and tools used daily for safe and hygiene

| Equipment | | not available | available | Mean | Std. Deviation |
|--------------------------|------|----------------------|------------------|-------------|-----------------------|
| Hand wash basin | Freq | 85 | 119 | 1.583 | 0.494 |
| | % | 41.7 | 58.3 | | |
| Refrigerator | Freq | 156 | 48 | 1.235 | 0.425 |
| | % | 76.5 | 23.5 | | |
| Freezers | Freq | 99 | 105 | 1.515 | 0.501 |
| | % | 48.5 | 51.5 | | |
| Hood and steam extractor | Freq | 62 | 142 | 1.696 | 0.461 |
| | % | 30.4 | 69.6 | | |
| Food warmers | Freq | 97 | 107 | 1.525 | 0.501 |
| | % | 47.5 | 52.5 | | |
| Steamers | Freq | 170 | 34 | 1.167 | 0.374 |
| | % | 83.3 | 16.7 | | |
| Sanitizer | Freq | 109 | 95 | 1.466 | 0.500 |
| | % | 53.4 | 46.6 | | |
| Thermometers | Freq | 172 | 32 | 1.157 | 0.365 |
| | % | 84.3 | 15.7 | | |
| Fire extinguisher | Freq | 35 | 169 | 1.828 | 0.378 |
| | % | 17.2 | 82.8 | | |
| Deep fat fryers | Freq | 104 | 100 | 1.490 | 0.501 |
| | % | 51 | 49 | | |
| equipment | | | | 1.466 | 0.188 |

Source: Author's own compilation

4.2.4. Availability of Kitchen Amenities in High schools in Kenya

Table 22 shows the results of respondents' opinions on the availability of kitchen equipment. Respondents were requested to indicate their responses as; Very adequate, Adequate, Average, Inadequate and Not Inadequate. Table 22 illustrates the results. In relation to the availability of cutlery, a vast majority (78.9%) of respondents admitted to having adequate cutlery that was enough for the entire school. With regards to crockery slightly above half of the respondents (56%) admitted to have both adequate and very adequate levels of crockery, while a slightly lower percentage (44%) denied having adequate levels of crockery. The results summed up to a mean of 3.446 and a standard deviation of 1.369 suggesting that crockery was adequate.

The study also determined the adequacy of the work space and 81.3% of the food handlers affirmed that they had adequate work surfaces. In relation to availability of gas cookers or burners, a sizeable percentage of the population, (66.2%) stated that their kitchen facilities had adequate numbers of cookers or gas burners. despite the main mode of fuel in school kitchens being fire wood and at times charcoal. However, 28% of the food handlers denied that there were adequate cookers. The results summed up to a mean of 3.451 and standard deviation of 1.439 an indication that cookers are adequate. In terms of ovens majority of the respondents (65.2%) stated there was an inadequacy of ovens in kitchen facilities, while 33% stated an adequate number of ovens. In general, the study gathered a mean of 2.628 and standard deviation of 1.603. Implying an inadequacy in the number of ovens. With regards to color coded chopping boards, an overwhelming percentage (80%) of the respondents affirmed an inadequate use of the color coded chopping boards. The respondents mentioned that all chopping boards were used for the same purposes. The findings yielded a mean of 1.814 and a standard deviation of 1.430 confirming an inadequacy in the number of color coded chopping boards.

The study also tried to find out the adequacy of cooking pots in the various kitchen facilities that were visited. Overwhelmingly 93.7% of the respondents confirmed the availability of cooking pots in their various kitchen facilities. They mentioned it was a basic requirement for any commercial kitchen. The mean stood at 4.177 and standard deviation of 0.956. These implied adequate numbers of cooking pots. In relation to cleaning equipment, the vast majority (53.4%) were neutral about the matter. This meant that rarely did food handlers lack cleaning material but it wasn't enough. The mean of the findings was 2.642 and a standard deviation of 1.370 confirming an inadequacy in cleaning material. With regards to chafing dishes, majority of the respondents (62.7%) reported the lack of chafing dishes in their various kitchen facilities. The findings of the study realized a mean of 2.255 and standard deviation of 1.659 revealing that chafing dishes were inadequate.

Table 22: Availability of Kitchen Amenities in High schools in Kenya

| Items | | not adequate | inadequate | average | adequate | very adequate | Mean | Std. Deviation |
|------------------------------------|------|-----------------|-------------|-------------|-------------|------------------|--------------|-------------------|
| Cutlery | Freq | 14 | 24 | 5 | 113 | 48 | 3.770 | 1.141 |
| | % | 6.9 | 11.8 | 2.5 | 55.4 | 23.5 | | |
| Crockery | Freq | 12 | 64 | 14 | 49 | 65 | 3.446 | 1.369 |
| | % | 5.9 | 31.4 | 6.9 | 24 | 31.9 | | |
| Working surfaces | Freq | 10 | 99 | 1 | 27 | 67 | 2.912 | 1.141 |
| | % | 4.9 | 48.5 | 0.5 | 13.2 | 32.8 | | |
| Cookers | Freq | 38 | 19 | 12 | 83 | 52 | 3.451 | 1.439 |
| | % | 18.6 | 9.3 | 5.9 | 40.7 | 25.5 | | |
| Ovens | Freq | 49 | 84 | 1 | 64 | 6 | 2.628 | 1.603 |
| | % | 24 | 41.2 | 0.5 | 31.4 | 2.9 | | |
| Color coded chopping board | Freq | 145 | 16 | 22 | 21 | 0 | 1.814 | 1.430 |
| | % | 71.1 | 7.8 | 10.8 | 10.3 | 0 | | |
| Cooking pots and pans / Sufuria | Freq | 13 | 0 | 0 | 116 | 75 | 4.177 | 0.956 |
| | % | 6.4 | 0 | 0 | 56.9 | 36.8 | | |
| Cleaning equipment | Freq | 39 | 6 | 109 | 50 | 0 | 2.642 | 1.370 |
| | % | 19.1 | 2.9 | 53.4 | 24.5 | 0 | | |
| Chafing dishes | Freq | 128 | 0 | 0 | 48 | 28 | 2.255 | 1.659 |
| | % | 62.7 | 0 | 0 | 23.5 | 13.7 | | |
| equipment | | | | | | | 3.344 | 0.596 |

Source: Author's own compilation

4.2.5. Tack Shop

Figure (6A) shows findings from the availability of tack shops in Kenyan high school. Of the school administrators interviewed, 70% percent confirmed the availability of tack shops in their institutions, while 30% did not have tack shops. Many of the administrators mentioned that tack shops were important as they supplemented the schools diet and also offered students other food and snacks other than the ones available in the diet. The study further investigated whether the schools' administration had control over what was sold to the students (figure 6B). From the findings, only 45% of the participants had control over what was offered to students while the majority (55%) did not have control. This heavily impacted on the health of student as schools were not sure of the types of foods or snacks their students were being sold.

Additionally the study also found out whether there were any healthy snacks in the various tack shops. Majority of the participants (80%) confirmed a lack of healthy snacks at the tack shops available in their institutions. Majority of the principals admitted to there being more unhealthy

snacks among them deep fried doughnuts (Mandazi), French fries, high energy beverages such as sodas, energy drinks and juices, sweets and chocolates compared to the minimal health snacks, bread, milk and in some instances fruits. Some of the high schools attested to there being no healthy snacks at the tack shops. Others reported that milk was the only item in the tack shop that was healthy. Despite this, some turned out as being healthy due to the religious doctrines the schools subscribed. For instance, high schools that belonged to the Seventh Day Adventist faith prevent students from coming with or selling sugary snacks, in the school compound.

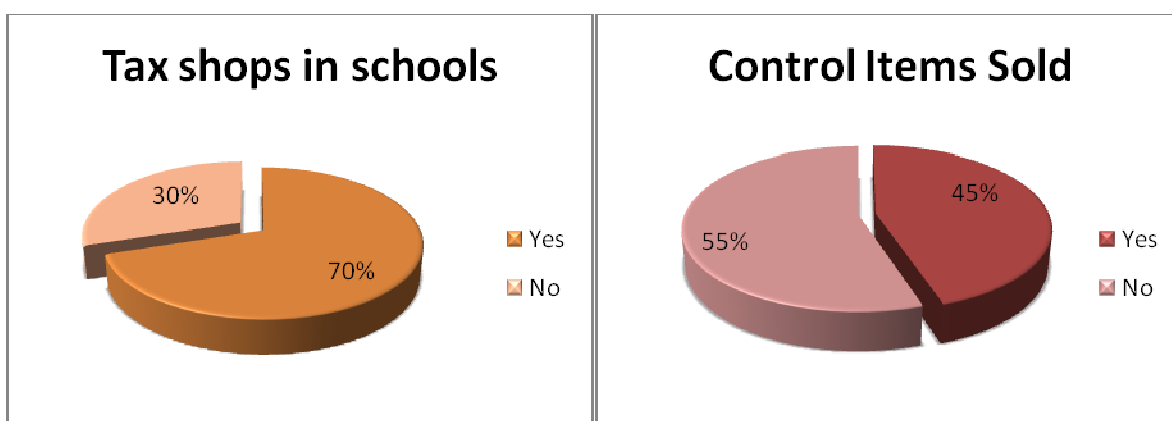


Figure 6: A: Percentage of Tack Shops In High Schools, B: Percentage of Control over Tacks Shops in High Schools

Source: Author’s own compilation

4.2.6. Dining facilities in High schools in Kenya

The study found out the availability of dining hall facilities in various high schools in Kenya (figure 7 A). A vast majority of the participants, (90%) confirmed the availability of dining hall facilities in the various institutions that were visited while a dismal (10%) of the participants’ denied the availability of dining hall facilities. The study went even further to find out if the available facilities were adequate for the various functions that they were meant to serve. Majority of the respondents (62%) denied the fact that the facilities were spacious enough, for the various purposes that schools wanted to use them for. Most of the participants reported that, due to the increase in the numbers of students attending high schools, many of the facilities need an upgrade to accommodate all students. This meant in some schools students ate meals in shifts, or ate in make shift structures, and in others, students ate in a library which was used as dining hall during lunch time

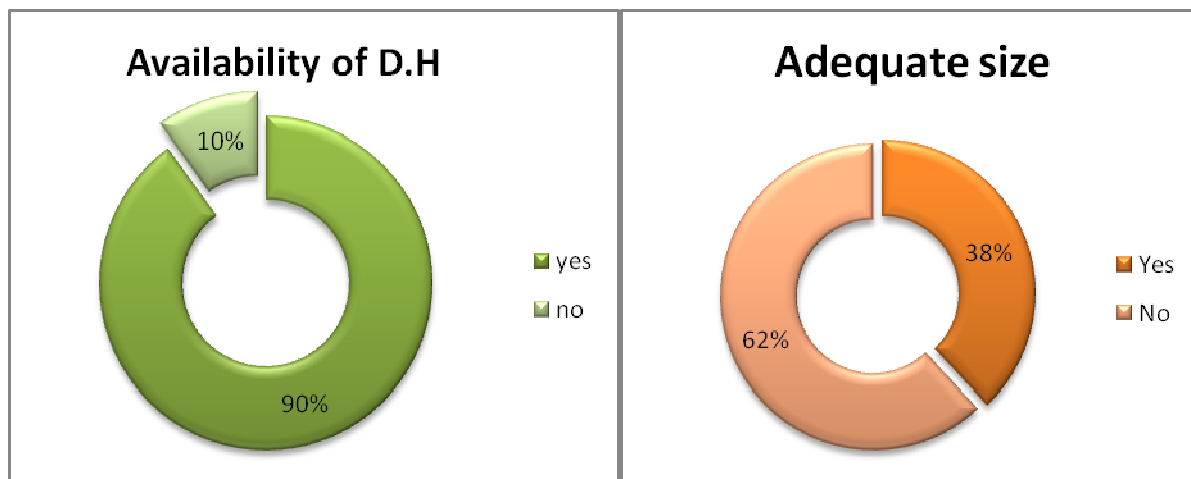


Figure 7: A: Availability of Dining Halls in High Schools, B: Percentage of Dining halls with adequate sizes/ space

Source: Author's own compilation

4.3. Results Interpretation (Objective Three)

To investigate the extent to which the current curriculum enhances adequate food safety and nutrition knowledge and practice among Students

4.3.1. Student Knowledge on food nutrition

The study established the level of knowledge of high school students concerning food safety and sanitation, which also determine the effectiveness of the curriculum that guides their studies in school. The study first tested the student's basic knowledge in Food and Nutrition. The findings of the study are illustrated in table 23. According to the findings, majority of the students had adequate knowledge on balanced diets and proteins as they attained a mean of 0.97 and 0.95 respectively. In addition, students lacked sufficient knowledge in areas such as energy rich foods, calorific foods, and vitamins and minerals whereby they attained means of 0.50, 0.57 and 0.60. The study adopted a scale, (45-65%) inadequate level of knowledge, (66-85%) adequate level of knowledge, and (86-100%) most adequate level knowledge. Based on the finding students obtained an average score of 0.65, which illustrated inadequate knowledge of basic nutritional knowledge among students. This also was a reflection of the curriculum as it failed to instill basic nutritional knowledge in learners.

Table 23: Knowledge on Food and Nutrition

| Knowledge Items | Mean | Std. Deviation | Skewness | Kurtosis |
|----------------------------|-------------|-----------------------|-----------------|-----------------|
| Carbohydrates | 0.82 | 0.38 | -1.67 | 0.78 |
| Dietary fiber | 0.54 | 0.50 | -0.15 | -1.98 |
| Fats | 0.73 | 0.45 | -1.03 | -0.94 |
| Protein | 0.95 | 0.22 | -4.19 | 15.64 |
| Calories | 0.57 | 0.50 | -0.28 | -1.93 |
| Rich in energy | 0.50 | 0.22 | 4.11 | 14.96 |
| Vitamin and mineral | 0.60 | 0.49 | -0.42 | -1.83 |
| Balanced diet | 0.97 | 0.18 | -5.33 | 26.48 |
| Nutrition knowledge | 0.65 | 0.16 | -0.48 | 0.13 |

Source: Author's own compilation

4.3.2. Knowledge on food safety

The study also investigated the level of food safety knowledge among students in Kenyan high schools (table 24). A vast majority of students were most knowledgeable on items such as; various symptoms of food poisoning and cross contamination of food as they scored a mean of 0.92 and 0.73, respectively. Moreover, students lacked adequate knowledge on items such as optimum temperature for the growth of bacteria 0.33, the transmission of cholera through food, 0.41, and causes of food poisoning 0.45. Having obtained an average mean of 0.58 and based on the scale adopted for the study, (45-65%) inadequate level of knowledge, (66-85%) adequate level of knowledge, and (86-100%) most adequate level knowledge, the study findings also revealed students had inadequate levels of food safety knowledge. Additionally, these reflected significantly on the impact the current curriculum and on the student, food safety on sanitation

Table 24: Knowledge on food safety

| Knowledge Items | Mean | Std. Deviation | Skewness | Kurtosis |
|--|-------------|-----------------------|-----------------|-----------------|
| Food poisoning | 0.63 | 0.48 | -0.56 | -1.69 |
| Symptoms food poisoning | 0.92 | 0.27 | -3.08 | 7.52 |
| Cause of food poisoning | 0.45 | 0.26 | 0.79 | -0.61 |
| Cross contamination of food | 0.73 | 0.45 | -1.03 | -0.94 |
| cholera be transmitted to humans through food | 0.41 | 0.21 | 1.38 | 2.35 |
| optimum temperature for the growth of bacteria | 0.33 | 0.20 | 3.75 | 24.99 |
| Fridge kill germs | 0.58 | 0.49 | -0.31 | -1.91 |
| Heat kill germs | 0.61 | 0.49 | -0.46 | -1.79 |
| Knowledge in food safety | 0.58 | 0.14 | -0.33 | -0.40 |

Source: Author's own compilation

4.3.3. Practice of Sanitation among Student in Kenyan High Schools

The study also investigated the student's level of hygiene practice (table 25). Majority of the students (72.1%) agreed that they always considered checking the expiry date of food items before consumption while only 27.9% denied paying attention to expiry dates. The findings summed up to a mean of 3.30 and a standard deviation of 0.91 clearly indicating that, generally students failed on checking expiry dates when purchasing food items.

Additionally, (58.4%) of the respondents agreed that, they always read instructions for use and preservation of items so as to ensure proper storage is done adequately. Despite the scores, this was a nice initiative from the students as it showed a genuine concern in trying to prevent food borne diseases by ensuring proper storage of food. The result summed up a mean of 3.30 and a standard deviation of 1.07, clearly indicating that focus in not on checking the expiry date when packed food is bought.

Students were also asked how often they washed their hands after visiting the toilet and before touching food. A vast majority of the respondents (79.1) agreed that they either, often or always washed their hand after visiting the toilets and before they touched food, while 20.9% denied washing their hands. The findings obtained a mean of 3.41 and standard deviation of 0.85. This meant that the majority of the respondents ensured that they always washed hands before touching food. Moreover, students were further questioned on whether they washed unpeeled fruits before consuming them. Almost three quarters of the students (69.8%) confirmed that they always wash fruits before consuming to avoid contacting food borne illnesses while 30.2% of participants denied washing fruits before consumption. The study acquired a mean of 3.23 mean and standard deviation of 0.98 indications the large percentage of the population washed fruits before consumption.

In relation to whether the respondents always ensured to purchase foods that were clean and in fresh condition, the results indicated that 87.1% of the respondents always ensure to purchase food that is clean and in fresh condition, while a mere 12.8% failed to ensure cleanliness and freshness of foods bought. The study obtained a mean of 3.53 and standard deviation of 0.53 indicating that majority of the respondents ensured the cleanliness and freshness of food purchased. Also, the study established if respondents tasted food to check whether it was safe for consumption or not. Results indicate that an adequate number of respondents (65%) disagreed to tasting food to find out whether they were suitable for consumption or not, as it would pass on disease causing germs to ones mouth, On the other hand 35% of the students agreed to the fact the sometime the tasted

various foods to confirm its safety before consumption. The results summed up to a mean of 2.20 and standard deviation of 2.09 meaning that not all of the respondents tasted foods to find out whether they were safe for consumption or not.

With regards to well cooked foods especially meat, a majority of respondents (92.8%) strive to always ensure that they ate well cooked foods especially meat. These were to avoid the consumption of harmful pathogens that would endure sickness and diseases. These findings obtained a mean of 3.74 and standard deviation of 0.67. This meant that most of the respondents always ate well cooked foods. Lastly the study investigated whether students reheated leftovers before consumption. Slightly over half of the participants (57.8%) admitted to heating leftovers before consumption. An almost similar percentage (42.2%) of participants indicated not heating leftovers before consumption. The study yielded a mean of 2.84 and standard deviation of 1.21, which meant that majority of the respondents, always reheated leftovers before consumption.

Table 25: Practice of Sanitation among Student in Kenyan High Schools

| Practice Items | | never | sometimes | often | always | Mean | Std. Dev |
|--|-------------|--------------|------------------|--------------|---------------|-------------|-----------------|
| When you buy packed food, do you check the expiry date | Freq | 8 | 159 | 73 | 353 | 3.30 | 0.91 |
| | % | 1.3 | 26.8 | 12.3 | 59.5 | | |
| Do you read the instructions for use and for preservation written on the packaged food | Freq | 55 | 192 | 81 | 265 | 2.94 | 1.07 |
| | % | 9.3 | 32.4 | 13.7 | 44.7 | | |
| Do you wash your hands before eating and before touching food | Freq | 10 | 114 | 93 | 376 | 3.41 | 0.85 |
| | % | 1.7 | 19.2 | 15.7 | 63.4 | | |
| Do you usually wash fruit that are not peeled before eating them | Freq | 27 | 152 | 72 | 342 | 3.23 | 0.98 |
| | % | 4.6 | 25.6 | 12.1 | 57.7 | | |
| I always ensure to purchase food that is clean and in fresh condition | Freq | 22 | 54 | 104 | 413 | 3.53 | 0.81 |
| | % | 3.7 | 9.1 | 17.5 | 69.6 | | |
| I taste food to see if it is safe or not | Freq | 255 | 130 | 81 | 127 | 2.20 | 2.09 |
| | % | 43 | 21.9 | 13.7 | 21.4 | | |
| I ensure that I eat well cooked food especially meat, I don't consume uncooked meat | Freq | 16 | 27 | 55 | 495 | 3.74 | 0.67 |
| | % | 2.7 | 4.6 | 9.3 | 83.5 | | |
| I always reheat leftover food before consuming | Freq | 118 | 132 | 70 | 273 | 2.84 | 1.21 |
| | % | 19.9 | 22.3 | 11.8 | 46 | | |
| Hygiene practice | | | | | | 3.15 | 0.56 |

Source: Author's own compilation

4.3.4. Other Sources of Food for High School Students in Kenya

The study established the other sources of food for student. This was important as it would reveal other sources of nutrition of which student used to subsidize their school diet. This information would reveal how healthy their supplementation to the diet was. From the findings in table 26, a vast majority of the students (72%), used the schools canteen as the main source of food other than the schools' diet. The second source of food or supplement to the diet for students was food from home by parents and guardians, (24.6%), third were food vendors and others (1.7%) mostly found outside the school premises. These findings pose a major threat to the students' health based on earlier results that only (45%) of the schools control what is sold in their school canteens. Furthermore from an interview with the school's principals, none of the schools offers healthy snacks, as more (90%) percent of what is sold in school canteens are unhealthy high calorie snacks.

Table 26: Other Sources of food for High School Students in Kenya

| Sources | Frequency | Percent |
|--------------------------|------------|------------|
| tack shop/school canteen | 427 | 72 |
| home/parents | 146 | 24.6 |
| food vendors | 10 | 1.7 |
| others | 10 | 1.7 |
| Total | 593 | 100 |

Source: Author's own compilation

4.3.5. Number of Times High School Students Fall Ill from Food Borne Diseases

The study also attempted to establish how often students fell ill based on food borne illnesses. The findings are represented in table 27. A Majority (55.3%) of the students fell ill at least once every school term, a further (18.4%) least four times in every schools term and dismal small number 2.4% at least three times every term. To further confirm the findings students, were asked to state the symptoms of their illness and they overwhelmingly stated, vomiting, diarrhea and stomach pains. In general the findings of this study show that the number of students who fall sick with regard to food borne illnesses are high and this could be attribute to lack of training by food handlers, or the lack of food safety and sanitation practice by the students.

Table 27: Number of Times High School Students Fall Ill from Food Borne Diseases

| Per a Term | Frequency | Percent |
|-------------------|------------------|----------------|
| Once | 328 | 55.2 |
| Twice | 71 | 12 |
| three times | 14 | 2.4 |
| Four | 109 | 18.4 |
| Others | 71 | 12 |
| Total | 593 | 100 |

Source: Author's own compilation

4.3.6. Students Level of Satisfaction of School Food

The study further investigated student's perceptions on what was offered to them in terms of the schools menu and meals served. The first part interrogated students on the amount of food that was offered to them and if it was satisfactory. From the findings in table 28, majority of the students (71%) were never satisfied with the amount of foods that were offered to them especially for meals such as breakfast where most still felt hungry after the meal. Only (29%) of the respondents were satisfied with the meals served. With regard to how tasty the meals served in schools were, an overwhelming percentage of students (80%) disliked how meals were prepared. Many of the respondents reported that majority of the foods that were served tasted as if they were all boiled and lacked any flavor whatsoever. Despite the amounts of food not being adequate, a lot of food ended up wasted as it was poorly cooked.

Table 28: Students Level of Satisfaction of School Food

| Items | | Frequency | Percent |
|----------------------------|--------------|------------------|----------------|
| Food satisfaction (amount) | yes | 238 | 29 |
| | no | 355 | 71 |
| delicious food | yes | 175 | 20 |
| | no | 415 | 80 |
| | Total | 593 | 100 |

Source: Author's own compilation

4.3.7. Correlation statistics

A correlation analysis of the independent factors and the dependent factor were carried out and the findings are summarized in Table 29. Nutrition knowledge has a positive and significant relationship with the hygiene practice ($r = 0.493$) at 0.01 level of significance. Finally, the findings revealed that there is a positive and significant relationship between knowledge in food safety and hygiene practice ($r = 0.194$) at 0.01 level of significance.

Table 29: Correlation statistics

| | | hygiene practice | nutrition knowledge | Knowledge in food safety |
|--|---------------------|------------------|---------------------|--------------------------|
| hygiene practice | Pearson Correlation | 1 | | |
| | Sig. (2-tailed) | 0 | | |
| Nutrition knowledge | Pearson Correlation | .493** | 1 | |
| | Sig. (2-tailed) | 0.000 | | |
| Knowledge in food safety | Pearson Correlation | .194** | .248** | 1 |
| | Sig. (2-tailed) | 0.000 | 0.000 | |
| ** Correlation is significant at the 0.01 level (2-tailed). | | | | |

Source: Author's own compilation

4.3.8. Regression findings

The regression results in table 30 revealed that nutrition knowledge has a positive and significant effect on sanitation and practice with a beta value of $\beta_1 = 0.47$ ($p\text{-value} = 0.000$ which is less than $\alpha = 0.05$). The study therefore infers that increase in nutrition knowledge by a unit results in an improvement in the hygiene practice by 0.47 units. Also, the effect of nutrition knowledge was stated by the t-test value = 12.88 which implies that the standard error associated with the parameter is less than the effect of the parameter.

Further, the standardized coefficient beta and p value of knowledge in food safety were positive and significant ($\beta = 0.08$, $p < 0.05$). Therefore, a unit increase in knowledge in food safety results in an improvement in practice food safety and nutrition by 0.08 units. The effect of knowledge in food safety is shown by the t-test value of 2.08 which implies that the effect of knowledge in food safety surpasses that of the error.

Consequently, findings show that the independent variables (nutrition knowledge and knowledge in food safety) contributed to 24.9% of the variation in hygiene practice as explained by R^2 of 0.249 which shows that the model is a good prediction. Finally, table 30 reveals that the F-value of 97.757 with a p value of 0.00 significant at 5% indicate that the overall regression model is significant, hence, the joint contribution of the independent variables was significant in predicting hygiene practice.

Table 30: Regression

| | Unstandardized Coefficients | | Standardized Coefficients | | |
|--|-----------------------------|------------|---------------------------|-------|------|
| | B | Std. Error | Beta | t | Sig. |
| (Constant) | 1.57 | 0.15 | | 10.50 | 0.00 |
| Nutrition knowledge | 2.38 | 0.19 | 0.47 | 12.88 | 0.00 |
| Knowledge in food safety | 0.43 | 0.21 | 0.08 | 2.08 | 0.04 |
| summary statistics | | | | | |
| R | 0.499 | | | | |
| R Square | 0.249 | | | | |
| Adjusted R Square | 0.246 | | | | |
| model fitness statistics | | | | | |
| F | 97.757 | | | | |
| Sig. | 0.00 | | | | |
| a Dependent Variable: practice of food safety and nutrition | | | | | |

Source: Author's own compilation

4.3.9. Hypothesis Testing (Objective 3)

Ho_{3a}. The current curriculum significantly enhances adequate food and nutrition Knowledge among Students

Summary finding of hypothesis testing performed ANOVA tests. The results revealed that both constructs that made up knowledge of student, had a p value of >0.05 . The constructs included Nutrition knowledge and food and safety knowledge which had ($F= 12.88, p< 0.15$) and ($F= 2.08, p < 0.90$) respectively. This indicated that the current curriculum does not significantly enhance adequate food and nutrition knowledge among students, hence a **REJECTION** of the Hypothesis. Furthermore, despite, the average performance on practice of food safety and sanitation among students, both Correlation analysis (table 29) and Regression analysis (table 30) both signify a positive significant relationship between knowledge, (food safety and nutrition) and the practice of food safety and sanitation. This implies that an increase in knowledge leads to also an increase in practice. Addition, from previous finding student lacked adequate knowledge of food safety and nutrition, hence a **REJECTION** of the alternative hypothesis

4.4. Results Interpretation (Objective Four)

To analyze the nutritional quality of meals served to students in relation to dietary requirements.

The study established whether Kenyan high school students were adequately feed, this was in relation to the nutritional quality and served portion size of meals offered on a daily basis in schools.

4.4.1. Mean amount of foods provided daily

Results in table 31 show the quantities of each type of food provided daily to individual students in the different school categories. Githeri (a mixture of maize and beans) was provided in the highest (377 g) quantities in county schools, while private schools provided the least. The highest (166 g) provision of ugali (stiff porridge) was by national schools, while private schools served the least. Compared to all other school types the highest (278 g) amount of rice was served by the private schools. Legume service was highest (90 g) in county schools and lowest in private schools, and vegetables were provided most (121g) in county schools and least in private schools. Bread and potatoes were served across all school types. The least provided foods were spreads, tea, coffee and milk. Animal source foods such as eggs, sausage and beef mainly appeared in the menus of private schools compared to other school types.

Table 31: The mean amount in grams of the foods consumed daily by students 15-18 years in the selected high schools

| Categories | Main foods (g) | Extra county schools | National schools | Private schools | County schools |
|-------------------|----------------------|----------------------|------------------|-----------------|----------------|
| Starchy Staples | Rice | 158.57±51.9 | 173.25±39.3 | 277.61±121.9 | 225±45.5 |
| | Potatoes | 7.95±18.4 | 44.91±41.8 | 35.31±29.6 | 19±26.2 |
| | Chapatti | 0.00 | 22.50±45.0 | 15.61±29.6 | 0 |
| | ¹ Githeri | 335.79±172.2 | 375.43±197.6 | 123.75±51.0 | 377±48.5 |
| | ² Ugali | 146.56±46.0 | 166.61±66.4 | 78.36±14.1 | 141±2.02 |
| | Bread | 61.07±38.6 | 100.00±0.0 | 100.00±0.0 | 100±0.0 |
| | Scones | 27.57±50.6 | 0.00 | 17.86±35.7 | 0 |
| Beverages | White tea | 109.00±48.5 | 150.00±0.0 | 132.86±64.2 | 201±30.3 |
| | Black tea | 58.57±77.58 | 0.00 | 0.00±0.0 | 0 |
| | Cocoa | 2.43±4.9 | 5.71±6.6 | 3.04±6.1 | 0 |
| | ³ Uji | 111.43±105.0 | 0.00 | 87.50±71.5 | 36±50.5 |
| | Coffee | 0.00 | 3.04±6.0 | 4.29±4.9 | 0 |
| Dairy | Milk | 0.00 | 26.79±53.57 | 0.00±0.0 | 0 |
| Fruits+ vegetable | Fruit | 0.70±0.78 | 0.50±0.6 | 1.75±0.9 | 0 |
| | Cabbage | 40.50±29.8 | 42.29±48.9 | 35.96±15.3 | 121±71.7 |
| | Kales | 47.15±25.6 | 52.00±66.17 | 8.34±16.69 | 0 |
| Legumes | Green grams | 0.00 | 0.00 | 15.00±17.4 | 16±22.7 |
| | Beans | 71.74±54.8 | 78.21±13.1 | 29.57±34.7 | 64±90.9 |
| Meat | Beef | 12.17±10.6 | 13.79±13.1 | 16.07±14.48 | 8.0±1.0 |
| | Sausage | 0.00 | 0.00 | 2.86±3.3 | 0 |
| Eggs | Egg | 0.50±1.5 | 6.25±4.8 | 30.00±40.0 | 0 |
| Spreads | Spreads | 0.00 | 0.00 | 15.00±0.0 | 0 |
| | Total | 1191 | 1261 | 1030 | 1308 |

Figures are means± standard deviation.

¹Githeri is a meal prepared from a stewed mixture of dry maize and beans.

²Ugali is stiff porridge prepared from maize meal.

³Uji is a Drinking porridge prepared from maize or millet meal

Source: Author's own compilation

4.4.2. Food Groups consumed by the Different categories of High Schools

Foods appearing in the school menu were classified into 8 food groups (Table 32). Results showed that the most provided group was the starchy staples which contributed 64 to 68% of the total diet. The highest servers of the staples were county schools (898g) and the lowest were private schools. Dairy products (milk) were only served in national schools. Private schools were the leading providers of fruits while county schools' menus did not feature fruits. Legumes were the main source of proteins across all the school types, with a high of 6% of the diet, except for the private schools which included more animal proteins in their menus than all the other school types.

4.4.3. Mean amount of nutrients consumed from the diet

Table 32 shows an estimate of the mean amount of nutrients consumed in from the diet for each student in the four school categories, and the ideal requirements. Results indicate that protein intake is highest in National schools (62 g) and lowest in private schools (45g) though it was not statistically significant. There was a significant difference in retinol and Vitamin A intake between Private schools and other schools types. Consumption of retinol was highest (191 μ g) in Private Schools and lowest (26 μ g) in Extra County schools. Vitamin A consumption in Private schools was significantly different from Extra County and County Schools with a high of (253 μ g) compared to a low of 114 and 40 μ g, respectively. Vitamin B₁ consumption in Extra County schools different from Private schools. The highest (8.15)intake was in County schools which also exceeded the ideal requirement eight time compared to the lowest intake in Extra County schools with almost eight times lower intake. Vitamin B₁₂ consumption is highly consumed in Private schools (1.55 μ g) and least consumed in County Schools (0.7 μ g). Its consumption between Extra County schools and private schools was significantly different Vitamin.

Table 32: The mean amount in grams of the food groups consumed daily by students 15-18 years old in different school types and their percentage contributions to the total dietary intake (g%/student/day)

| Food Group | Extra county schools | National schools | Private schools | County schools |
|------------------------|-----------------------------|-------------------------|------------------------|-----------------------|
| Starchy staples | 849±47 (68.69) | 883±61 (67.66) | 736±35 (64.50) | 898±26 (68.65) |
| Beverages | 170±25 (13.75) | 159±1 (12.18) | 52±21 (4.56) | 201±30 (15.37) |
| Dairy | 0 (0) | 27±54 (2.07) | 0 (0) | 0 (0) |
| Fruits | 80±92 (6.47) | 60±69 (4.60) | 200±105 (17.53) | 0(0) |
| Vegetables | 88±16 (7.12) | 78±9 (5.98) | 44±12 (3.86) | 121±21 (9.25) |
| Legumes | 36±29 (2.91) | 78±13 (5.98) | 45±36 (3.94) | 80±68 (6.12) |
| Meat | 12±11 (0.97) | 14±13(1.07) | 19±17 (1.67) | 8±1 (0.61) |
| Eggs | 1±2 (0.08) | 6±5 (0.46) | 30±40 (2.63) | 0 (0) |
| Spreads | 0 (0) | 0 (0) | 15±10 (1.31) | 0 (0) |
| Total | 1236 (100) | 1305 (100) | 1141 (100) | 1308 (100) |

Values are means±Standard deviations. Values in parenthesis are percentage contributions to total dietary intake.

Source: Author's own compilation

4.4.4. Mean amount of nutrients provided from the diet

Table 33 shows an estimate of the mean amount of nutrients provided from the diet for each student in the four school categories. Results indicate that protein intake is highest in national schools (62 g) and lowest in private schools. Retinol and Vitamin A intake were significantly higher in private schools compared with other school types. Retinol intake was lowest (26 µg) in extra county schools while vitamin A provision in extra county and county schools ranged from 114 to 40 µg. The highest (8.15ug) intake of vitamin B1 was in county schools which also exceeded the required daily intake compared to the lowest intake in extra county schools with an almost eight times lower intake. Vitamin B12 provision is high in private schools (1.55 µg) and lowest in county schools (0.7 µg). Its provision in extra county schools and private schools was significantly different.

Intake of vitamin B6 and folic acid were significantly higher in private schools compared to all other school categories while national schools had the highest calcium and magnesium intakes.

Only the private schools' phosphorous intake was very low 900.6 mg when compared to other schools. There was a significant difference in zinc provision between national and private schools at 9.55 and 6.8 mg, respectively (Table 33).

Table 33: The mean amount of nutrients consumed daily from the total diet of the high school student diets in the sampled schools

| Nutrients | Units | School type | | | | Ideal Nutrient requirements |
|-------------------------------|----------|--------------------------------|--------------------------------|----------------------------|------------------------------|-----------------------------|
| | | Extra County Schools | National Schools | Private Schools | County Schools | |
| Energy | K Cal | 1453.1 ^a ± 267.3 | 1729.0 ^a ± 309.0 | 1494.0 ^a ± 294 | 1576.0 ^a ± 201 | 2036 ^a |
| Minerals | g | 12.46 ^{ab} ±2.8 | 13.95 ^a ±3.5 | 9.73 ^b ±0.9 | 13.40 ^{ab} ±2.12 | |
| Proteins | g | 52.98 ^a ±9.4 | 61.80 ^a ±12.9 | 44.80 ^a ±7.2 | 56.35 ^a ±11.9 | 60.10 ^a |
| Fat | g | 27.38 ^a ±5.9 | 37.27 ^a ±12.8 | 38.80 ^a ±16.7 | 28.75 ^a ±2.9 | 69.10 ^b |
| Carbohydrates | g | 227.8 ^a ±40.9 | 264.8 ^a ±35.3 | 228.8 ^a ±33.7 | 249.0 ^a ±26.3 | 290.7 ^a |
| Dietary fiber | g | 45.83 ^a ±11.9 | 48.63 ^a ±13.1 | 26.13 ^{ab} ±3.6 | 45.80 ^{ab} ±10.0 | 30.0 ^{ab} |
| Retinol* | µg | 26.08 ^b ±10.6 | 66.10 ^b ±31.9 | 191.6 ^a ±129.0 | 35.40 ^b ±4.5 | |
| Vitamin A* | µg | 114.6 ^b ±43.8 | 169.8 ^{ab} ±148.5 | 253.2 ^a ±160.4 | 39.5 ^b ±4.74 | |
| β-Carotene | mg | 882 ^a ±488 | 975 ^a ±1205 | 167 ^a ±310 | 33.75 ^a ±4.88 | |
| Vitamin B₁ | mg | 0.80 ^c ±0.2 | 0.97 ^{bc} ±0.3 | 7.55 ^a ±8.0 | 8.15 ^{ab} ±10.2 | 1.15 ^a |
| Vitamin B₂ | mg | 0.56 ^a ±0.0 | 0.75 ^a ±0.2 | 0.6 ^a ±0.2 | 0.6 ^a ±0.1 | 1.35 ^a |
| Vitamin B₁₂ | µg | 0.74 ^b ±0.5 | 1.12 ^{ab} ±0.8 | 1.55 ^a ±0.9 | 0.7 ^{ab} ±0.1 | 3.00 ^a |
| Vitamin B₆ | mg | 0.21 ^c ±0.1 | 0.43 ^{ab} ±0.2 | 0.48 ^a ±0.2 | 0.15 ^{bc} ±0.0 | 1.40 ^a |
| Folic acid | µg | 32.89 ^b ±14.2s | 38.13 ^b ±15.6 | 68.50 ^a ±34.9 | 19.95 ^b ±3.9 | 400.0 ^a |
| Vitamin C | mg | 67.74 ^a ±26.8 | 44.5 ^a ±37.6 | 63.0 ^a ±17.9 | 31.60 ^a ±6.6 | 100.0 ^a |
| Sodium | mg | 1631.0 ^a ±471 | 1851.0 ^a ± 430 | 1592.9 ^a ±179.3 | 1978.0 ^a ±195 | 2000 ^a |
| Potassium | mg | 1542.0 ^a ±610 | 1863.0 ^a ±537 | 1279 ^a ±345 | 1657 ^a ±345 | 3500 ^a |
| Calcium | mg | 455.4 ^a ±91.8 | 474.0 ^a ±233 | 254.9 ^b ±29.6 | 292.8 ^{ab} ±56.4 | 1200 ^a |
| Magnesium | mg | 295.3 ^a ±67.5 | 330.2 ^a ±80.4 | 210.9 ^b ±25.2 | 290.1 ^{ab} ±43.5 | 375.0 ^a |
| Phosphorus | mg | 1336.0 ^a ±351 | 1551.0 ^a ±399 | 900.6 ^b ±116.7 | 1456.0 ^{ab} ±254 | 1250 ^a |
| Iron | mg | 19.52 ^a ±8.0 | 19.55 ^a ±7.4 | 12.00 ^a ±4.0 | 14.25 ^a ±1.9 | 13.50 ^a |
| Zinc | mg | 8.32 ^{ab} ±1.4 | 9.55 ^a ±1.9 | 6.78 ^b ±1.0 | 8.80 ^{ab} ±1.7 | 8.50 ^a |

Values are means± standard deviation. Values with the same superscript on the same column are not significantly different at p<0.05 as assessed by Fisher's Least significant difference

Source: Author's own compilation

4.4.5. Percentage fulfilment of different nutrients

The percentage fulfilment of the Recommended Daily Allowance of Nutrients for students in the four categories of schools is shown in Table 34. Results show that school meals did not meet 100% of the energy needs of the students. Carbohydrates, proteins and fats provided 57.6, 11.8 and 30.5% of energy requirements, respectively. The meals met more than 75% of the nutritional requirements for proteins, fats and carbohydrates. The diets fell short in vitamins A, C, and B12. In terms of minerals, calcium was the nutrient for which the requirements were least fulfilled (3-37%). The mineral requirements that were adequately fulfilled were phosphorous, iron and zinc.

Table 34: Percentage fulfilment of the different nutrients according to school type

| Nutrients | Units | Recommended value/day ¹ | Percentage (%) fulfilment | | | |
|-------------------------|-------|------------------------------------|---------------------------|------------------|-----------------|----------------|
| | | | Extra County Schools | National Schools | Private Schools | County Schools |
| Energy | kCal | 2036.3 | 71.35 | 84.91 | 73.37 | 77.40 |
| Proteins | g | 60.1 | 88.15 | 102.83 | 74.54 | 93.76 |
| Fat | g | 69.1 | 39.62 | 53.94 | 56.15 | 41.61 |
| Carbohydrates | g | 290.7 | 78.36 | 91.09 | 78.71 | 85.66 |
| Dietary fiber | g | 30 | 152.77 | 162.10 | 87.10 | 152.67 |
| Vitamin A | µg | 1000 | 11.46 | 16.98 | 25.32 | 3.95 |
| Vitamin B ₁ | mg | 1.15 | 69.57 | 84.35 | 656.52 | 708.70 |
| Vitamin B ₂ | mg | 1.35 | 41.48 | 55.56 | 44.44 | 44.44 |
| Vitamin B ₁₂ | µg | 3 | 24.67 | 37.33 | 51.67 | 23.33 |
| Vitamin B ₆ | mg | 1.4 | 15.00 | 30.71 | 34.29 | 10.71 |
| Folic acid | µg | 400 | 8.22 | 9.53 | 9.53 | 4.99 |
| Vitamin C | mg | 100 | 67.74 | 44.50 | 63.00 | 31.60 |
| Sodium | mg | 2000 | 81.55 | 92.55 | 79.65 | 98.90 |
| Potassium | mg | 3500 | 44.06 | 53.23 | 36.54 | 47.34 |
| Calcium | mg | 1200 | 37.95 | 3.95 | 21.24 | 24.40 |
| Magnesium | mg | 375 | 78.75 | 88.05 | 56.24 | 77.36 |
| Phosphorus | mg | 1250 | 106.88 | 124.08 | 72.00 | 116.48 |
| Iron | mg | 13.5 | 144.59 | 144.81 | 88.89 | 105.56 |
| Zinc | mg | 8.5 | 97.88 | 112.35 | 79.76 | 103.53 |

¹WHO, 2006

Source: Author's own compilation

4.4.6. Hypothesis Testing (Objective 4)

Ho₄. Kenyan high schools do not provide student with adequately nutritious meals that are in line with their dietary requirements.

From the foregoing results, table 33 illustrates a summary of the hypotheses. After carrying out a Fisher's Least significant difference, it can be concluded that none of the four categories of schools offer nutritiously adequate foods, as majority of the categories of school either offer less nutrients (under nutrition) or excessive nutrients (Over nutrition). While majority of the nutrients do not indicate significant differences, a few indicate significantly different at $p < 0.05$ hence an **ACCEPTANCE** of the null hypothesis.

5. DISCUSSION

5.1. Discussion of Results (Objective One)

Determine food handler's knowledge, attitude and practice in providing adequate food safety and sanitation services to students

5.1.1 Training of food handlers and Knowledge of HACCP

The study established whether the food handlers undergo in-service training on healthy food preparation, food safety and hygiene. Results showed that, less than half of the respondents 47.5% (97) of the food handlers underwent training. Out of this number, 23.5% of them stated that they regularly underwent training at least once or twice a school term. However, Majority 52.5% (107) of the respondents stated that they had never undergone any form of training on healthy food preparation, food safety and hygiene. These findings contradict a similar study carried out by (SIBANYONI and TABIT, 2017) on food handlers in schools in South Africa, where (70%) of the participants indicated that in-service training for safe food handling had been provided to food handlers in their current National School Nutrition Program (NSNP) food preparation facilities. ABABIO&LOVATT, (2015) and KO, (2013) further emphasis that, proper and adequate training should be given to newly employed food handlers, without which, they should not be allowed to handle food. Adequate knowledge and experience in food safety is imperative for effective formulation of food safety programs in food service establishment, (ALTEKRUSE et al., 1996)

This study also strived to find out whether food handlers have knowledge on HACCP. Majority of the participants 83.3% (170) confirmed that they do not have knowledge on HACCP. This has further been corroborated by the fact that 85.3% (174) of the food handlers indicated that the various institutions in which they worked did not use any HACCP program. The outcome of the current study yielded similar results to those of SIBANYONI and TABIT (2017), where who found that (91.4%) of the food handler in the Mupumalanga region of South Africa were not aware of what Hazard Analysis and Critical Control Points (HACCP) was, and a similar percentage of respondents revealed that majority of the institution in which they worked did not have HACCP programs in place. According to TOMASEVIC et al., (2016), an overwhelming number of institutions neglect important use of tools such as HACCP, hence highly pre expose learners to the risk of food borne diseases. HACCP is a requisite in the global food supply chain that minimizes the occurrence of negative effects of food safety to consumers (HERATH&HENSON, 2010; WILCOCK&BALL., 2017).

5.1.2. Knowledge, attitude and Practice of food handlers

With regards to knowledge, nearly half of the respondents (45%) lacked adequate knowledge that food prepared too long in advance gave microbes time to grow. A similar study conducted by THELWELL-REID (2014) during the retraining of rural Jamaican food handlers observed that a majority of the population, 76%, had adequate knowledge on the influence of time between the preparation of food and the growth of bacteria. Slightly over a half of the respondents, (63%) disagreed with the suggestion that HIV virus could be spread through food, which contrasts with a similar study by THELWELL-REID (2014) who found that only a mere (16%) of the population had the knowledge that HIV cannot be spread through the consumption of food. Slightly over a half (63%) of the respondents, agreed that food handlers could handle food with injuries as long as the wound was covered. These findings were relatively similar to a study conducted by (EBENEZER et al., 2020), on caterers in a Ghanaian high schools, who observed that (67.5%) of catering staff agreed that handing food with injury may be a potential cause for food borne illnesses. Various other scholars reveal much higher results on other studies conducted. on the threat that wounds pose while cooking. They include ANGELILLO et al 2001 (99%), GIRITLIOGLU et al., 2010 (86%) and TOKUC et al., 2009 (93.2%).

In relation to wearing of protective attire while cooking and serving of students, the study observed low scores from the food handlers. Knowledge items such as wearing gloves while handling food protects food service staff from infection, and wearing a cap or chef's hat when touching or distributing foods to learners scored(46%) and (48%), respectively. These findings are inconsistent with observations made by (LARTEY, 2019), who discovered that (95%) of the caterer in high school wore protective clothes, such as gloves, Chef's hat and aprons while cooking or during the service of food to learners. These finding go hand in hand with the findings of, GIRITLIOGLU et al., (2010) and CAKIROGU and UCAR, (2008), which revealed similar percentages of knowledge among food handlers, (97.6 %) and (82.9%) respectively. Similarly a study conducted by KARANJA and ORAGO (2007) on food handler in Embu Municipality in Kenya established that only, 21% of the food handlers did not wear protective clothing while preparing food. However, over 30% of the participants who wore protective cloths, lacked adequate hygiene and as a result wore extremely dirty clothes. Additionally, (36%) of the respondents were of the view that ready to eat food could be prepared on the same cutting boards that were used to prepare meat. These finding are inconsistent with findings from previous studies such as SANTOS et al., (2008) and TOKUC et al., (2009), where there were higher knowledge levels of hand washing after sneezing or

nose blowing which stood at (94%) and, (93%) washing hands with soap in the bathroom rather than in the kitchen sink.

The study observed an adequate level of service among food handlers, with a mean of (4.008) having been acquired by the respondents. These findings were relatively similar to a similar study conducted by WEN-HWA KO, (2011), which revealed an average performance of (4.03) and (4.29) for sanitary guiding and sanitary habit behaviors, respectively. Of concern was, only about a half of the respondents (2.882) used different chopping boards while cutting various food items. These findings contradict a similar study conducted by LILLIAN SOARES et al., (2012) which indicated that 79.1% of Brazilian school food handler use color coded copping boards when preparing food. About Three quarter of the food handlers (2.907) wore gloves in cases of injury prior to cooking. The finding indicated inadequacy in practice among Kenyan high school food handlers, in comparison to a similar study conducted by WEN-HWA KO, (2011), on university restaurant employees, which revealed that 99.6% of the food handlers wore gloves when handling raw ready to eat foods and in case of wounds on their hands. The study also revealed that slightly above a half of the respondents used the three sink method while washing utensils. These findings are similar to ABDULLAH et al., (2016) whereby he found that, slightly above a half (3.79) of the food handlers in universities in Malaysia used the three sink method while washing utensils.

5.1.3. Demographics in relation to Knowledge, Attitude and Practice

In view of Knowledge, the study established male food handlers as more knowledgeable on food transmission diseases and food contamination with average means of (2.833 and 2.761) and (2.683 and 2.633) for males and females respectively. Despite these there was significant difference between food handlers' gender and food contamination. These findings go hand in hand with a similar study conducted by (ISONI et al., 2019), on Brazilian food truck food handlers, where by female food handlers were found to be more knowledgeable, (8.25) compared to their male counterparts (6.97), though this study did not yield a statistically significant difference between knowledge and gender.

In relation to age, ANOVA yielded statistical significance difference between food handlers' age and all knowledge constructs, which included; food transmission diseases ($F= 5.188$, $\rho=0.001>0.05$), personal health and hygiene ($F= 6.824$, $\rho=0.00<0.05$), and food contamination ($F= 4.712$, $\rho=0.001<0.05$). The study revealed that in all instances knowledge decreased with the increase of age. Table 4.8, indicated that food handlers' aged (25 to 35-year) were more knowledgeable on food transmission diseases (mean = 2.930) than those aged 65 and above years

of age (mean = 2.375). Similar results were observed, for personal health and food contamination knowledge constructs with means of 2.589, for 46 to 55-years of age and 2.4 for 65 years and above. These findings contradict AUAD and GINANI et al., (2019) whose findings on a similar study indicated that food handlers aged 40 and above were most knowledgeable (8.17) compared to their younger counterparts aged 26-40 (7.14). The study also yielded no significant differences in relation of knowledge and age. Similar findings were conveyed in a study conducted by ADETUNJI et al. (2018) on the personal hygiene of food handlers in the south region of Makkah, Saudi Arabia. The study revealed no significant differences in the relationship between knowledge and age. This was despite the food handlers showing positive knowledge related to personal hygiene.

Concerning practice, the study observed significant difference ($F= 19.886$, $p=0.00<0.05$) between gender of food handlers' behaviour and practice. This was further emphasized by the study portraying men (4.078) as more keen on caring about food safety and hygiene practices compared to their female counterparts (3.762). These findings contradict a similar study done by (SIBANYONI AND TABIT, 2016) whereby 90% of the food handlers in South African schools were female. Despite this School coordinators, are nominated female teacher, whose role is to ensure hygienic standards are maintained. The study also highlighted significant difference ($F= 18.119$, $p=0.00<0.05$) between respondents' age and practice of food safety and hygiene, with the population aged 56-65 years (4.278) most likely to carry out food safety and hygienic practices compared to above 65 years (2.400). These findings were similar to a study carried out by SIBANYONI and TABIT (2016) who revealed there was high significance between age of food handlers and that majority of the food handlers ranged between 46-65, this also implies that the longer the food handlers worked the more they observed hygienic practices. The study also realized statistically significant difference ($F= 9.543$, $p=0.00<0.05$) between education levels and levels of practice, with food handlers who attended technical colleges (4.051) being in a better position to practice food safety and hygiene compared to those who attended universities (2.143). These findings contradict the findings of (SOARES et al., (2012) and ABDULLAH et al., (2016), despite a common agreement on the moderate level of education shared by food handlers, level of education differs, majority of the food handler only got to High school. Lastly there was significant difference ($F= 17.874$, $p=0.00<0.05$) between job tenure (4.141) and practice, with those food handlers having worked for 4 year (4.141) being more competent to carry out food safety and hygiene practices compared to those worked for one year (3.521)

5.2. Discussion of Results (Objective Two)

To find out the extent to which the current school environment (facilities, equipment, and tuck shop) enhances food safety and health among students during consumption

5.2.1. Kitchen Amenities storage facilities

The findings of the study revealed that majority (94.1%) of the school kitchen visited confirmed the presence of a school menu, these finding were slightly similar to the finding of (SIBANYONIET al., 2017) who in a similar study revealed (98.7%) of kitchen facilities in South Africa acknowledged the presence of a school menu. The Food and Drug Administration (FDA (2006) further affirms the findings, by stating that menus play a vital role in the planning phase of any food and safety management program as it provides guidance on the type of food stuff to be purchased and prepared, various equipment needed, storage facilities required, specific stages for preparation especially food safety critical limits such as final cooking temperatures cooking temperatures that need to be monitored and verified.

The study also indicated that a sizeable percentage (75%) of the respondents noted the existence of a designated kitchen while only 25% noted the existence of a temporary/makeshift kitchen. These findings elaborated a much higher outcome in comparison to a similar study carried out by (KIBRET and ABERA, 2012) where they revealed a (52%) availability of permanent kitchen and a (32.7%) availability of temporary/makeshift kitchens in schools in Mupumalanga region of South Africa. Preparation of food in less adequate infrastructure constitutes a food safety hazard which can easily contribute to the outbreak of food born diseases (KIBRET and ABERA, 2012). Poor layout of food service establishments such as inadequate infrastructure and equipment have been found to be one of the biggest impediments to food safety programs (US DEPARTMENT OF HEALTH AND HUMAN SERVICES, 2015; GARAYOA et al., 2011; LOCKIS et al., 2011). The study further indicated that (65.7%) of the respondents mentioned there was adequate cooking space in the kitchens, while a further (63.7%) affirmed adequate serving space. Similar study conducted by (SIBANYONIET al., 2017) revealed higher percentages (81.6%) of participants in agreement with adequate cooking and serving spaces in South African schools.

In terms of storage facilities, the study noted that all (100%) the kitchen facilities that participated in the study indicated the availability of dry storage facilities. This was despite the poor dilapidated condition of some of the storage facilities and poor storage practices such as placing vegetables on bear floors. In terms of cold storage facilities the study realized that none of the kitchen facilities

had cold rooms, as most of the kitchen managers' sited challenges such as, it was expensive to maintain such facilities in school. Slightly over a half (57.1%) of the respondents opted for dip freezers instead. The rest lacked cold storage facilities. The study also affirmed that all (100%) kitchen storage facilities were cleaned regularly, with majority (66.7%) being cleaned at least once every week. A large percentage (71.4%) of the kitchen facilities preferred the use of First in First out (FIFO) stock rotation system. These findings were similar to those of SIBANYONI (2017) who also indicated that (97%) of the kitchen facilities in South Africa preferred the use of (FIFO).

5.2.2. Kitchen Equipment and Amenities, and Tuck shops

The study indicated that most (76.5%) of the kitchens lacked refrigerators among the facilities, (97%) lacked food warmers, a further (84.3%) did not have thermometers and (83.3%) lacked steamers. Additionally more than half of the participating facilities lacked basic hygiene items such as sanitizers. More than half of the respondents (53.4%) mentioned the lack of adequate work surfaces in kitchens in which they worked while a vast majority (80%) of participants in the study denied the use of color coded chopping boards and further explained that all chopping boards were used for similar purposes. This results are in agreement with the findings of (LOCKIS et al., 2011) who conducted a similar study in Brazilian schools which revealed that only (30%) of them had adequate equipment, out of which only (35%) submitted their equipment for maintenance and calibration and 30% of the equipment and tools had resistance to corrosion hence jeopardizing students' health. These findings also similar to those of BUHL (2010), who whose study of schools in Ghana reported that a vast majority lacked, equipment, kitchens, storage and dining facilities.

The study also brought to light the existence of tuck shops in Kenyan High schools. At least (70%) of schools that participated in the study confirmed the availability of tuck shops in their school compounds. These finding are consistent with HARVEY (2004), where after conducting similar studies in European primary and high schools reported that it was very difficult for schools to avoid canteens or vending machines. Furthermore, the study revealed that majority (55%) of high schools with tuck shops did not control what was sold to students. The outcome of this study contradicts the finding of HARVEY (2004), who found that despite the lucrative earnings that schools gain from various companies that place their vending machine in school, the schools always choose what to be sold or not from the vending machines. According to the RAKOTOSAMIMANANA (2012), in Madagascar, despite the tucks shops providing students and teachers with a range of nourishing and affordable foods and snacks, they are leased to private owners who are not regulated by the

Department of Health. This makes it difficult for schools to control the quality of snacks sold in the tuck shops. In this study also, (80%) of the participants confirmed the lack of healthy snacks in the tuck shops available in their institutions. These findings complement the findings of HARNACK et al., (1999) based on studies in European schools that school canteens, tuck shops and vending machines are characterized as low nutrient, high calorie foods and sweetened drinks. They are the primary source of added sugar in children's daily diet (HARNACK et al., 1999) and increase total energy intake (JAMES, 2004).

The study also investigated the availability of dining facilities in various high schools in Kenya. The finding indicates that a vast majority of the participants, (90%) confirmed the availability of dining facilities in the various institutions that were visited while a small (10%) of the participants denied the availability of dining hall facilities. These findings contradict the BUHL, 2010) who reported that a majority lacked, equipment, kitchens, storage and dining facilities. According to WHO (2016), an inspection of schools in Nova Scotia, found that schools lacked equipment and facilities required to serve food and often were unable to comply with the food safety and service regulations. Further the study also established that (62%) of the participants denied that the facilities were spacious enough, for the various purposes school needed to use them for. These findings corroborate the findings of RUSSELL et al., (2005), where the lack of dining space for students was found to be a particularly troublesome issue. Many schools had been forced to split their lunch periods, which often resulted in very little time for students to eat for only 10 or 15 minutes in some cases.

5.3. Discussion of Results (Objective Three)

To investigate the extent to which the current curriculum enhances adequate food safety and nutrition knowledge and practice among Students

5.3.1 Knowledge on food nutrition and food safety

This study also established the level of knowledge of high school students concerning food safety and sanitation, which also determine the effectiveness of the curriculum, in terms of food and nutrition knowledge. A majority of the students had adequate knowledge on balanced diets and proteins intake, which attained means of 0.97 and 0.95, respectively. On the contrary, students lacked sufficient knowledge in areas such as energy rich and calorific foods and also vitamins and minerals which attained means of 0.50, 0.57 and 0.60, respectively. The study scored an average of 0.65 which was perceived as low. These findings are similar to those from the study by (JAFARI et

al., 2016) in Iran where students' nutrition knowledge was found to be quite low at 48.95% indicating a significant difference between male and female. This was further confirmed by MILOSAVLJEVIĆ and MANDIĆ, 2015) from a study in Croatia that found that students scored an average of (56%), hence inadequate knowledge in nutrition, is an indication of a poor curriculum.

The study further established the level of knowledge on food safety. It was observed that a majority of the respondents were most knowledgeable on aspects such as common symptoms of food poisoning 0.92 and cross contamination of food 0.73. On the other hand students lacked knowledge on aspects such as optimum temperature for the growth of bacteria 0.33, the transmission of cholera through food, 0.41, and causes of food poisoning 0.45. These findings were similar to the findings of (TEMITAYO, 2017), where a majority of Nigerian students were most knowledgeable on aspects such as cross contamination of food (88%), and temperature control on food (68%). The study revealed an average score of 0.58, which signified a poor score and lack of adequate food safety knowledge by the students. The study also yielded similar results to the finding of (KOTEH and MULLAN, 2011) whose study demonstrated an average, slightly lower result 56.7, citing a lack of adequate food safety knowledge among students and a failure of the curriculum.

5.3.2. Practice of food safety and sanitation

With regards to practice of food hygiene and sanitation, this study found that (72.1%) of the respondents always considered checking the expiry date of food items before consumption. These findings are similar to those of AL-SHABIB et al (2016), where after carrying out similar studies on students in Saudi Arabia, found that (75%) of respondents always confirmed expiry dates on food items, Further, (79.1%) of the participants agreed to the fact that they always washed their hands after visiting the toilets and before touching food. These findings went are in agreement with those of TEMITAYO, (2017) where (82%) of high school students in Nigeria always washed their hands after visiting the toilet. Additionally the study also showed that (69.8%) of the participants always washed fruits before consuming to avoid contracting food borne illnesses. These findings go concur with those of KOTEH and MULLAN (2011), where they reported, that healthy handling of fruits and vegetable consumption requires an appropriate level of knowledge, determinant of safe food handling practices.

The study also determined that a significant majority of the respondents (87.1%) always ensured that they purchase food that was clean and in a fresh condition. These findings are in line with the

findings of NAMKUNG (2007), who after carrying out a similar study mentioned that 85% of the respondents were cautious when purchasing food, food had been clean and in fresh conditions. These findings are also similar to the findings of EMMANUEL (2016) who carried out a similar study on senior high school pupils and found that over (90%) would always purchase clean and fresh food. Additionally, a vast majority of the participants (92.8%) always ensured they ate well cooked foods. These findings are similar to those obtained by TEMITAYO, 2017) where (84%) of the participants always ensured they consumed well cooked foods, especially meat due to fear of food borne diseases.

5.3.3. Sources of other foods and the number of times students falling ill

The study investigated other sources of foods for students. A majority of the students (72%) used the schools canteen as their other main source of food other than the schools diet. These results show a huge comparison to the findings of HARNACK et al., (1999), who found that despite being the nearest alternative to the daily menus, tuck shops serve as the main source of unhealthy snack foods and soft drinks, hence the high preference by students as a second source of food to their diets. The second source of food or supplement to the diet for students was food from home of parents and guardians which stood at (24.6%). The study also established the frequency in which students fell ill and exhibited symptoms such as those related to food borne illnesses. The study discovered that more than half of the respondents, (55%) fell ill at least once every term, while (18.4%) fell ill at least twice a term. Additionally the study also revealed that students' perception of the amount and type of foods offered to them, a vast majority of the participants (71%) and (80%) respectively declined that least 4 times a term they were neither satisfied with amount or type of food served to them.

5.3.4. Students' gender in relation to food safety and nutrition Knowledge

The study established the relationship or significance between gender and knowledge in food safety and hygiene. There was a significant difference between gender and knowledge on carbohydrates ($F= 18.491, p=0.000<0.05$), dietary fiber ($F= 68.209, p=0.000<0.05$), fats ($F= 9.364, p=0.00<0.05$), rich in energy ($F= 4.458, p=0.035<0.05$) and nutrition knowledge ($F= 6.062, p=0.014<0.05$). The outcome of the study yielded results similar to those of (BYRD-BREDBENNER et al., 2007) who after carrying out a nationwide study on young adults and their knowledge on food safety and nutrition found that there was a significance between gender and food safety and nutrition knowledge. Also, women were found to be more knowledgeable compared to men. Similar results

were also obtained by MULLAN and KOTEH (2011) who after carrying out a study on university students from both Australia and United Kingdom found that there was a significant difference ($t=7.73$, $P < 0.01$) between gender and food hygiene knowledge. Also female participants were more knowledgeable in comparison to their male counterparts. According to LOW (2016), gender had an influence in relation to the level of education among various ages of consumer in Malaysia.

With regard to age, the study established that most of the variables had a significant difference in relation to age of the participants. They included knowledge on carbohydrates ($F= 18.352$, $\rho=0.000 < 0.05$), proteins ($F= 34.400$, $\rho=0.000 < 0.05$), foods rich in energy ($F= 3.847$, $\rho=0.022 < 0.05$), balanced diet ($F= 14.054$, $\rho=0.000 < 0.05$) and nutrition knowledge ($F= 12.237$, $\rho=0.000 < 0.05$). In contrast, (NAEENI et al., 2014) after carrying out a similar survey in a high school in Nigeria, concluded that there was no significant difference between food hygiene knowledge and age ($F=70.5$, $p=0.125$) despite the young adults aged 12-14 years indicating highest levels of knowledge. On the other hand the study findings are in agreement with those of (BYRD-BREDBENNER et al., 2007) where he established there was a significant difference ($M 5.63$, $p=0.01$) between the knowledge in food hygiene and age. He categorically concluded that knowledge increases with the increase in age. According to SANLIER and KONAKLIOGLU (2012), young adults who lived with their parents had lower levels of knowledge compared to those that lived on their own indicating that knowledge was co tied to age. Therefore, the only way young adults could be independent and live on their own was if they were old enough.

In relation to class level, the study revealed that there was a significant difference between the class level and knowledge on dietary fiber ($F= 3.35$, $\rho=0.02 < 0.05$), knowledge on proteins ($F= 3.06$, $\rho=0.03 < 0.05$), knowledge on foods rich in energy ($F= 15.76$, $\rho=0.00 < 0.05$), knowledge on vitamins and minerals ($F= 7.35$, $\rho=0.00 < 0.05$) and nutrition knowledge ($F= 3.98$, $\rho=0.01 < 0.05$). These finding do not agree with the findings of EMMANUEL (2016) who after carrying out a similar study on adolescents in a Nigerian high school found no significant difference between student's class or grade levels and the level of knowledge of food safety and nutrition. The study finding are in agreement with those of LOU et al (2019) after carrying out an intrinsic study on young Chinese adults from the nursing, education and medical college in Chongqing, and found that education levels had no significant difference ($M264, 000$) in relation to level of education. The study indicated that the higher the level or ranking of education the more knowledgeable participants are. UNKLESBAY et al., (1998) further supports this study by explaining that, knowledge of food

safety and nutrition is greatly influenced by the level of education but by the type of course registered by participants

5.4. Discussion of Results (Objective Four)

To analyze the nutritional quality of meals served to students in relation to dietary requirements.

5.4.1. Diversity of foods consumed

The study found that, the diversity of school meals in private schools was significantly higher compared to those of other schools while county schools consumed least diverse foods. The low diversity of food items could be influenced by limited government funding in public schools, and the more diverse foods in the private school menus could be influenced by the purchasing power of the parents, as attested by high amounts of school fees paid by parents. A study by ZUILKOWSKI et al. (2018) in primary schools in Nairobi shows that Low Cost Private Schools (LCPS) spent an average of Ksh 1962 per annum for school meals while public schools spent an average of Ksh. 870. This can be extrapolated to secondary schools considering that they are guided by similar National School Meals and Nutrition Strategy 2017–2022 (GOVERNMENT OF KENYA/WORLD FOOD PROGRAMME, 2018). Furthermore, studies show that apart from proper infrastructure and better learning conditions in private schools compared to public schools, parents with students in private schools are more likely to pay more money to ensure that their children are well fed in school (ZUILKOWSKI et al., 2018). This could be the reason for increased diversity of school meals in private schools. Private schools have been shown to have better autonomy to make decisions regarding the foods that should appear in school menus compared to public schools (FAO, 2019). Results showed that private schools least consumed starchy staples such as *Ugali* and *githeri*. Their major source of carbohydrate is rice. This could be explained by the fact that maize and beans require a lot of energy to cook, and this might be quite expensive for the private schools and therefore prefer to cook rice.

5.4.2. Food groups consumed

The study established that the majority of the food groups consumed were starchy staples as they contributed more than 60% of the entire diet. Studies indicate that the major foods fed to school children in developing countries are majorly starchy staples (KENNEDY et al., 2007). This is because of their availability and they are low cost sources of energy compared to other food groups.

THOMPSON and AMOROSO (2009) indicate that there is a shift from a varied diet rich in micronutrients to one that is derived from predominantly high carbohydrate starchy staples. Animal source foods have been shown to be least consumed in school menus because they are expensive, particularly in the context of school feeding in developing countries. A study by CORNELSEN et al., (2016) in Kenya found that price was the most reported barrier to consumption of Animal Source Foods (ASF), therefore affordability to most ASF is a major driver to increase their consumption. Additionally, the study revealed that, milk was consumed only by the National schools. This is because they kept dairy animals in their school farms and therefore had a constant supply of milk. AZZARRI et al., (2015) suggests that livestock ownership confers households more opportunities to increase the consumption of animal source food as it translates into cheaper or more reliable access to animal source food supplies. A study by KABUNGA et al., (2017) showed that adoption of improved dairy cow breeds at farm level led to increased consumption of milk in Ugandan households and translated to improved dietary quality among young children. Meat and eggs were also least consumed and they contributed an estimated 2% to the total dietary intake among the high school students. The major source of proteins were legumes, which have been known to have low protein qualities (THOMPSON and AMOROSO, 2009).

However, the study indicated that, fruits were mostly consumed in Private schools (200 g) and were not consumed in at all County schools. The difference could be explained by the purchasing ability of the parents of children attending private schools compared to those attending County Schools. Fruits are known to be an expensive source of energy and therefore could be the reason for high intake in Private schools. Review studies on determinants of fruit and vegetables among adolescents consistently show that high income levels largely influence fruit intake, often because of affordability (RASMUSSEN et al., 2006). Students attending County schools are majorly day scholars and therefore could be meeting their requirements for fruits from their diets at home.

Further, the study found out that, vegetables were majorly consumed in County schools (121g) and least consumed in Private Schools (44 g). The high vegetable consumption in County schools could be explained by the fact that, parents sometimes supply vegetables from their farms as a form of school fees payment, since most of these school types are commonly found in rural areas. A review on determinants of vegetable consumption among adolescents by RASMUSSEN et al., (2006) have shown that availability of vegetables is one of the determinants that greatly influence vegetable intake, which could be true in this study. Furthermore, low vegetable consumption in Private schools could be attributed to lack of engagement of the children in school gardening activities owed to limited land sizes in private schools. Despite epidemiological evidence for the health

benefits of a diet rich in fruits and vegetables, such as reduced risk of chronic diseases later in life (HE et al., 2007), large proportions of adolescents do not meet the WHO requirement of daily intake of at least 400 g (roughly equivalent to five servings per day) of fruits and vegetables (KIMMONS et al., 2009). A study by PELTZER and PENGPID (2010) in seven African countries, Kenya included found that most adolescents (77.5%) did not meet the recommended daily servings of vegetables. Similar results to this have been reported by DOKU et al., (2013) who found that 56% and 48% of adolescents in Ghana rarely consumed fruits and vegetables. According to South African dietary guidelines, it is recommended that adolescents consume at least one fruit and/or vegetable in a meal (KIMMONS et al., 2009). Findings from this study show that this recommendation was not met. This could be due to limited variety of fruits (banana and orange) and vegetables (kales and cabbages) that appear on most of the school menus. This study is in agreement with other studies that fruit and vegetable consumption is consistently low in many Low Middle Income Countries (DARFOUR-ODURO et al., 2018).

5.4.3. The mean amount of nutrients consumed daily from the total diet

The study revealed a significant difference in the protein intake between National and Private Schools. This could be explained by the fact that the major sources of proteins in the school diets is cereals and legumes, therefore the low value reported in Private schools could be due to their low consumption. Furthermore, they consumed more rice and potatoes which are low sources of proteins. However, they consumed more beef, eggs and sausages than the other schools. This implies that as much as their protein intake is low, it is of high quality since it is from animal sources.

The study unveiled, a significant difference in the mineral intake between National and Private schools. This could be explained by the fact that most of the meals consumed in National Schools were whole meal, and therefore the presence of the bran in the foods leads to high mineral content in the diet. On the other hand, most of the foods consumed in private schools such as rice, chapatti and potatoes have low mineral content, and are to some extent processed, and therefore the husks are removed. For example processing of maize by dry milling and fractionation results in the removal of bran which is the major constituent of the pericarp, and which contains B-vitamins and minerals (GWIRTZ AND GARCIA-CASAL, 2014). Furthermore, corn bran contains more iron, zinc and phosphorous than the corn starch (USDA, 2018). This therefore shows that the micronutrient content of cereals reduces greatly after processing and therefore consumption of

processed foods provides a small proportion of the daily requirements for most vitamins and minerals.

Furthermore, the consumption of retinol and Vitamin A was significantly different in private schools compared to the other school types. This is attributed to consumption of higher amounts of fruits, and also spreads in bread which are fortified with Vitamin A, which was not common in other school types. Margarine has been found to be one of the most suitable vehicles for Vitamin A (DARY and MORA, 2002). A study involving Filipino pre-school children who consumed 27 g of vitamin A-fortified margarine per day for a period of 6 months showed that there was a reduced prevalence of low serum retinol from 26% to 10%, hence consumption of the margarine significantly improved the Vitamin A status of the children (SOLON et al., 1996).

In addition, vitamin B₁₂, B₆ and Folic acid intake were significantly higher in Private schools compared to the other school types. These vitamins are commonly gotten from animal source foods such as eggs and beef. Results in this study show that students from private school were fed on more animal source foods compared to the other schools. Calcium, phosphorous and magnesium consumption were significantly lower in Private schools compared to other school types. This is due to the fact that there was low consumption of cereals and legumes which are rich sources of magnesium and phosphorous (ROLFES et al., 2014). The low intake of milk and milk products could explain the low calcium levels in their diet. National schools' consumption of zinc was higher compared to Private schools. This could be explained by the fact that they consumed more beans compared to other schools. They also consumed milk which is a rich source of zinc.

5.4.4. Fulfilment of the different nutrients

Study findings portrayed that, school meals did not meet 100% energy needs of the students. This finding contradict those of BULUKU (2012) who found that energy was adequately met in the diets of girls in selected boarding schools in Nairobi, Kenya. However, this finding concurs with that of NHLAPO et al., (2015) who found that meals served under a South African school feeding scheme did not meet the energy for school children 11-18 years old. Carbohydrates, proteins and fats provided 57.6, 11.8 and 30.5% of energy, respectively. According to SCHOOL FOOD TRUST (2013), a minimum of 50% of energy consumed should be sourced from carbohydrates, less than 35% should be met from fats and the rest from proteins. Results form study indicates that, meals provided met the recommendation on the contributions of the three macronutrients to the energy needs of the high school students. This finding is similar to that of CHARRONDIERE et al., (2004)

on numerous food items from different countries in which the total carbohydrate content supplied 50-80% of energy and 7-11% of energy was from protein.

Protein intake was met only in National schools and fell short in the other school types. This could be attributed to the fact that they consumed more food groups rich in proteins, and was the only school type that served milk. Protein is important in adolescent nutrition as they provide structure for the body and major components of the bones, blood, muscle, cell membranes, enzyme and immune factors (ROLFES et al.,2020).

The study discovered that, public schools had higher intake of dietary fiber as 150%, which could be attributed to consumption of starchy unrefined grains and pulses in meals such as *githeri* (stewed mixture of maize and beans), whole meal *ugali* and vegetables such as kales which are rich in fibre. This is an advantage as high fibre diets have low glycemic index, therefore keeping students full for a longer time hence reduces the rate of hunger. For instance, a study by YE et al., (2015) consumption of dietary fibre decreased hunger and increased satiety hormones in humans when ingested with a meal. This implies that that the students can concentrate in class for long without feeling hungry. However, high fibre diets tend to be rich in phytates and therefore could bind key mineral elements such as calcium and also reduce absorption of minerals such as iron and zinc (PROSKY, 2003). Private schools reported low intake of fibre because of low consumption of *githeri* (57-180g per day), *ugali* (61-93g/day), little consumption of kales, and consumption of potatoes which are low in fibre as compared to the other schools.

Vitamin intake was different among school types; however, the least met intake was in Vitamin A whose intake was less than 50%. For instance, the percentage fulfilment was highest (25%) in private schools and lowest (4%) in County schools. The high consumption in private schools could be due to high intake of fruits, and intake of spreads in bread with is fortified with Vitamin A. The low value reported in County schools is as a result of non-consumption of fruits and spreads. This finding is similar to that of BULUKU (2012) who found that Kenyan boarding school meals did not meet the nutrient requirements for adolescent girls. Vitamin A is a key micronutrient in adolescent nutrition. Vitamins play important roles in the body such as vision, and immunity (Vitamin A), calcium absorption (Vitamin D) and ant oxidative protection in cell membranes (Vitamin E) (ROLFES et al., 2020).

The study revealed that mineral intake among the students varies according to school. Calcium intake was highest in National schools (40% of requirement) and lowest in Private schools (21%). This could be due to milk consumption among students in National schools, compared to Private

schools which did not consume milk. Sodium and potassium percentage fulfilment was more than 50%. Phosphorous, zinc and iron met the nutrient requirement in most school types by more than 100%. This could be attributed to consumption of cereals and pulses which are rich sources of these minerals (ROLFES et al., 2014b). The intake of iron and zinc appears overestimated because the diet was majorly composed of cereals and pulses. These minerals were mainly found in the *githeri*, *ugali*, millet porridge, maize porridge, beans and green grams which were the majorly consumed foods.

However, cereals and legumes contain phyates which chelates with mineral and metals such as calcium, magnesium, zinc and iron, forming insoluble salts that are not easily absorbed by humans (AL HASAN et al., 2016). Pytates particularly form complexes which can severely impair availability of zinc and iron (MURPHY et al., 2018). Furthermore, most schools took beverages in form of tea, coffee or cocoa, which may also contain tannins that could further bind the minerals (DELIMONT et al., 2017). Deficiencies of iron and zinc are a public health problem in developing countries, particularly among adolescents and women of reproductive age. A systematic review to evaluate iron and zinc intakes in adolescents from Ethiopia, Kenya, Nigeria and South Africa concluded that diet related anaemia and zinc deficiencies are problems of public health significance (HARIKA et al., 2017). Zinc is important in adolescence because of its critical function in growth and sexual maturation (KAWADE, 2012). However, adolescents are at high risk of deficiency often related to consumption plant-based diets which have low zinc and iron bioavailability (GIBSON et al., 2018), which is similar to the diets consumed in this study.

6. NEW AND NOVEL SCIENTIFIC RESULTS

School feeding policies are phenomenon's that have been adopted the world over to, ensure adequate nutrition and health, proper food safety practices and sufficient health and nutrition education are either executed or passed on to school goers. This study in particular focuses on the inadequate school feeding policy in Kenya and the challenges it poses to schools in the provision of a healthy and safe environment for school goers. Below are summaries of the New and Novel results.

1. The Novelty of the study comes in to play on the onset. This study is unique as it is the first of its kind to be carried out in Kenya with regard to both enhancing and implementing an already existent school feeding policy. Empirically, based on average knowledge scores, the study denotes insufficient knowledge of food safety and sanitation among food handlers (cooks and cateresses) in Kenyan high schools. This study has provided evidence, that no form of training has been put in place to provide either new skills or refresher course training for cooks and cateresses in Kenyan High Schools. Additionally, lack of knowledge of HACCP among food handlers and lack of implementation of basic HACCP procedures such as (washing of hands, wearing of uniform and food storage) in daily Kitchen operations, made it difficult for schools to provide school goers with adequate food safety and health measures.
2. This study further reveals disunion between the ministry of education (Kenya Government) and Kenyan schools with regard to school feeding. The study outcome verifies that the government is incapable to funding school feeding in the country hence, relegates school feeding responsibilities to school principals who in turn provide catering facilities based on the resources available. Coupled with the lack of a school feeding policy, schools in Kenya provide student with the bare minimal food safety and sanitation services in relation to school feeding. The situation has further lead to, majority of Kenyan high schools lacking adequate infrastructure such as large enough kitchens and dining halls, causing many school to construct temporary make shift facilities that pose even greater food safety and sanitation risk to students. In addition, most Kenyan high schools lack basic kitchen facilities such as fridge's and freezers, thermometers and mechanical cutters and slices, hence posing even greater risk of food borne illness especially regarding foods that need cold storage to increase the shelf life.

3. The study contributes empirical knowledge with regard to the nutritional quality of meals served to students in various categories of high schools. Study findings confirm that the lack of nutritional guidelines in Kenyan schools have caused high schools to fail in providing students with nutritionally adequate foods in terms of both types and quantities of foods offered per meal. Based on the WHO (2004) recommended nutrient intake majority of the schools provide less nutrients than required while in some cases they greatly surpass the recommended dietary requirements. For instance, most of the Kenyan high schools provide dietary fiber, three times more than its recommended daily allowance. In retrospect, the provision of meals in schools without dietary guidelines, is leading Kenyan high schools to promote malnutrition other than alleviating it.

4. The study has shown that the lack of adequate knowledge and failure to practice food safety and sanitation has led to a high number of cases related to food borne illnesses among students in Kenyan high schools. The study demonstrates that despite students registering significant levels of knowledge, they had inadequate levels of nutritional knowledge. Furthermore, admissions by Students' to high frequency (at least once every term) of falling ill from food related diseases, is a strong testament to poor food safety and sanitation practices among students. This further demonstrates the poor practice levels among students established in this study. The content of or poor implementation the current curriculum in schools seems to be the major cause as the it does not teach or train students on matters related to food safety and sanitation.

7. CONCLUSIONS AND RECOMMENDATION

7.1. Conclusion

From the forgoing, it is concluded that food handlers in Kenyan high schools possess significant levels of knowledge and practice to provide adequate food safety and sanitation services to high school students. Despite this, food handlers face many challenges that pose a threat to their effective and efficient delivery of services, including, the lack of training, poor knowledge of HACCP, poor application or non-existence of HACCP procedures in almost all kitchen facilities, poor provision of protective ware, lack of basic equipment such fridge's and freezers and in some cases poor kitchen facilities (temporary kitchens). From the study findings, the lack of training or refresher courses offered to food handlers, results in a lapse in food safety and sanitation knowledge among food handlers. This is especially evident, as food handlers lack adequate personal hygiene knowledge, indicated by the lowest average scores. Additionally, lack of training or refresher course exerts a negative impact in food handler's attitude as the food handlers fail to see the importance in taking precautionary food safety and sanitation measures. As a result, the study concluded that; Null hypothesis (**Hypothesis H_{01}**) **Knowledge: Rejected, Attitude: Accepted, and Practice: Rejected.**

With reference to the influence of curriculum on student's knowledge of food safety and nutrition and the practice of food safety and sanitation, the study concludes that, high school student in Kenya have inadequate knowledge on both nutrition and food safety. This is clearly indicated by the low average scores obtained by high school students. Furthermore, in relation to practice, the study demonstrates relatively low average scores obtained by students, with student low scores on basic food safety practices such as washing of fruits before consumption and washing hands after visiting the toilets. Additionally, the high frequency of students falling ill due to food borne diseases shows the inadequacy of the curriculum in influencing student's nutrition and food safety knowledge, as well as the practice of food safety and hygiene. Majority of the students fell ill at least once every school term. Despite a significant relationship between knowledge and practice of food safety and sanitation, the study concludes that inadequate nutrition and food safety knowledge results in poor food safety and sanitation practice. As a result, the **Hypothesis H_{03}** , on **Knowledge was Rejected** and on **Practice was Rejected.**

The study further concludes that Kenyan high schools fail to provide students with adequately nutritious foods. In comparison to the WHO (2004) recommended nutrient intake which acts as worldwide benchmark for the development for school dietary guidelines, the study demonstrates

that none of the high schools in Kenya adequately meet the nutritional requirements of meals served to school goers of this age group. Furthermore, study findings established that Kenyan high school meal menus lack a variation in food options, are very repetitive and simplistic in nature. It observed that most consumed foods in schools have high dietary fiber such as, Githeri (mixture of maize and beans) and starchy foods such as Ugali (stiff porridge) and rice whereas the least consumed food are fruits and vegetables and proteins especially during breakfasts. National schools consume the highest quantities of starch and dietary fiber in comparison to other high schools whilst county schools consume the highest quantities of vegetables. In addition, private schools consumed the highest quantities of breakfast proteins while county schools consumed the highest quantities of legumes. Majority of Kenyan high school failed to attain nutrient requirement in meals offered to students while in some cases schools surpassed the recommended amount such as dietary fiber offered more than three times the recommended Amount. As a result, the null hypotheses (**Hypothesis H_{04}**) was accepted

Finally, the study concludes that Kenyan schools lack adequate equipment and facilities to facilitate provision of health and safe foods to school goers. According to the study, Kenyan schools lack basic facilities such as adequate kitchens and dining halls that suit their intended purpose. Due to lack of funds from the government, schools are prompted to use cheap quick solutions, other than long term solutions, hence the creation of makeshift kitchens which do not meet requirements and jeopardize the provision of safe and healthy foods to students. Furthermore, schools also lack basic kitchen equipment such a fridges, dip freezers as well as adequate cutlery and crockery. The government should provide funds for school feeding and not relegate the responsibility to school heads of principals.

Table 35: Summary of the Hypothesis

| | Objective | Hypotheses | Acceptance or Rejection |
|----|--|---|--------------------------------|
| 1. | To determine food handler's knowledge, attitude and practice in providing adequate food safety and sanitation services to students | Ho1a. Food handlers lack significant knowledge, to ensure proper food safety and sanitation services to students. | REJECTED |
| | | Ho1b. Food handlers lack significant Attitude, to ensure proper food safety and sanitation services to students. | ACCEPTED |
| | | Ho1c. Food handlers lack significant practice, to ensure proper food safety and sanitation services to students. | REJECTED |
| 2. | To find out the extent to which the current school environment (facilities, equipment, tuck shop) enhances food safety and health among students during consumption | Ho2. The current school environment (facilities, equipment, tuck shop) does not significantly enhance food safety and health among students during consumption | |
| 3. | To investigate the extent to which the current curriculum enhances adequate food safety and nutrition knowledge, as well as the practice of food safety and sanitation among students. | Ho3a. The current curriculum significantly enhances adequate food safety and nutrition Knowledge among Students | REJECTED |
| | | Ho3b. The current curriculum significantly enhances the practice of food safety and sanitation among Students | REJECTED |
| 4. | To analyze the nutritional quality of meals served to students in relation to their dietary requirements | Ho4. Quality nutritious foods are always served to students which are in line with their dietary requirement. | ACCEPTED |

Source: Author's own compilation

7.2. Recommendations

Based on the findings of the research, it is recommended that the following be considered in improving health, food safety and sanitation in Kenyan schools

1. The Kenyan government through the ministry of education, should urgently develop and implement a comprehensive, robust, and all inclusive school feeding policy, that addresses

the needs of students in all the regions of Kenya that would spear head development, growth, learning ensure health, and safety among Kenyan schools. This would help bring, equity among various categories of schools, and a sustainable healthy and safe environment for school goers all around the country. If successfully implemented, the policy could be emulated in the larger east Africa region, Uganda, Ethiopia, Rwanda, Tanzania, Eretria and Djibouti, as these countries face similar challenges with school feeding

2. The ministry of education in collaboration with the ministry of health should ensure stringent health and food safety measures in Kenyan schools, as both the reported and unreported numbers of food borne illnesses among schools are relatively high. The duo should ensure that schools have adequate commercial kitchens as stipulated by law. They should ensure proper kitchen procedures or guidelines and food safety standards are adhered to by various institutions in accordance with the law. They should encourage institutions to hire adequately qualified personnel and provide necessary trainings and refresher courses when required.
3. The ministry of education should ensure a more robust and dynamic curriculum, one that not only teaches the theoretic aspects, but also encompasses the practical aspect as well so as to curb the numerous food borne illness cases that have occurred among students due to inadequate knowledge and poor levels of practice. Additionally, the curriculum should emphasize on physical education, specify particular activities to be carried out in the sessions and train teachers for physical education, so that learners are guided through these sessions. Schools should be sensitized on the importance of physical education, so as not replace physical education lessons with other subjects.
4. The ministry of education should ensure the development and implementation of nutrition guidelines for schools in the country, to provide a bench mark and standardize the provision of meals to students in the entire country. This would improve the type of meals offered to students. It would reduce the monotony of particular types of meals and ultimately the nutritional value of the meal. If adequately developed and implemented, the government would use it as mitigating tool in the prevention of malnutrition (Under and over nutrition) in the county, and to address deficiency cases country wide through fortification of foods used for school feeding. Additionally it would assist the government attain some of the SDG goals in the country such as Education, Good health and equality.

5. Government should fund and invest in school feeding in Kenya. The Kenyan government should be more involved in the feeding of students in schools, and not relegate this responsibility to schools to feed their own students. Due to lack of funding schools lack facilities such as adequate kitchens, dining halls and even storage facilities, while equally lack kitchen equipment such fridges and deep freezers, food warmers and so on.

8. SUMMARY

The purpose of this thesis was to establish the influence and inadequate school feeding policy in Kenyan schools, while trying to provide both safe and healthy, services and environment for students. After an intensive review of literature, it was established that Kenya is among many developing countries that despite needing school feeding policies to assist alleviate hunger, poverty, improve school attendance and mitigate malnutrition among the population, little or no attention is paid in the creation and development of a sustainable policy.

To carry out in depth analysis, four research questions and five hypotheses were drawn from the study. The study employed a descriptive cross sectional survey drew a sample size of 780 participants comprising school principals, cooks and cateresses and students in Kenyan high schools. The study was conducted in eight different counties in Kenya namely Nakuru, Uasin Gishu, Nandi, Kakamega, Nairobi, Kisumu, Likipia and ElgeyoMarakwet. Questioners were self administered, in some cases researcher administered. Additionally, semi structured interviews were also used for data collection. The researcher employed purposive judgmental sampling to select both the counties and high schools that participated in the study. This was done based on preliminary knowledge of the various counties and how well they were facilitated with various school categories. While stratified sampling was used for in the selection of various cooks and cateresses.

Data was subjected to various tests, Anova and correlation was used to address research questions 1 (hypothesis *Ho_{1a}*, *Ho_{1b}*, *Ho_{1c}*) and 3 (hypothesis *Ho_{3a}*, *Ho_{3b}*). Fisher's Least significant difference was used to address research question 4 (hypothesis *Ho₄*), while research question 2 was addressed by the use of descriptive statistics. Results revealed that food handler knowledge and practice was significant, however the lack of training or refresher courses offered to the food handler cause them to score primarily poor knowledge and practice scores, additionally lack appropriate attitude towards food safety and sanitation. The study also indicated inadequate knowledge of food safety and nutrition among high school students in Kenya. The study further revealed that poor practice of food safety and sanitation by students, which was also reflected in the high frequency with which students fell ill.

Additionally, the study revealed that high school students in Kenya were fed on poor diets, none of which meet WHO recommended daily intake requirements. Finally, the study revealed that majority of the high schools in Kenya were found to lack adequate facilities such as kitchens, dining halls and food storage facilities Moreover, they lacked basic kitchen equipment such as

fridges and dip freezers for cold food storage. It was recommended that government and relevant stakeholders should deliberate and agree on the development and implementation of a more robust school feeding policy in Kenya, that would ensure proper recruitment and training of food handlers and a curriculum adequate in content for the students to learn food safety and sanitation both practically and theoretically. Lastly a policy that would ensure the development of Dietary guide/ Nutritional guides, which would guide schools on how to feed students.

9. ACKNOWLEDGMENTS

First and foremost, all praise and honor to the Almighty God for his enduring love for me, and the opportunity and capacity he granted me that saw me through my PhD study. I also wish to express my deepest and most sincere appreciation and gratitude to Prof. Dr. Csaba Bálint Illés and Prof. Dr. Anna Dunay for their remarkable support, continuous patience, encouragement, valuable advice and guidance during my PhD studies, as well as the warm and cordial friendship they accorded me.

Special thanks are extended to the institute of Business Economics, Leadership and Management for accepting me in to the program and allowing me to fulfill my dream of attaining a PhD.

I especially want to thank my family, my parents, Dr. Charlotte Serrem and Dr. Cornelius Serrem, and my brothers Rodel and Edgar for their constant love, support and consistent encouragement that saw me through my PhD studies. Finally, special gratitude are extended to my fiancée, Bridgette for her endless love and support, always cheering me on and being my sounding board whenever things got difficult.

Heartfelt thanks are also extended to Prof. Maria Farkas-Feketefor valuable advice and consistent support.

Last but not least, special thanks to my classmates and colleagues, who, always were a voice of reason and made challenging situations manageable. Thanks to everyone who has directly or indirectly contributed to the success of my doctoral degree.

APPENDIX 1: REFERENCES

1. ABABIO, P.F. AND LOVATT, P., 2015. A review on food safety and food hygiene studies in Ghana. *Food Control*, 47, pp.92-97.
2. ABDULLAH, N.F., TEO, P.S. and FOO, L.H., 2016. Ethnic differences in the food intake patterns and its associated factors of adolescents in Kelantan, Malaysia. *Nutrients*, 8(9), p.551.
3. ADAMOVICH, Y., ROUSSO-NOORI, L., ZWIGHAFT, Z., NEUFELD-COHEN, A., GOLIK, M., KRAUT-COHEN, J., WANG, M., HAN, X. AND ASHER, G., 2014. Circadian clocks and feeding time regulate the oscillations and levels of hepatic triglycerides. *Cell metabolism*, 19(2), pp.319-330.
4. ADELMAN, S., GILLIGAN, D. AND LEHRER, K., 2008. *How effective are food for education programs?: A critical assessment of the evidence from developing countries* (Vol. 9). Intl Food Policy Res Inst.
5. ADETUNJI, H., BAOTHMAN, M., ALSERHAN, F., ALMUNYIF, A., ALSHARBE, G. AND SAMAREN, H., 2018. Knowledge, Attitude, and Practice (KAP) of Personal Hygiene among Food Handlers in the South Region of Makkah, Saudi Arabia. *International Journal of Medical Research & Health Sciences*, 7(5), pp.96-102.
6. ADETUNJI, HAMED ADEMOLA, GAFAAR SOLA SALAMI, MOHAMED SALIH EL FADIL, MOHAMMED SHAMIM, TABREZ UZ ZAMAN, MOHAMMED BAKRI, KHALIL MOHAMED, AND MOHAMED OSMAN ELAMIN BUSHARA. "Relative Merits of Selected Anthropometric Measurements for Detecting Protein-Energy-Malnutrition (PEM) in Children Under Five Years in a Resource Limited Setting." *International Journal of Medicine and Public Health* 9, no. 4 (2019).
7. AL HASAN, S.M., HASSAN, M., SAHA, S., ISLAM, M., BILLAH, M. AND ISLAM, S., 2016. Dietary phytate intake inhibits the bioavailability of iron and calcium in the diets of pregnant women in rural Bangladesh: a cross-sectional study. *BMC Nutrition*, 2(1), p.24.
8. ALDERMAN, H. AND BUNDY, D., 2011. School feeding programs and development: are we framing the question correctly?. *The World Bank Research Observer*, 27(2), pp.204-221.
9. ALIYAR, R., GELLI, A. AND HAMDANI, S.H., 2015. A review of nutritional guidelines and menu compositions for school feeding programs in 12 countries. *Frontiers in public health*, 3, p.148.

10. AL-KANDARI, D., AL-ABDEEN, J. AND SIDHU, J., 2019. Food safety knowledge, attitudes and practices of food handlers in restaurants in Kuwait. *Food control*, 103, pp.103-110.
11. ALLEN, S. AND DE BRAUW, A., 2019. Nutrition-Sensitive Value Chain Development in a Changing Climate. In *The Climate-Smart Agriculture Papers* (pp. 247-256). Springer, Cham.
12. ALTEKRUSE, S.F., STREET, D.A., FEIN, S.B. AND LEVY, A.S., 1996. Consumer knowledge of food borne microbial hazards and food-handling practices. *Journal of food protection*, 59(3), pp.287-294.
13. ANGELILLO, I.F., VIGGIANI, N.M., GRECO, R.M. AND RITO, D., 2001. HACCP and food hygiene in hospitals knowledge, attitudes, and practices of food-services staff in Calabria, Italy. *Infection Control & Hospital Epidemiology*, 22(6), pp.363-369.
14. AURINO, E., TRANCHANT, J.P., DIALLO, A.S. AND GELLI, A., 2018. School Feeding or General Food Distribution?.
15. AZZARRI, C., CROSS, E., HAILE, B. AND ZEZZA, A., 2014. *Does livestock ownership affect animal source foods consumption and child nutritional status? Evidence from rural Uganda*. The World Bank.
16. BALDWIN, T.T. AND FORD, J.K., 1988. Transfer of training: A review and directions for future research. *Personnel psychology*, 41(1), pp.63-105.
17. BARNEKOW, V., BUIJS, G., CLIFT, S., BRUUN JENSEN, B. AND PAULUS, P.R., D., YOUNG, I. 2006. Health promoting schools: a resource for developing indicators. ENHPS, Council of Europe, WHO, European Commission.
18. BASTIA, T., 2007. South Africa: a desk review of the school feeding programs. *Rome: World Food Programme*.
19. BILLSBOROUGH, S., 1999. An approach to food hygiene and safety training. *Health and Hygiene*, 20(1), p.5.
20. BITTSÁNSZKY, A., TÓTH, A.J., ILLÉS, B. CS. AND DUNAY, A. 2015. Knowledge and Practice in Food Safety Processes: A Case Study on Hungarian School Catering. *International Journal of Innovation and Learning*, 18 (3), pp. 380-396., <https://doi.org/10.1504/IJIL.2015.071554>
21. BOVET, P., VISWANATHAN, B., SHAMLAYE, C., ROMAIN, S. AND GEDEON, J., 2010. Addressing non-communicable diseases in the Seychelles: towards a comprehensive plan of action. *Global health promotion*, 17(2_suppl), pp.37-40.

22. BROWN, R. AND OGDEN, J., 2004. Children's eating attitudes and behaviour: a study of the modelling and control theories of parental influence. *Health education research*, 19(3), pp.261-271.
23. BUHL, A., 2010. Meeting nutritional needs through school feeding: a snapshot of four African nations. *Global Child Nutrition Foundation*.
24. BUHL, A.L., COLOPLAST AS, 2010. *Package for an ostomy appliance*. U.S. Patent 7,704,240.
25. BUNDY, D., BURBANO, C., GROSH, M.E., GELLI, A., JUKE, M. AND LESLEY, D., 2009. *Rethinking school feeding: social safety nets, child development, and the education sector*. The World Bank..
26. BUZBY, J.C. AND GUTHRIE, J.F., 2002. Plate waste in school nutrition programs. *The Journal of Consumer Affairs*, 36(2), pp.220-238.
27. BYRD-BREDBENNER, C., MAURER, J., WHEATLEY, V., SCHAFFNER, D., BRUHN, C. AND BLALOCK, L., 2007. Food safety self-reported behaviors and cognitions of young adults: results of a national study. *Journal of food protection*, 70(8), pp.1917-1926.
28. ÇAKIROĞLU, F.P. AND UÇAR, A., 2008. Employees' perception of hygiene in the catering industry in Ankara (Turkey). *Food Control*, 19(1), pp.9-15.
29. CANADA. HEALTH CANADA, 1999. *Nutrition for a healthy pregnancy: national guidelines for the childbearing years*. Health Canada.
30. CARDELLO, A.V., BELL, R. AND KRAMER, F.M., 1996. Attitudes of consumers toward military and other institutional foods. *Food Quality and Preference*, 7(1), pp.7-20.
31. CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC), 1997. Lyme disease--United States, 1996. *MMWR. Morbidity and mortality weekly report*, 46(23), p.531.
32. CENTERS FOR DISEASE CONTROL AND PREVENTION, 2017. Core elements of hospital antibiotic stewardship programs. Atlanta, GA: US Department of Health and Human Services, CDC; 2014.
33. CHARRONDIERE, U.R., CHEVASSUS-AGNES, S., MARRONI, S. AND BURLINGAME, B., 2004. Impact of different macronutrient definitions and energy conversion factors on energy supply estimations. *Journal of food composition and analysis*, 17(3-4), pp.339-360.
34. CLAYTON, D.A. AND GRIFFITH, C.J., 2008. Efficacy of an extended theory of planned behaviour model for predicting caterers' hand hygiene practices. *International journal of environmental health research*, 18(2), pp.83-98.

35. COHEN, J.F., RICHARDSON, S., PARKER, E., CATALANO, P.J. AND RIMM, E.B., 2014. Impact of the new US Department of Agriculture school meal standards on food selection, consumption, and waste. *American journal of preventive medicine*, 46(4), pp.388-394.
36. COLLINS, A. AND FAIRCHILD, R., 2007. Sustainable food consumption at a sub-national level: an ecological footprint, nutritional and economic analysis. *Journal of Environmental Policy & Planning*, 9(1), pp.5-30.
37. COMPO, G.P., SARDESHMUKH, P.D., WHITAKER, J.S., BROHAN, P., JONES, P.D. AND MCCOLL, C., 2013. Independent confirmation of global land warming without the use of station temperatures. *Geophysical Research Letters*, 40(12), pp.3170-3174.
38. CONKLIN, M.T., CRANAGE, D.A. AND LAMBERT, C.U., 2005. Nutrition information at point of selection affects food chosen by high school students. *Journal of Child Nutrition & Management*, 20(2), pp.97-108.
39. CORNELSEN, L., ALARCON, P., HÄSLER, B., AMENDAH, D.D., FERGUSON, E., FÈVRE, E.M., GRACE, D., DOMINGUEZ-SALAS, P. AND RUSHTON, J., 2016. Cross-sectional study of drivers of animal-source food consumption in low-income urban areas of Nairobi, Kenya. *BMC nutrition*, 2(1), p.70.
40. CROCKETT, S.J., MULLIS, R.M. AND PERRY, C.L., 1988. Parent nutrition education: a conceptual model. *Journal of School Health*, 58(2), pp.53-57.
41. DARFOUR-ODURO, S.A., BUCHNER, D.M., ANDRADE, J.E. AND GRIGSBY-TOUSSAINT, D.S., 2018. A comparative study of fruit and vegetable consumption and physical activity among adolescents in 49 Low-and-Middle-Income Countries. *Scientific reports*, 8(1), pp.1-12.
42. DARY, O. AND MORA, J.O., 2002. Food fortification to reduce vitamin A deficiency: International Vitamin A Consultative Group recommendations. *The Journal of nutrition*, 132(9), pp.2927S-2933S.
43. DENMAN, S., 1999. Health promoting schools in England-a way forward in development. *Journal of Public Health*, 21(2), pp.215-220.
44. DIXEY, R., HEINDL, I., LOUREIRO, I., PÉREZ-RODRIGO, C. AND INTERNATIONAL PLANNING COMMITTEE, 1999. Healthy eating for young people in Europe: a school-based nutrition education guide. In *Healthy eating for young people in Europe: A school-based nutrition education guide*.

45. DOKU, D., KOIVUSILTA, L., RAISAMO, S. AND RIMPELÄ, A., 2013. Socio-economic differences in adolescents' breakfast eating, fruit and vegetable consumption and physical activity in Ghana. *Public health nutrition*, 16(5), pp.864-872.
46. DRAKE, L., WOOLNOUGH, A., BUNDY, D. AND BURBANO, C. EDS., 2016. *Global school feeding sourcebook: lessons from 14 countries*. world scientific.
47. DUNAY, A., BITTSÁNSZKY, A., TÓTH, A. J. AND ILLÉS, B. CS. 2015. Minőségaziskolaiétkeztetésben. (Quality in school catering service), *Élelmiszer, Táplálkozásés Marketing*, 11(2). pp. 17-22.
48. EBENEZER, A.V., KUMAR, M.D., KAVITHA, S. AND BANU, J.R., 2020. State of the art of food waste management in various countries. In *Food Waste to Valuable Resources* (pp. 299-323). Academic Press.
49. EDITH, M. AND PRIYA, L., 2016. Knowledge, attitude, and practice (KAP) survey on dietary practices in prevention of malnutrition among mothers of under-five children. *Manipal Journal of Nursing and Health Sciences (MJNHS)*, 2(2), pp.19-24.
50. EDMONDS, C.J. AND JEFFES, B., 2009. Does having a drink help you think? 6–7-Year-old children show improvements in cognitive performance from baseline to test after having a drink of water. *Appetite*, 53(3), pp.469-472.
51. EDWARDS 3RD, H.M., DOUGLAS, M.W., PARSONS, C.M. AND BAKER, D.H., 2000. Protein and energy evaluation of soybean meals processed from genetically modified high-protein soybeans. *Poultry Science*, 79(4), pp.525-527.
52. EDWARDS, J.S.A. AND HARTWELL, H.H., 2002. Fruit and vegetables—attitudes and knowledge of primary school children. *Journal of Human Nutrition and Dietetics*, 15(5), pp.365-374.
53. EMMANUEL, L.R., Knowledge and Practices of Food safety among Senior secondary school students of Ambassadors College, Ile-Ife, Nigeria.
54. ENE-OBONG, H., SCHÖNFELDT, H.C., CAMPAORE, E., KIMANI, A., MWAISAKA, R., VINCENT, A., EL ATI, J., KOUEBOU, P., PRESSER, K., FINGLAS, P. AND CHARRONDIERE, U.R., 2019. Importance and use of reliable food composition data generation by nutrition/dietetic professionals towards solving Africa's nutrition problem: constraints and the role of FAO/INFOODS/AFROFOODS and other stakeholders in future initiatives. *Proceedings of the Nutrition Society*, 78(4), pp.496-505.
55. ENGHARDT BARBIERI, H., PEARSON, M. AND BECKER, W., DIETARY HABITS AND NUTRIENT INTAKE IN SWEDISH CHILDREN 4 YEAR OLD AND SCHOOL

- CHILDREN IN GRADE 2 AND 5. RIKSMATEN–CHILDREN 2003, National Food Administration, Uppsala, Sweden: 2007.
56. ETTENBERG, S.A., CHARLAT, O., DALEY, M.P., LIU, S., VINCENT, K.J., STUART, D.D., SCHULLER, A.G., YUAN, J., OSPINA, B., GREEN, J. AND YU, Q., 2010. Inhibition of tumorigenesis driven by different Wnt proteins requires blockade of distinct ligand-binding regions by LRP6 antibodies. *Proceedings of the National Academy of Sciences*, 107(35), pp.15473-15478.
57. FAIRCHILD, R. AND COLLINS, A., 2011. Serving up healthy and sustainable school meals? An analysis of school meal provision in Cardiff (UK). *Journal of Environmental Policy & Planning*, 13(3), pp.209-229.
58. FANZO, J., HAWKES, C., UDOMKESMALEE, E., AFSHIN, A., ALLEMANDI, L., ASSERY, O., BAKER, P., BATTERSBY, J., BHUTTA, Z., CHEN, K. AND CORVALAN, C., 2018. Global Nutrition Report: Shining a light to spur action on nutrition.
59. FAO, I. AND UNICEF, 2018. WFP AND WHO: THE STATE OF FOOD SECURITY AND NUTRITION IN THE WORLD 2018. *Building climate resilience for food security and nutrition*, 200.
60. FAO, I., 2015. WFP (2014) 'The State of Food Insecurity in the World 2014: Strengthening the enabling environment for food security and nutrition', Rome: FAO.
61. FAO, I., 2015. WFP (2015) The state of food insecurity in the world 2015. In *Meeting the* (pp. 107-119).
62. FAO, I., 2015. WFP. 2014. The State of Food Insecurity in the World 2014. Strengthening the enabling environment for food security and nutrition. Rome, FAO.
63. FAO, I., 2016. WFP (2015), The State of Food Insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress. *Food and Agriculture Organization Publications, Remunerability analysis*. 2011.
64. FAO, I., WFP (2013) The state of food insecurity in the world 2013. *The multiple dimensions of food security*.
65. FAO, W., 2004. UNU. Human Energy Requirements. *Food and Nutrition Technical Report Series, 1*, p.20074.
66. FAO. 2019. Nutrition guidelines and standards for school meals: a report from 33 low and middle-income countries. Rome. 106 pp. Licence: CC BY-NC-SA 3.0 IGO
67. FINAN, T., 2010. Evaluation on school feeding programme in Kenya.
68. FISHER, D.L., RIZZO, M., CAIRD, J. AND LEE, J.D. EDS., 2011. *Handbook of driving simulation for engineering, medicine, and psychology*. CRC Press.

69. FISHER, E., 2007. A desk review of the Ghana School Feeding Programme. The World Food Programme's Home Grown School Feeding Project.
70. FLICK, H., BARRETT, S. AND CARTER-HANSON, C., 2016. Oral health on wheels: A service learning project for dental hygiene students. *American Dental Hygienists' Association*, 90(4), pp.226-233.
71. GARAYOA, R., VITAS, A.I., DÍEZ-LETURIA, M. AND GARCÍA-JALÓN, I., 2011. Food safety and the contract catering companies: Food handlers, facilities and HACCP evaluation. *Food Control*, 22(12), pp.2006-2012.
72. GELLI, A., AL-SHAIBA, N. AND ESPEJO, F., 2009. The costs and cost-efficiency of providing food through schools in areas of high food insecurity. *Food and Nutrition Bulletin*, 30(1), pp.68-76.
73. GIBSON, R.S., RABOY, V. AND KING, J.C., 2018. Implications of phytate in plant-based foods for iron and zinc bioavailability, setting dietary requirements, and formulating programs and policies. *Nutrition reviews*, 76(11), pp.793-804.
74. GIRITLIOĞLU, İ. AND AVCIKURT, C., 2010. An Investigation directing at the undergraduate tourism students on the classification of school websites using kano model. *Journal of Travel and Hospitality Management*, 7(3), pp.64-78.
75. GIRITLIOĞLU, İ., OLCAY, A. AND ÖZEKICI, Y.K., 2015. Bir Turizm Çeşitliliği Olarak Festival Etkinliklerinin Sınıflandırılması: Türkiye Üzerine Bir Değerlendirme. *ODÜ Sosyal Bilimler Araştırmaları Dergisi (ODÜSOBİAD)*, 5(13), pp.306-323.
76. GORARD, S., 2012. Who is eligible for free school meals? Characterizing free school meals as a measure of disadvantage in England. *British Educational Research Journal*, 38(6), pp.1003-1017.
77. GOVERNMENT OF KENYA/WORLD FOOD PROGRAMME, 2018. National School Meals and Nutrition Strategy 2017-2022.
78. GREEN, L.R., RADKE, V., MASON, R., BUSHNELL, L., REIMANN, D.W., MACK, J.C., MOTSINGER, M.D., STIGGER, T. AND SELMAN, C.A., 2007. Factors related to food worker hand hygiene practices. *Journal of food protection*, 70(3), pp.661-666.
79. GROSH, M., DEL NINNO, C., TESLIUC, E. AND OUERGHI, A., 2008. *For protection and promotion: The design and implementation of effective safety nets*. World Bank Publications.
80. GUENTHER, P.M., KIRKPATRICK, S.I., REEDY, J., KREBS-SMITH, S.M., BUCKMAN, D.W., DODD, K.W., CASAVALE, K.O. AND CARROLL, R.J., 2014. The

- Healthy Eating Index-2010 is a valid and reliable measure of diet quality according to the 2010 Dietary Guidelines for Americans. *The Journal of nutrition*, 144(3), pp.399-407.
81. GULLBERG, E., 2006. Food for future citizens: school meal culture in Sweden. *Food, Culture & Society*, 9(3), pp.337-343.
 82. GUTHRIE, J.F. AND BUZBY, J.C., 2002. Several strategies may lower plate waste in school feeding programs. *FOOD REVIEW-WASHINGTON DC-*, 25(2), pp.36-42.
 83. GWIRTZ, J.A. AND GARCIA-CASAL, M.N., 2014. Processing maize flour and corn meal food products. *Annals of the New York Academy of Sciences*, 1312(1), p.66.
 84. HAINES, J., HAYCRAFT, E., LYTLE, L., NICKLAUS, S., KOK, F.J., MERDJI, M., FISBERG, M., MORENO, L.A., GOULET, O. AND HUGHES, S.O., 2019. Nurturing Children's healthy eating: Position statement. *Appetite*.
 85. HARIKA, R., FABER, M., SAMUEL, F., MULUGETA, A., KIMIYWE, J. AND EILANDER, A., 2017. Are low intakes and deficiencies in iron, vitamin A, zinc, and iodine of public health concern in Ethiopian, Kenyan, Nigerian, and South African children and adolescents?. *Food and nutrition bulletin*, 38(3), pp.405-427.
 86. HARNACK, L., STANG, J. AND STORY, M., 1999. Soft drink consumption among US children and adolescents: nutritional consequences. *Journal of the American Dietetic Association*, 99(4), pp.436-441.
 87. HARPER, C., WOOD, L. AND MITCHELL, C., 2008. The provision of school food in 18 countries. *London: School Food Trust*.
 88. HARVEY, J.A. AND BOVBJERG, V.E., 2004. Quantitative assessment of mammographic breast density: relationship with breast cancer risk. *Radiology*, 230(1), pp.29-41.
 89. HAWKES, C., JEWELL, J. AND ALLEN, K., 2013. A food policy package for healthy diets and the prevention of obesity and diet-related non-communicable diseases: the NOURISHING framework. *Obesity reviews*, 14, pp.159-168.
 90. HE, F.J., NOWSON, C.A., LUCAS, M. AND MACGREGOR, G.A., 2007. Increased consumption of fruit and vegetables is related to a reduced risk of coronary heart disease: meta-analysis of cohort studies. *Journal of human hypertension*, 21(9), pp.717-728.
 91. HERATH, D. AND HENSON, S., 2010. Barriers to HACCP implementation: evidence from the food processing sector in Ontario, Canada. *Agribusiness*, 26(2), pp.265-279.
 92. HERNANDEZ, K., ENGLER-STRINGER, R., KIRK, S., WITTMAN, H. AND MCNICHOLL, S., 2018. The case for a Canadian national school food program. *Canadian Food Studies/La Revue canadienne des études sur l'alimentation*, 5(3), pp.208-229.

93. HOBBS, S.H., RICKETTS, T.C., DODDS, J.M. AND MILIO, N., 2004. Analysis of interest group influence on federal school meals regulations 1992 to 1996. *Journal of nutrition education and behavior*, 36(2), pp.90-98.
94. HUANG, Y., 2019. Applying a “hypocrisy” strategy to improve food safety practices in restaurants.
95. IFAD, W., 2013. FAO (2013). *The State of Food Insecurity in the World: The multiple dimensions of food security*.
96. ILLÉS, B. CS., TÓTH, A. J., DUNAY, A., LEHOTA, J. AND BITTSÁNSZKY, A. 2018. Evaluation of food safety knowledge and microbial status of food contact surfaces in schools. *Journal of Food Safety*, 38(4), Paper: e12480, <https://doi.org/10.1111/jfs.12480>
97. ILLÉS, C. B., DUNAY, A., SERREM, C., ATUBUKHA, B. AND SERREM, K.(2021): Food Safety and Sanitation Implementation Impasse on Adolescents in Kenyan High Schools International. *Journal of Environmental Research and Public Health*, 18:(3), 1304, 15 p. doi: 10.3390/ijerph18031304
98. INCHLEY, J., MULDOON, J. AND CURRIE, C., 2006. Becoming a health promoting school: evaluating the process of effective implementation in Scotland. *Health promotion international*, 22(1), pp.65-71.
99. ISONI AUAD, L., CORTEZ GINANI, V., DOS SANTOS LEANDRO, E., STEDEFELDT, E., COSTA SANTOS NUNES, A., YOSHIO NAKANO, E. AND PUPPIN ZANDONADI, R., 2019. Brazilian food truck consumers’ profile, choices, preferences, and food safety importance perception. *Nutrients*, 11(5), p.1175.
100. JAFARI, R., SHARIFI, F., BAGHERPOUR, B. AND SAFARI, M., 2016. Prevalence of intestinal parasites in Isfahan city, central Iran, 2014. *Journal of Parasitic Diseases*, 40(3), pp.679-682.
101. JAMES, S., 2004. Why do foster care placements disrupt? An investigation of reasons for placement change in foster care. *Social service review*, 78(4), pp.601-627.
102. JAY, J.M., LOESSNER, M.J. AND GOLDEN, D.A., 2005. Staphylococcal gastroenteritis. *Modern food microbiology*, pp.545-566.
103. JIANU, C. AND CHIȘ, C., 2012. Study on the hygiene knowledge of food handlers working in small and medium-sized companies in western Romania. *Food Control*, 26(1), pp.151-156.
104. JOMAA, L.H., MCDONNELL, E. AND PROBART, C., 2011. School feeding programs in developing countries: impacts on children's health and educational outcomes. *Nutrition reviews*, 69(2), pp.83-98.

105. KABUNGA, N.S., GHOSH, S. AND WEBB, P., 2017. Does ownership of improved dairy cow breeds improve child nutrition? A pathway analysis for Uganda. *PLoS one*, 12(11).
106. KALLMAN, K., 2005. Food for thought: a review of the National School Nutrition Programme. *Cape Town: University of Cape Town*.
107. KARANJA, N., LANCASTER, K.J., VOLLMER, W.M., LIN, P.H., MOST, M.M., ARD, J.D., SWAIN, J.F., SACKS, F.M. AND OBARZANEK, E., 2007. Acceptability of sodium-reduced research diets, including the dietary approaches to stop hypertension diet, among adults with prehypertension and stage 1 hypertension. *Journal of the American Dietetic Association*, 107(9), pp.1530-1538.
108. KAWADE, R., 2012. Zinc status and its association with the health of adolescents: a review of studies in India. *Global health action*, 5(1), p.7353.
109. KENNEDY, G.L., PEDRO, M.R., SEGHERI, C., NANTEL, G. AND BROUWER, I., 2007. Dietary diversity score is a useful indicator of micronutrient intake in non-breast-feeding Filipino children. *The Journal of nutrition*, 137(2), pp.472-477.
110. KENYA, 2015. Kenya demographic and health survey.
111. KIBRET, M. AND ABERA, B., 2012. The sanitary conditions of food service establishments and food safety knowledge and practices of food handlers in Bahir Dar town. *Ethiopian journal of health sciences*, 22(1), pp.27-35.
112. KIMMONS, J., GILLESPIE, C., SEYMOUR, J., SERDULA, M. AND BLANCK, H.M., 2009. Fruit and vegetable intake among adolescents and adults in the United States: percentage meeting individualized recommendations. *The Medscape Journal of Medicine*, 11(1), p.26.
113. KIRKPATRICK, R.L., HOWLAND, B.E., FIRST, N.L. AND CASIDA, L.E., 1967. Ovarian and pituitary gland changes in gilts on two nutrient energy levels. *Journal of animal science*, 26(2), pp.358-364.
114. KISA, S., 2014. The influence of school feeding programme on retention of children in primary schools: the case of Laikipia east district, Kenya (Doctoral dissertation, The University Of Nairobi).
115. KJØRSTAD, M., 2005. Between professional ethics and bureaucratic rationality: the challenging ethical position of social workers who are faced with implementing a workfare policy
Mellomprofesjonsetikkogbyråkratiskrasjonalitet: Sosialarbeideresutfordrendeetiskeposisjonvediverksettingavarbeidslinjen. *European Journal of Social Work*, 8(4), pp.381-398.

116. KJØRSTAD, M., 2008. Opening the Black Box—Mobilizing Practical Knowledge in Social Research: Methodological Reflections based on a Study of Social Work Practice. *Qualitative Social Work*, 7(2), pp.143-161.
117. KLEINE, D. AND DAS GRAÇAS BRIGHTWELL, M., 2015. Repoliticising and scaling-up ethical consumption: Lessons from public procurement for school meals in Brazil. *Geoforum*, 67, pp.135-147.
118. KNBS, I., 2010. Macro: Kenya Demographic and Health Survey 2008-09. *Calverton, MD: Kenya National Bureau of Statistics and ICF Macro*, 430.
119. KO, W.H., 2013. The relationship among food safety knowledge, attitudes and self-reported HACCP practices in restaurant employees. *Food control*, 29(1), pp.192-197.
120. KOTHARI, C.R., 2004. *Research methodology: Methods and techniques*. New Age International.
121. LANGINGER, N., 2011. School feeding programs in Kenya: Transitioning to a homegrown approach. *Stanford Journal of International Relations*, 13(1), pp.30-37.
122. LARTEY, K.A., 2019. *Assessing the Quality of Household Drinking Water in Selected Communities in the Akuapem South District* (Doctoral dissertation, University of Ghana).
123. LEHOTA, J., GYENGE, B., KOMÁROMI, N., KOMÁROMI-GERGELY, A., RÁCZ, G., HORVÁTH, Á., KÖNYVES, E. AND TÖRÖNÉ DUNAY, A. 2015. Az étteremválasztás összefüggéseinek vizsgálata Magyarországon (Factors influencing consumers' selection of restaurants), pp. 77-141., In: Könyves E. and Lehota J. (eds.): A fogyasztóimádatartásvizsgálata a gasztronómiában. Debrecen, Hungary
124. LOCKIS, V.R., CRUZ, A.G., WALTER, E.H., FARIA, J.A., GRANATO, D. AND SANT'ANA, A.S., 2011. Prerequisite programs at schools: diagnosis and economic evaluation. *Foodborne Pathogens and Disease*, 8(2), pp.213-220.
125. LOW, S., 2016. *Spatializing culture: The ethnography of space and place*. Taylor & Francis.
126. LUDWIG, D.S., PETERSON, K.E. AND GORTMAKER, S.L., 2001. Causes of obesity. *The Lancet*, 357(9272), pp.1978-1979.
127. LUNDMARK, K., WESTERMARK, G.T., NYSTRÖM, S., MURPHY, C.L., SOLOMON, A. AND WESTERMARK, P., 2002. Transmissibility of systemic amyloidosis by a prion-like mechanism. *Proceedings of the National Academy of Sciences*, 99(10), pp.6979-6984.
128. LUO, X., XU, X., CHEN, H., BAI, R., ZHANG, Y., HOU, X., ZHANG, F., ZHANG, Y., SHARMA, M., ZENG, H. AND ZHAO, Y., 2019. Food safety related knowledge,

- attitudes, and practices (KAP) among the students from nursing, education and medical college in Chongqing, China. *Food Control*, 95, pp.181-188.
129. MARTINS, R.B., HOGG, T. AND OTERO, J.G., 2012. Food handlers' knowledge on food hygiene: The case of a catering company in Portugal. *Food Control*, 23(1), pp.184-190.
 - Macnab, A.J., Gagnon, F.A. and Stewart, D., 2014. Health promoting schools: consensus, strategies, and potential. *Health Education*, 114(3), pp.170-185.
 130. MARQUES-VIDAL, P., MADELEINE, G., ROMAIN, S., GABRIEL, A. AND BOVET, P., 2008. Secular trends in height and weight among children and adolescents of the Seychelles, 1956–2006. *BMC Public Health*, 8(1), p.166.
 131. MCCLINTOCK, N., WOOTEN, H. AND BROWN, A.H., 2012. Toward a food policy" first step" in Oakland, California: A food policy council's efforts to promote urban agriculture zoning. *Journal of Agriculture, Food Systems, and Community Development*, 2(4), pp.15-42.
 132. MCDOWELL, M.A., TABAK, C.J. AND FLEGAL, K.M., 2006. Prevalence of overweight and obesity in the United States, 1999-2004. *Jama*, 295(13), pp.1549-1555.
 133. MEDEIROS, L.C., HILLERS, V.N., KENDALL, P.A. AND MASON, A., 2001. Food safety education: what should we be teaching to consumers? *Journal of Nutrition Education*, 33(2), pp.108-113.
 134. MEYER, M.K., CONKLIN, M.T. AND TURNAGE, C., 2002. School Foodservice Administrators' Perceptions of the School Nutrition Environment in Middle Grades. *Topics in Clinical Nutrition*, 17(4), pp.47-54.
 135. MILOSAVLJEVIĆ, D., MANDIĆ, M.L. AND BANJARI, I., 2015. Nutritional knowledge and dietary habits survey in high school population. *Collegium antropologicum*, 39(1), pp.101-107.
 136. Minister, O.P.W., Government Services Canada.1997. *Procedures for an assessment by a review panel*.
 137. MORGAN, K., MARSDEN, T. AND MURDOCH, J., 2008. *Worlds of food: Place, power, and provenance in the food chain*. Oxford University Press on Demand.
 138. MORISET, B., 2013. Building new places of the creative economy. The rise of coworking spaces.
 139. MOYNIHAN, P. AND PETERSEN, P.E., 2004. Diet, nutrition and the prevention of dental diseases. *Public health nutrition*, 7(1a), pp.201-226.

140. MUCHEMI, O.M., ECHOKA, E. AND MAKOKHA, A., 2015. Factors associated with low birth weight among neonates born at Olkalou District Hospital, Central Region, Kenya. *Pan African Medical Journal*, 20(1).
141. MUGENDA, O.M. AND MUGENDA, A.G., 1999. *Research methods: Quantitative and qualitative approaches*. Acts press.
142. MULLAN, B., WONG, C., TODD, J., DAVIS, E. AND KOTHE, E.J., 2015. Food hygiene knowledge in adolescents and young adults. *British Food Journal*.
143. MULLER, M.J., ASBECK, I., MAST, M., LANGNASE, K. AND GRUND, A., 2001. Prevention of obesity-more than an intention. Concept and first results of the Kiel Obesity Prevention Study (KOPS). *International Journal of Obesity & Related Metabolic Disorders*, 25.
144. MURPHY, K., 2015. Why students hate school lunches. *The New York Times*.
145. MURPHY, K.J., MARQUES-LOPES, I., SÁNCHEZ-TAINTA, A., 2018. Chapter 7 - Cereals and Legumes, in: Sánchez-Villegas, A., Sánchez-Tainta, A. (Eds.), *The Prevention of Cardiovascular Disease Through the Mediterranean Diet*. Academic Press, pp. 111–132. <http>
146. NABUDERE, D.W., 2003. Towards a new model of production—an alternative to NEPAD. *African Perspective*, 4, p.15.
147. NAEENI, M.M., JAFARI, S., FOULADGAR, M., HEIDARI, K., FARAJZADEGAN, Z., FAKHRI, M., KARAMI, P. AND OMIDI, R., 2014. Nutritional knowledge, practice, and dietary habits among school children and adolescents. *International journal of preventive medicine*, 5(Suppl 2), p.S171.
148. NAMKUNG, Y. AND JANG, S., 2007. Does food quality really matter in restaurants? Its impact on customer satisfaction and behavioral intentions. *Journal of Hospitality & Tourism*
149. NDIVO, R.M. AND OKECH, R.N., 2020. Tourism Governance in Transition Period: Restructuring Kenya's Tourism Administration from Centralized to Devolved System. *Tourism Planning & Development*, 17(2), pp.166-186.
150. NESTLE, M., 2002. *Food politics*. Berkeley and Los Angeles: University of California Press, Ltd.
151. NHLAPO, N., LUES, R.J., KATIVU, E. AND GROENEWALD, W.H., 2015. Assessing the quality of food served under a South African school feeding scheme: A nutritional analysis. *South African Journal of Science*, 111(1-2), pp.01-09.\

152. NICHOLAS, J., WOOD, L., HARPER, C. AND NELSON, M., 2013. The impact of the food-based and nutrient-based standards on lunchtime food and drink provision and consumption in secondary schools in England. *Public health nutrition*, 16(6), pp.1052-1065.
153. NJERU, S.N., THANG'WA, M.K., MUTAI, C., BULUKU, E.A., AYO, E.A., NJENGA, G.M., OBARE, M.M., OTIENO, G.A., MUSABE, T., NYAKINYUA, M.M. AND MUTUA, K.J., 2002. Factors influencing career dress selection by secondary school women teachers. A case of Nairobi province. *Unpublished Msc Thesis. Kenyatta University*.
154. NUR FARDILLA NADIA, A.B., 2018. *MengkajistailnyanyianSalomadaripadaperspektifteknikvokalklasikalbarat: Penggunaanvokal register/NurFardilla Nadia Abu Bakar* (Doctoral dissertation, University of Malaya).
155. CANADA, D. AND AMERICAN DIETETIC ASSOCIATION, 2003. Position of the American dietetic association and dietitians of Canada: Vegetarian diets. *Journal of the American Dietetic Association*, 103(6), pp.748-765.
156. OGUTU, W.K., 2014. *Perception of the influence of incentives on employee job performance in the Ministry of Education in Kenya* (Doctoral dissertation, University of Nairobi).
157. ONSOMU, E.O., ABUYA, B.A., OKECH, I.N., MOORE, D. AND COLLINS-MCNEIL, J., 2015. Maternal education and immunization status among children in Kenya. *Maternal and child health journal*, 19(8), pp.1724-1733.
158. OWUSU, J., NARTEY, E., GAMOR, E. AND MENSAH, E.E., 2017. Knowledge and practices of Hygiene of Fresh-Cut Fruit Vendors-A case study of New Juaben Municipality in the Eastern Region of Ghana. *International Journal of Technology and Management Research*, 2(1), pp.36-45.
159. PADDISON, P.J., CAUDY, A.A., BERNSTEIN, E., HANNON, G.J. AND CONKLIN, D.S., 2002. Short hairpin RNAs (shRNAs) induce sequence-specific silencing in mammalian cells. *Genes & development*, 16(8), pp.948-958.
160. PASCOLINI, D. AND MARIOTTI, S.P., 2012. Global estimates of visual impairment: 2010. *British Journal of Ophthalmology*, 96(5), pp.614-618.
161. PEARCE, M. AND FORLIN, C., 2005. Challenges and potential solutions for enabling inclusion in secondary schools. *Australasian Journal of Special Education*, 29(2), pp.93-105.

162. PELTZER, K. AND PENGPID, S., 2010. Fruits and vegetables consumption and associated factors among in-school adolescents in seven African countries. *International journal of public health*, 55(6), pp.669-678.
163. PÉREZ-RODRIGO, C. AND ARANCETA, J., 2001. School-based nutrition education: lessons learned and new perspectives. *Public Health Nutrition*, 4(1a), pp.131-139.
164. PETERSEN, P.E., 2003. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Programme. *Community Dentistry and oral epidemiology*, 31(s1), pp.3-24.
165. POPKIN, B.M. AND SLINING, M.M., 2013. New dynamics in global obesity facing low and middle income countries. *Obesity Reviews*, 14(S2), pp.11-20.
166. POPPENDIECK, J., 2014. Food assistance, hunger and the end of welfare in the USA. In *First world hunger revisited* (pp. 176-190). Palgrave Macmillan, London.
167. PROSKY, L., 2003. DIETARY FIBER| Effects of Fiber on Absorption.
168. Public Service Commission, Report on the Evaluation of the National School Nutrition Programme (NSNP). 2008. Pretoria.
169. QUAYE, W., ESSEGBEY, G., FREMPONG, G. AND RUIVENKAMP, G., 2010. Understanding the concept of food sovereignty using the Ghana School Feeding Programme (GSFP). *International Review of Sociology*, 20(3), pp.427-444.
170. RABEN, A., VASILARAS, T.H., MØLLER, A.C. AND ASTRUP, A., 2002. Sucrose compared with artificial sweeteners: different effects on ad libitum food intake and body weight after 10 wk of supplementation in overweight subjects. *The American journal of clinical nutrition*, 76(4), pp.721-729.
171. RAKOTOSAMIMANANA, V.R., ARVISENET, G. AND VALENTIN, D., 2014. Studying the nutritional beliefs and food practices of Malagasy school children parents. A contribution to the understanding of malnutrition in Madagascar. *Appetite*, 81, pp.67-75.
172. RASMUSSEN, M., KRØLNER, R., KLEPP, K.I., LYTLE, L., BRUG, J., BERE, E. AND DUE, P., 2006. Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I: quantitative studies. *International Journal of Behavioral Nutrition and Physical Activity*, 3(1), p.22.
173. REGNAULT DE LA MOTHE, M., 2008. Kenya Case Study. *Learning from Experience: Good Practices from*, 45, pp.45-47.
174. REIS, F.S., BARROS, L., MARTINS, A. AND FERREIRA, I.C., 2012. Chemical composition and nutritional value of the most widely appreciated cultivated mushrooms: an inter-species comparative study. *Food and Chemical Toxicology*, 50(2), pp.191-197.

175. RENNIE, D.M., 1995. Health education models and food hygiene education. *Journal of the Royal Society of Health*, 115(2), pp.75-79.
176. RICHARDSON, I.R. AND STEVENS, A.M., 2003. Microbiological examination of ready to eat stuffing from retail premises in the north-east of England. The 'Get Stuffed' survey. *Journal of Applied Microbiology*, 94(4), pp.733-737.
177. ROLFES, S.R., PINNA, K. AND WHITNEY, E.N., 2020. *Understanding normal and clinical nutrition*. Cengage learning.
178. RUEL, M.T., ALDERMAN, H. AND MATERNAL AND CHILD NUTRITION STUDY GROUP, 2013. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition?. *The Lancet*, 382(9891), pp.536-551.
179. RUSSELL, C., DUNBAR, P., SALISBURY, S., SKETRIS, I. AND KEPHART, G., 2005. Hypertension control: results from the Diabetes Care Program of Nova Scotia registry and impact of changing clinical practice guidelines. *Cardiovascular diabetology*, 4(1), p.11.
180. SÁNCHEZ, A. AND CONTRERAS, L.R., 2003. *Relationship of the physical dining environment and service styles to plate waste in middle/junior high schools*. National Food Service Management Institute, University of Mississippi.
181. SANLIER, N. AND KONAKLIOGLU, E., 2012. Food safety knowledge, attitude and food handling practices of students. *British Food Journal Research*, 31(3), pp.387-409.
182. SANTOS, N.A.G., MEDINA, W.S.G., MARTINS, N.M., RODRIGUES, M.C., CURTI, C. AND SANTOS, A.C., 2008. Involvement of oxidative stress in the hepatotoxicity induced by aromatic antiepileptic drugs. *Toxicology in vitro*, 22(8), pp.1820-1824.
183. SEAMAN, P., 2010. Food hygiene training: Introducing the food hygiene training model. *Food Control*, 21(4), pp.381-387.
184. SERREM, K., DUNAY, A., SERREM, C., ATUBUKHA, B., OLÁH, J., AND ILLÉS C. B. (2020): Paucity of Nutrition Guidelines and Nutrient Quality of Meals Served to Kenyan Boarding High School Students. *Sustainability*, 12:(8), 3463, 12 p., doi: 10.3390/SU12083463
185. SIBANYONI, J.J., TSHABALALA, P.A. AND TABIT, F.T., 2017. Food safety knowledge and awareness of food handlers in school feeding programmes in Mpumalanga, South Africa. *Food Control*, 73, pp.1397-1406.
186. SOARES, L.S., ALMEIDA, R.C., CERQUEIRA, E.S., CARVALHO, J.S. AND NUNES, I.L., 2012. Knowledge, attitudes and practices in food safety and the presence of

- coagulase-positive staphylococci on hands of food handlers in the schools of Camaçari, Brazil. *Food control*, 27(1), pp.206-213.
187. SOLON, F.S., SOLON, M.S., MEHANSHO, H., WEST, J.K., SAROL, J., PERFECTO, C., NANO, T., SANCHEZ, L., ISLETA, M., WASANTWISUT, E. AND SOMMER, A., 1996. Evaluation of the effect of vitamin A-fortified margarine on the vitamin A status of preschool Filipino children. *European journal of clinical nutrition*, 50(11), pp.720-723.
188. SOMMER, M., CARUSO, B.A., SAHIN, M., CALDERON, T., CAVILL, S., MAHON, T. AND PHILLIPS-HOWARD, P.A., 2016. A time for global action: addressing girls' menstrual hygiene management needs in schools. *PLoS medicine*, 13(2), p.e1001962.
189. SPENCE, S., DELVE, J., STAMP, E., MATTHEWS, J.N., WHITE, M. AND ADAMSON, A.J., 2013. The impact of food and nutrient-based standards on primary school children's lunch and total dietary intake: a natural experimental evaluation of government policy in England. *PloS one*, 8(10).
190. STARK, D.P., ELLIS, R.S., BUNKER, A., BUNDY, K., TARGETT, T., BENSON, A. AND LACY, M., 2009. The evolutionary history of Lyman break galaxies between redshift 4 and 6: observing successive generations of massive galaxies in formation. *The Astrophysical Journal*, 697(2), p.1493.
191. STETTLER, N., BOVET, P., SHAMLAYE, H., ZEMEL, B.S., STALLINGS, V.A. AND PACCAUD, F., 2002. Prevalence and risk factors for overweight and obesity in children from Seychelles, a country in rapid transition: the importance of early growth. *International journal of obesity*, 26(2), pp.214-219.
192. STIPANUK, M.H., DOMINY JR, J.E., LEE, J.I. AND COLOSO, R.M., 2006. Mammalian cysteine metabolism: new insights into regulation of cysteine metabolism. *The Journal of nutrition*, 136(6), pp.1652S-1659S.
193. ST-ONGE, M.P., KELLER, K.L. AND HEYMSFIELD, S.B., 2003. Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights. *The American journal of clinical nutrition*, 78(6), pp.1068-1073.
194. STORY, M., NANNEY, M.S. AND SCHWARTZ, M.B., 2009. Schools and obesity prevention: creating school environments and policies to promote healthy eating and physical activity. *The Milbank Quarterly*, 87(1), pp.71-100.
195. SUMBERG, J. AND SABATES-Wheeler, R., 2011. Linking agricultural development to school feeding in sub-Saharan Africa: theoretical perspectives. *Food Policy*, 36(3), pp.341-349.

196. SWAMINATHAN, M.S. AND BHAVANI, R.V., 2013. Food production & availability- Essential prerequisites for sustainable food security. *The Indian journal of medical research*, 138(3), p.383.
197. SZEITZNÉ SZABÓ M. (2005): Food borne disease outbreaks associated with the catering sector in Hungary. pp. 61-75. In: Maunsell, B. and Bolton, D. J. (Ed.), Restaurant and catering food safety: putting HACCP on the menu. EU Risk Analysis Network. Teagasc - Ashtown Food Research Centre, Dublin, Ireland.
198. TABER, D.R., CHRIQUI, J.F. AND CHALOUPKA, F.J., 2013. State laws governing school meals and disparities in fruit/vegetable intake. *American journal of preventive medicine*, 44(4), pp.365-372.
199. TANAKA, N. AND MIYOSHI, M., 2012. School lunch program for health promotion among children in Japan. *Asia Pacific Journal of Clinical Nutrition*, 21(1), p.155.
200. TEMITAYO, I.O., OLUWASEUN, A.A., ADEGBENRO, C.A., AWOPEJU, O.F., OLATONA, F.A., ERHABOR, G.E. AND ADENIYI, B.O., Effect of Health Educational Intervention on Knowledge and Perceptions of Asthma among Secondary School Students in Ile-Ife, South-West, Nigeria.
201. THE HEALTHY EATING IN SCHOOLS (NUTRITIONAL STANDARDS AND REQUIREMENT) REGULATIONS 2013
202. THELWELL-REID, M.A., 2014. Food safety knowledge and self-reported practices of food handlers in Jamaica.
203. THOMPSON, B. AND AMOROSO, L. EDS., 2011. *Combating micronutrient deficiencies: food-based approaches*. CABI.
204. TOKUÇ, B., EKUKLU, G., BERBEROĞLU, U., BILGE, E. AND DEDELER, H., 2009. Knowledge, attitudes and self-reported practices of food service staff regarding food hygiene in Edirne, Turkey. *Food Control*, 20(6), pp.565-568.
205. TOMASEVIC, I., KUZMANOVIĆ, J., ANĐELKOVIĆ, A., SARAČEVIĆ, M., STOJANOVIĆ, M.M. AND DJEKIC, I., 2016. The effects of mandatory HACCP implementation on microbiological indicators of process hygiene in meat processing and retail establishments in Serbia. *Meat science*, 114, pp.54-57.
206. TONES, K., 1990. Why theorise? Ideology in health education. *Health Educational Journal*, pp 2-6.
207. TÓTH, A. J. AND BITTSÁNSZKY, A. 2014. A comparison of hygiene standards of serving and cooking kitchens in schools in Hungary. *Food Control*, 46, pp. 520-524. <https://doi.org/10.1016/j.foodcont.2014.06.019>

208. TÓTH, A. J., KOLLER, Z., ILLÉS, B. CS., AND BITTSÁNSZKY, A. (2017). Development of conscious food handling in Hungarian school cafeterias. *Food Control*, 73, Part B:(March), pp. 644-649. <https://doi.org/10.1016/j.foodcont.2016.09.011>
209. TREUHAFT, S. AND KARPYN, A., 2010. *The grocery gap: Who has access to healthy food and why it matters*. PolicyLink.\
210. UNICEF., 2010. *Progress for children: achieving the MDGs with equity* (No. 9). Unicef.
211. UNKLESBAY, N.A.N., SNEED, J. AND TOMA, R., 1998. College students' attitudes, practices, and knowledge of food safety. *Journal of Food Protection*, 61(9), pp.1175-1180.
212. UNU, W., 2004. FAO, Human Energy Requirements: Report of A Joint FAO/WHO/UNU Expert Consultation.
213. US DEPARTMENT OF HEALTH AND HUMAN SERVICES, 2015. US Department of Agriculture website. 2015-2020 Dietary Guidelines for Americans. health.gov/dietaryguidelines/2015/resources/2015-2020_Dietary_Guidelines.pdf. Updated December.
214. USDA, 2018. USDA Food Composition Databases.
215. VOZORIS, N., DAVIS, B. AND TARASUK, V., 2002. The affordability of a nutritious diet for households on welfare in Toronto. *Canadian Journal of Public Health/Revue Canadienne de Sante'ePublique*, pp.36-40.
216. WANDOLO, M.A., NDIRITU, D., KHAYIYA, R. AND MUGENDI, B.W., 2018. Assessment of the Capacity of TVET and University Hospitality Schools in offering Food Safety and Hygiene Training in Kenya. *International Journal of Scientific Research and Management*, 6(06).
217. WEGNER, T., 2010. *Applied business statistics: Methods and Excel-based applications*. Juta and Company Ltd.
218. WEINREB, L., WEHLER, C., PERLOFF, J., SCOTT, R., HOSMER, D., SAGOR, L. AND GUNDERSEN, C., 2002. Hunger: its impact on children's health and mental health. *Pediatrics*, 110(4), pp.e41-e41.
219. WEN-HWA, K., 2011. Food sanitation knowledge, attitude, and behavior for the university restaurants employees. *Food and Nutrition Sciences*, 2011.
220. WFP, U., 2017. Rural Madagascar comprehensive food and nutrition security and vulnerability analysis. 2011.n
221. WHO, U.N.I.C.E.F., 2010. *Progress on sanitation and drinking-water, 2010 Update*. World Health Organization.
222. WILCOCK, A. AND BALL, B., 2017. Food safety: Consumer perceptions and practices.

223. WORLD BANK GROUP, 2014. *Doing Business 2015: Going Beyond Efficiency: Comparing Business Regulations for Domestic Firms in 189 Economies: a World Bank Group Flagship Report*. World Bank Publications.
224. WORLD BANK, 2016. Kenya country economic memorandum: From economic growth to jobs and shared prosperity.
225. WORLD HEALTH ORGANIZATION AND UNICEF, 2012. Trends in maternal mortality: 1990 to 2010: WHO, UNICEF, UNFPA and The World Bank estimates.
226. WORLD HEALTH ORGANIZATION AND UNICEF, 2015. Trends in maternal mortality: 1990-2015: estimates from WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division.
227. WORLD HEALTH ORGANIZATION, 1998. Health promotion evaluation: recommendations to policy-makers: report of the WHO European Working Group on Health Promotion Evaluation.
228. WORLD HEALTH ORGANIZATION, 2000. *The world health report 2000: health systems: improving performance*. World Health Organization.
229. WORLD HEALTH ORGANIZATION, 2003. *Diet, nutrition, and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation* (Vol. 916). World Health Organization.
230. WORLD HEALTH ORGANIZATION, 2006. *Food and nutrition policy for schools: A tool for the development of school nutrition programs in the European Region* (No. EUR/06/5073063). Copenhagen: WHO Regional Office for Europe.
231. WORLD HEALTH ORGANIZATION, 2007. *International travel and health: situation as on 1 January 2007*. World Health Organization.
232. WORLD HEALTH ORGANIZATION, 2011. HRP biennial technical report 2009-2010: UNDP/UNFPA/WHO/World Bank Special Programme of Research, Development and Research Training in Human Reproduction.
233. WORLD HEALTH ORGANIZATION, 2013. WEEKLY EPIDEMIOLOGICAL RECORD, 2013, VOL. 88, 35 [FULL ISSUE]. *WEEKLY EPIDEMIOLOGICAL Record=Relevéépidémiologiquehebdomadaire*, 88(35), pp.365-380.
234. WORLD HEALTH ORGANIZATION, 2016. *World health statistics 2016: monitoring health for the SDGs sustainable development goals*. World Health Organization.
235. WORSFOLD, D., GRIFFITH, C. AND WORSFOLD, P., 2004. A survey of environmental health officers' views of food hygiene training. *British Food Journal*.

236. WYATT, S., HENWOOD, F., HART, A. AND SMITH, J., 2005. The digital divide, health information and everyday life. *New Media & Society*, 7(2), pp.199-218.
237. YE, Y., CHIOGNA, G., CIRPKA, O.A., GRATHWOHL, P. AND ROLLE, M., 2015. Enhancement of plume dilution in two-dimensional and three-dimensional porous media by flow focusing in high-permeability inclusions. *Water Resources Research*, 51(7), pp.5582-5602.
238. YOUNG, R.J., 2005. *Colonial desire: Hybridity in theory, culture and race*. Routledge
239. ZINBARG, R.E., REVELLE, W., YOVEL, I. AND LI, W., 2005. Cronbach's α , Revelle's β , and McDonald's ω H: Their relations with each other and two alternative conceptualizations of reliability. *psychometrika*, 70(1), pp.123-133.
240. ZUILKOWSKI, S.S., PIPER, B., ONG'ELE, S. AND KIMINZA, O., 2018. Parents, quality, and school choice: why parents in Nairobi choose low-cost private schools over public schools in Kenya's free primary education era. *Oxford Review of Education*, 44(2), pp.258-274.

APPENDIX 2: LIST OF TABLES AND FIGURES

List of tables

| | |
|---|----|
| Table 1: Macronutrient Recommended ranges of nutrient intakes for WHO?..... | 24 |
| Table 2: Estimates of daily macronutrient requirements for children and adolescents..... | 25 |
| Table 3: Recommended micronutrient intakes..... | 26 |
| Table 4: School meal provision frame work table for high-income countries..... | 28 |
| Table 5: School meal provision framework table for middle-income countries..... | 30 |
| Table 6: Distribution of Samples..... | 52 |
| Table 7: Food Handlers Demographic Characteristics..... | 56 |
| Table 8: Training on healthy food preparation, food safety and hygiene..... | 57 |
| Table 9: Types of training..... | 58 |
| Table 10: Hazard Analysis and Critical Control Points (HACCP)..... | 58 |
| Table 11: Food safety and sanitation Knowledge..... | 60 |
| Table 12: Attitude assessment of food handlers..... | 61 |
| Table 13: Food handler’s behavior and practice in Kenyan High School kitchens..... | 62 |
| Table 14: Handler’s demographic characteristics and level of food knowledge..... | 64 |
| Table 15: Food handler demographic in relation to attitude..... | 65 |
| Table 16: Barriers to food safety and hygiene practice..... | 66 |
| Table 17: Correlation Results..... | 67 |
| Table 18: Multiple Regression..... | 69 |
| Table 19: Kitchen Amenities in High schools in Kenya..... | 71 |
| Table 20: Kitchen storage facilities in High schools in Kenya..... | 72 |
| Table 21: Equipment and tools used daily for safe and hygiene..... | 73 |

| | |
|--|-----|
| Table 22: Availability of Kitchen Amenities in High schools in Kenya..... | 75 |
| Table 23: Knowledge on Food and Nutrition..... | 78 |
| Table 24: Knowledge on food safety..... | 78 |
| Table 25: Practice of Sanitation among Student in Kenyan High Schools..... | 80 |
| Table 26: Other Sources of food for High School Students in Kenya..... | 81 |
| Table 27: Number of Times High School Students Fall Ill from Food Borne Diseases..... | 82 |
| Table 28: Students Level of Satisfaction of School Food..... | 82 |
| Table 29: Correlation statistics..... | 83 |
| Table 30: Regression..... | 84 |
| Table 31: The mean amount in grams of the foods consumed daily by students 15-18 years in the selected high schools..... | 86 |
| Table 32: The mean amount in grams of the food groups consumed daily by students 15-18 years old in different school types and their percentage contributions to the total dietary intake (g%/student/day)..... | 88 |
| Table 33: The mean amount of nutrients consumed daily from the total diet of the high school student diets in the sampled schools..... | 89 |
| Table 34: Percentage fulfilment of the different nutrients according to school type..... | 90 |
| Table 35: Summary of the Hypothesis..... | 111 |

List of Figures

| | |
|--|----|
| Figure 1: Process model reflecting the structure of the research study.. Hiba! A könyvjelző nem létezik. | |
| Figure 2: Home Grown School Feeding Program in Kenya, A, Net Enrollment Ratio, B, Gender Parity Index | 21 |
| Figure 3: Food Hygiene Training model | 44 |
| Figure 4: The Social Ecological Model..... | 45 |
| Figure 5: Food and nutrition policy for schools | 48 |
| Figure 6: A: Percentage of Tack Shops in High Schools, B: Percentage of Control over Tacks Shops in High Schools | 76 |
| Figure 7: A: Availability of Dining Halls in High Schools, B: Percentage of Dining halls with adequate sizes/ space | 77 |

APPENDIX 3: QUESTIONNAIRE FOR HIGH SCHOOL STUDENTS

SECTION A: DEMOGRAPHIC INFORMATION

(Answer questions by ticking Boxes below)

1. Gender Male [] Female []
2. Age
13- 15 years [] 16-19 years [] 20-22 years []
3. Name of High school _____
4. Class in high school Form 1 Form 2 Form 3 Form 4

SECTION B: GENERAL NUTRITION KNOWLEDGE

(For each question select one answer by ticking the boxes below)

5. Which category of foods contains most carbohydrates (energy giving food)?
Meat Margarine Bread Yoghurt
6. Which Food contains the most dietary fiber?
Whole meal bread beans White Bread Meat
7. Which food is least rich in fats?
Chips mango sausages steamed rice
8. Which food is rich in protein
Mokimo Rice Pilau Ugali Eggs
9. Which food is richest in Calories (sugar)
Coke Potatoes Fruit Salad Omena
10. Which food categories contains most energy
Proteins Carbohydrates Fat Alcohol
11. What are the function of Vitamins and mineral to our bodies
Put on muscular tissue Lose fat from our bodies
Provide energy Catalyze reactions in the body
12. According to you what is a balanced diet

- Diet rich of protein a diet poor in fat
 Diet without carbohydrate Diet containing all nutrients

13. According to you what is daily energy expenditure

- Energy consumed the whole day Energy consumed during sleep
 Energy consumed only for physical Activities Energy consumed to maintain body temp

SECTION C: KNOWLEDGE ON FOOD SAFETY

14. What is food intoxication (food poisoning)

(Select one answer by ticking either of the boxes)

- An infection caused by lack of Vitamin
 A disease caused by consumption of food contaminated by pathogens (harm bacteria)
 A disease caused by an excessive consumption of food
 A disease caused by consumption of food contaminated by chemical

15. Which of the following are caused by food poisoning

(Select one answer by ticking either of the boxes)

- Vomiting, diarrhea, fever
 Headache, painful joint, fever
 Painful chest, Wheezing, Sweating
 Fever, sore throat and Cough

16. Which of the following activities are most likely to cause food poisoning

(Tick all that apply)

- Improper food storage
 Contamination of food prior to cooking
 Mishandling of food prior to consumption
 Inadequately washed plates and silver ware

17. Which of the following behaviours can cause cross contamination of food

(Select one answer by ticking either of the boxes)

- Use of the same utensils for cooked and raw foods
 Washing ones hands after handling raw foods and before handling cooked Foods
 Using different surfaces for cooked and raw foods
 Keeping cooked and raw foods separated

18. How can bacteria such as salmonella be transferred to food **(Tick all that apply)**

- By coughing and sneezing on the food
- By touching food without washing your hands
- By use of contaminated water to wash vegetables
- By smoking while preparing food

19. Which is the optimum temperature for the growth of bacteria

(Tick all that apply)

- From 0°C to 4°C
- From 4°C to 60°C
- Above 60°C
- Under -5°C

20. Does putting food in the fridge or freezer kill germs and bacteria

(Select one answer by ticking either of the boxes)

- Rarely No, it facilitates the growth
- No, it inhibits growth Yes, always

21. Does heat kill germs **(Select one answer by ticking either of the boxes)**

- Yes, always yes, above 40
- No, never yes, above 60

SECTION D: FOOD SAFETY AND BEHAVIOUR IN HYGIENE PRACTICE

| No | Question | never | sometimes | often | always |
|----|--|-------|-----------|-------|--------|
| 22 | When you buy packed food, do you check the expiry date | | | | |
| 23 | Do you read the instructions for use and for preservation written on the packaged food | | | | |
| 24 | Do you wash your hands before eating and before touching food | | | | |
| 25 | Do you usually wash fruit that not be peeled before eating them | | | | |
| 26 | I always ensure to purchase food that is clean | | | | |

| | | | | | |
|----|---|--|--|--|--|
| | and in fresh condition | | | | |
| 27 | I taste food to see if it is safe or not | | | | |
| 28 | I ensure that I eat well cooked food especially meat, I don't consume uncooked meat | | | | |
| 29 | I always reheat leftover food before consuming | | | | |

22. Other than the School's dining hall or cafeteria where is your other source of food

Tax shop/ School Canteen Home/ parents
 Food Venders Others _____

23. What type of foods do you get from your other sources of food, _____

24. How often do you fall ill in a term because of the food you have eaten

Once Twice Three times Four Others _____

25. What are the symptoms of the illness (**Tick all that apply**)

Vomiting diarrhea stomach pains

26. Do you usually get satisfied with the amount of food served per meal

Yes No

27. Do you like the food offered in school

Yes No

Why _____

APPENDIX 4: QUESTIONNAIRE FOR FOOD HANDLERS

SECTION A: DEMOGRAPHIC INFORMATION

(Answer questions by ticking Boxes below)

1. What is your gender? Male Female

2. What is your age? Under 25 years 25-35 years 36-45years
 46-55 years 56-65 years over 65 years of age

3. What is your highest education level?
Primary school level High school level College
Bachelors Degree Post Graduate

4. How long have you been a food handler
Less than one year One two three four
Five and above

5. Do you have previous work experience in food service
Yes No

SECTION B: TRAINING INFORMATION FOR FOOD SERVICE STAFF

(Answer questions by ticking Boxes below)

6. Has any training about healthy food preparation , food safety and hygiene been provided
Yes No
If yes, how often is training conducted?
At least once every term At least every twice
Others _____

7. Have you received training on either of the following?

| | | |
|---------------------|-----|----|
| Personal hygiene | Yes | No |
| Purchase procedures | Yes | No |

| | | |
|------------------------------|-----|----|
| Pest control | Yes | No |
| Equipment cleaning procedure | Yes | No |
| Kitchen operations polices | Yes | No |
| Food safety training | Yes | No |
| Food allergy procedure | Yes | No |
| Healthy cooking practices | Yes | No |

8. Do you know what HACCP is? Yes No
9. Is the school you work for currently using a HACCP program / monitoring system
Yes No

SECTION C: KITCHEN AND KITCHEN FACILITIES

(Answer questions by ticking appropriate Boxes below)

10. Do you have a school menu? Yes No
11. Where is food prepared?
Designated kitchen Temporary/ makeshift kitchen Classroom
Outside
12. Is there adequate space for cooking Yes No
13. Is there adequate space for serving/ portioning cook food Yes No
14. Are there enough cleaning tools in the kitchen e.g. broom, mop, dusters, sponge
Yes No
15. The following are some equipment and tools used daily for safe and hygienic handling of food in commercial kitchens. **(Please indicate whether each of the equipment is available or not a tick under the appropriate column to indicate whether the equipments are available or not and to be more specific write a remark)**

| Equipment | Available | Not available | Remarks |
|-----------------|-----------|---------------|---------|
| Hand wash basin | | | |

| | | | |
|--------------------------|--|--|--|
| Refrigerator | | | |
| Freezers | | | |
| Hood and steam extractor | | | |
| Food warmers | | | |
| Steamers | | | |
| Sanitizer | | | |
| Thermometers | | | |
| Fire extinguisher | | | |
| Deep fat fryers | | | |

16. To what extent do the school have the following equipment; Place a tick under the appropriate column to indicate the extent of availability of each equipment

1. **Not Adequate** 2. **Inadequate** 3. **Average** 4. **Adequate** 5. **Very adequate**

| Equipment/ facility | Not Adequate | Inadequate | Average | Adequate | Very adequate |
|---------------------------------|---------------------|-------------------|----------------|-----------------|----------------------|
| Cutlery | | | | | |
| Crockery | | | | | |
| Working surfaces | | | | | |
| Cookers | | | | | |
| Ovens | | | | | |
| Color coded chopping board | | | | | |
| Cooking pots and pans / Sufuria | | | | | |

| | | | | | |
|--------------------|--|--|--|--|--|
| Cleaning equipment | | | | | |
| Chafing dishes | | | | | |

SECTION D: KNOWLEDGE ASSESSMENT OF FOOD HANDLERS

17. INSTRUCTIONS; Place a tick under the appropriate column to indicate whether you Agree with or Disagree with or don't know each of the following statement.

| Transmission of food born diseases | Agree | Disagree | Don't know |
|--|-------|----------|------------|
| Well cooked foods do not have microbes | | | |
| Fresh eggs can have Salmonella | | | |
| Cholera can be spread through food | | | |
| Canned foods may have harmful microbes | | | |
| Healthy people can cause illness by carrying germs to food | | | |
| Vegetables and raw salads may be a media for transmitting harmful microbes | | | |
| The HIV virus can be spread through food | | | |
| You can tell if food is unfit for consumption by smell, taste and look | | | |
| Food prepared too long in advance might give microbes time to grow | | | |
| Fresh meat always has microbes on the surface | | | |

SECTION E: PERSONAL HEALTH AND HYGIENE

18. INSTRUCTIONS; Place a tick under the appropriate column to indicate whether you Agree with or Disagree with or don't know each of the following statement.

| Personal health and hygiene | Agree | disagree | Don't to know |
|---|--------------|-----------------|----------------------|
| Hands can be washed with water alone before handling raw meat | | | |
| You can prepare food with a wound on your hand if the wound is covered with a bandage | | | |
| It is not necessary to wash hands so as to handle food that is already cooked | | | |
| Hands should be properly washed after sneezing or blowing your nose | | | |
| Wearing gloves while handling food protects food service staff from infection | | | |
| After using the bathroom, hands can be washed in the kitchen sink | | | |
| you should always change your foot wear when you leave the kitchen and go out | | | |
| Do you always check the use by dates of food before using them | | | |
| Do you wear a cap or chef's hat when touching or distributing foods to learns | | | |
| Does the school provide you with adequate food handling uniform | | | |

19. List the clothing items that the school provides that constitute your uniform

SECTION F: FOOD CONTAMINATION

20. INSTRUCTIONS; Place a tick under the appropriate column to indicate whether you **Agree** with or **Disagree** with or **don't know** each of the following statement.

| Food contamination | Agree | Disagree | I don't know |
|--|--------------|-----------------|---------------------|
| Foods prepared with many steps increases handling and possibility of food contamination | | | |
| Food preparation surfaces can contaminate food | | | |
| Food borne diseases can result from storing raw meat and cooked foods in the same refrigerator | | | |
| Ready to eat foods can be prepared on the same cutting boards that were used to prepare meat | | | |
| Foods can be contaminated with microbes by coming in to contact with unsafe foods | | | |
| Meat cutting boards, slicers and knives should always be sterilized after use | | | |

SECTION G: BARRIERS TO FOOD SAFETY AND HYGIENE PRACTICES

21. The following are some of the perceived barriers to food safety and hygiene practices.

Please indicate the extent to which each is a challenge in you institution.

1. Worst problem, 2. Badproblem 3. Moderate problem 4. Small problem 5. Least problem

| Challenge | 1 | 2 | 3 | 4 | 5 |
|----------------------|----------|----------|----------|----------|----------|
| Lack of finances | | | | | |
| Inadequate equipment | | | | | |
| Lack of facilities | | | | | |
| Lack of experience | | | | | |
| Lack of motivation | | | | | |

| | | | | | |
|--|--|--|--|--|--|
| Lack of knowledge | | | | | |
| Lack of set standards in the institution | | | | | |

**APPENDIX 5: QUESTIONER FOR FOOD HANDLING MANAGEMENT (SCHOOL
CATERESS)**

SECTION A: DEMOGRAPHIC INFORMATION

(Answer questions by ticking Boxes below)

22. What is your gender? Male Female
23. What is your age? Under 25 years 25-35 years 36-45years
 46-55 years 56-65 years over 65 years of age
24. What is your highest education level?
Primary school level High school level College
Bachelors Degree Post Graduate
25. How long have you been a food handler
Less than one year One two three four
Five and above

SECTION B: TRAINING INFORMATION FOR FOOD SERVICE STAFF

(Answer questions by ticking Boxes below)

5. Do food handlers in the school receive training Yes No
a) If yes, how often are the Trainings carried out Ongoing Weekly
Monthly Once a term Once a Year Never
b) If yes, which topics have the trainings covered Food Safety
Food Hygiene Cooking methods Hand washing techniques
c) If yes, who provides the training _____
6. Have you ever had training in food safety and nutrition? **(choose all that apply)**
Training in food or nutrition
Training in nutrition
Training in food preparation
Training in food safety

SECTION C: KITCHEN AND KITCHEN FACILITIES

7. Where is food prepared?

Designated kitchen Temporary/ makeshift kitchen Classroom
 Outside

8. Is there adequate space for cooking based on the number of students served per meal

Yes No

9. The following are some equipment and tools used daily for safe and hygienic handling of food in commercial kitchens. **(Please indicate whether each of the equipment is available or not for further clarification on availability write a remark)**

| Equipment | Available | Not available | Remarks |
|--------------------------|-----------|---------------|---------|
| Hand wash basin | | | |
| Refrigerator | | | |
| Freezers | | | |
| Hood and steam extractor | | | |
| Food warmers | | | |
| Steamers | | | |
| Sanitizer | | | |
| Thermometers | | | |
| Fire extinguisher | | | |
| Deep fat fryers | | | |

26. To what extent do the school have the following equipment (Place a tick under the appropriate column to indicate the extent of availability of each equipment

1. Not Adequate 2. Inadequate 3. Average 4. Adequate 5. Very adequate)

| Equipment/ facility | Not Adequate | Inadequate | Average | Adequate | Very adequate |
|--|---------------------|-------------------|----------------|-----------------|----------------------|
| Cutlery | | | | | |
| Crockery | | | | | |
| Working surfaces | | | | | |
| Cookers | | | | | |
| Ovens | | | | | |
| Color coded chopping boards | | | | | |
| Cooking pots and pans / Sufuria | | | | | |
| Cleaning equipment | | | | | |
| Chafing dishes | | | | | |

10. List some of the kitchen equipment that you need to run an efficient process or system in the kitchen but you lack _____

SECTION D: DELIVERIES, STORAGE AND S.O.P'S

11. The following are some of the steps taken during the delivery of food by the suppliers. Please indicate how often you carry out the mentioned steps/process at the reception of food from a supplier in an attempt to ensure that Hazard Analysis Critical Control Point (HACCP) standards are adhered to

| Steps/ procedures | Always | Rarely | Never |
|---|--------|--------|-------|
| Inspection of the delivered food to confirm the quantities, qualities, and conditions | | | |
| Taking temperatures for the supplies especially for food such as meat and fish | | | |

12. Does the school have storage facilities Yes No

13. If Yes, please specify (**Tick all that apply**)

Dry store Cold room

Fridges/ Freezers Others _____

14. If No, Where are food supplies stored (**Tick all that apply**)

Kitchen Classroom

Offices Others _____

15. Is there a regular cleaning schedule for the storage area? Yes No

16. How often is the storage area cleaned? Once a week Twice a week

Three times a week once a fortnight

17. Is there a stock rotation system in place Yes No

18. If yes, How is it done (**Tick all that apply**)

Delivery dates Expiry dates

Correct storage on delivery First in First out

20. Indicate which of the following guidelines have been developed in your institution

(**Tick all that apply**)

Food storage procedure

Procedure for personal hygiene of food service staff

Cleaning and disinfection of surface and equipment

Temperature monitoring of foods

SECTION E: BARRIERS TO FOOD SAFETY AND HYGIENE PRACTICES

21. The following are some of the perceived barriers to food safety and hygiene practices.

Please indicate the extent to which each is a challenge in you institution.

- 1. Worst problem, 2. Badproblem 3. Moderate problem 4. Small problem 5. Least problem**

| Challenge | 1 | 2 | 3 | 4 | 5 |
|---|----------|----------|----------|----------|----------|
| Lack of finances | | | | | |
| Inadequate equipment | | | | | |
| Lack of facilities | | | | | |
| Lack of experience | | | | | |
| Attitude | | | | | |
| Lack of motivation | | | | | |
| Lack of knowledge | | | | | |
| Lack of set standards in the institution | | | | | |
| Lack of time | | | | | |

22. Does the school have a dining facilities, (A Dining hall) Yes No

23. Is it big and specious enough to accommodate all student Yes No

24. Kindly highlight what is offered to students on a daily basis

| Day of the week | Breakfast | 10.00 break | Lunch | 4.00 break | Dinner | Any other |
|------------------------|------------------|--------------------|--------------|-------------------|---------------|------------------|
| Monday | | | | | | |

| | | | | | | |
|------------------|--|--|--|--|--|--|
| Tuesday | | | | | | |
| Wednesday | | | | | | |
| Thursday | | | | | | |
| Friday | | | | | | |
| Saturday | | | | | | |
| Sunday | | | | | | |

25. How do you ensure that the portions served per meal to students are adequate?

APPENDIX 6: DATA COLLECTION PICTURES



Picture A: Researcher and his research assistant collecting data from a food handler, **Picture B, C and E:** are examples of food handlers in their various food protective attires provided by various institutions. **Picture F:** Lack of HACCP procedures as meat is cut in the open, and exposed to various elements such as dust. **Picture D,** Lack of proper HACCP procedures in the handling of misen place, as prepared vegetable are exposed to various contaminative elements. **Picture G:** examples of institutional Kitchens adopting kitchen machinery. **Picture H:** example of poorly constructed Dining halls, one that is small and lacks windows. **Picture I:** Kenyan High school students filling out research questionner.