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

The Thesis of the PhD dissertation

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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).

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 this 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. Main Objective

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

1.2.1. Research Objective

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.

1.2.2. Research Hypothesis

The main hypotheses in this research were as follows:

***H₀₁**. Food handlers lack significant knowledge, attitude, and practice, to ensure proper food safety and sanitation services to students.*

H0₂. The current school environment (facilities, equipment, tack shop) does not significantly enhance food safety and health among students during consumption

H0₃. The current curriculum significantly enhances adequate food and nutrition Knowledge and practice among students

H0₄. Quality nutritious foods are always served to students which are in line with their dietary requirement.

2.MATERIALS AND METHODS

2.1. 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, 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, 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(NDIVO, 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 Likipia 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)

2.2. 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.

2.3. 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, Elgeiyo 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.

2.4. 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.

2.5. 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 1: 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

2.6. 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.

2.6.1. 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.

2.6.2. Semi- Structured Interview Schedule

Semi-structured interview schedules 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.

2.6.3. 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.

2.7. 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).

2.7.1. 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.

2.7.2. 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.

2.8. 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 was performed. Descriptive statistics included frequencies and percentages and enabled the researcher to meaningfully describe distribution of measurements using a few indices or statistics.

3. RESULTS

3.1. Results Interpretation (Objective One)

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

3.1.1. Food Handlers Demographic Information

A total of 204 respondents who participated in the study, a majority were men (76%), while women were only (23%). 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

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

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.

3.1.3. Attitude assessment of food handlers

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 whether 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)

3.1.4. Assessment of Food handler's behaviour and practice

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).

3.1.5. Correlation Results

Pearson's product moment correlation analysis was used to assess the correlation between the variables. The results 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 indicate that the highest relationship is found between food handlers' knowledge on food transmission services with their behavior and practice.

3.1.6. Multiple Regression

Results of multiple regressions, 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 0.226 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. Results indicate 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.

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 44.1% of the variation in behavior and practice as explained by R^2 of 0.441 which shows that the model is a good prediction. Further, the results reveal 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.

3.1.7. Hypothesis Testing (Objective 1)

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

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

3.2 .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)

3.2.1. Kitchen Amenities

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.

3.2.2. 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 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, indicate an inadequacy in the number of deep freezers. Furthermore, 69.6% (142), of participants acknowledge the availability of a hood 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 findings 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.

3.2.3. Availability of Kitchen Amenities in High schools in Kenya

Respondents were requested to indicate their responses as; Very adequate, Adequate, Average, Inadequate and Not Inadequate. 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 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.

3.2.4. Tack Shop

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. 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.

3.2.5. Dining facilities in High schools in Kenya

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

3.3 . Results Interpretation (Objective Three)

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

3.3.1. 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. 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.

3.3.2. Knowledge on food safety

The study also investigated the level of food safety knowledge among students in Kenyan high schools. 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

3.3.3. Practice of Sanitation among Student in Kenyan High Schools

The study also investigated the student's level of hygiene practice. Majority of the students (72.1%) agreed that they always considered checking the expiry date of food items before consumption while only 28.1% 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.

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.

3.3.4. Correlation statistics

A correlation analysis of the independent factors and the dependent factor were carried out. 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.

3.3.5. Regression findings

The regression results revealed that nutrition knowledge has a positive and significant effect on sanitation and practice with a beta value of $\beta_1 = 0.47$ (p-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, outcome 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.

3.3.6. Hypothesis Testing (Objective 3)

Ho₃. 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 (Dissertation: Table 29) and Regression analysis (Dissertation: 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

3.4 . Results Interpretation (Objective Four)

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

3.4.1. Mean amount of foods consumed daily

Results demonstrate 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.

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

Foods appearing in the school menu were classified into 8 food groups. 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.

3.4.3. Mean amount of nutrients provided from the diet

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.

3.4.4. Percentage fulfilment of different nutrients

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.

3.4.5. Hypothesis Testing (Objective 4)

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

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.

4. 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.

5. CONCLUSIONS

5.1. Conclusion

From the forgoing, it is concluded that food handlers in Kenyan high schools poses 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, 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) being key issues. 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, (**Hypothesis H_{03} , Knowledge, Rejected**), (**Practice, 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} , 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 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.

5.2. 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 and that would spear head development, growth, learning, health, and safety among Kenyan school children. This would help bring, equity among

various categories of schools, and a sustainable healthy and safe environment for school goes 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.

6. LIST OF PUBLICATIONS

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