



Effects of hazard analysis and critical control points principles on food safety at national youth service in Nakuru County, Kenya



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ABSTRACT

This study examined the effect of hazard analysis and critical control points principles on food safety at the National Youth Service in Nakuru County; Kenya. Application of Hazard Analysis and Critical Control Point (Hazard Analysis and Critical Control Point, HACCP) principle in food production and service areas is a requirement especially in all food handling stages. Successful implementation of the procedures based on the HACCP principles requires the full cooperation and commitment of food handlers' requiring employees to undergo training. Food safety plays a significant role in the economic and health development of Nations by safeguarding the nation's health, enhancing tourism, hospitality, and international trade, the production, distribution, and consumption of safe food. The scope of the study was limited to NYS Catering unit kitchens in Gilgil College. The findings explain the hygiene and safety practices of other Academic kitchens in Kenya. The study adopted a mixed research methodology, this study adopted a census method; the reason being the total population was 121. The response from the quantitative data from the questionnaires was tabulated, coded, and processed by use of the statistical package for social sciences Data collected was analyzed using descriptive and inferential statistics. From the findings, the R and R² value representing the simple correlation summary showed that 16.6 percent of HACCP principles can be explained by variance in food safety. ANOVA results showed that the model applied was statistically significant to predict the outcome variable. The study also concludes that food-hygiene operating procedure that is documented and awareness too that food safety inspections by health inspectors help to ensure safe food handling practices are followed.

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Introduction

Food poisoning and contamination has become a major issue in our public institutions, with so many incidences being reported and some still in the hidden by food consumers. Hygiene practices covers proper acquisition and storage of food items, maintenance of clean environment during food preparation and serving, and assurance that all equipment and serving dishes are clean/ free from pathogens and further contaminants (Lee et al, 2012). In Kenya, where food business is the order of the day with different stages of production, processing and distribution in the entire value chain, adherence to satisfy relevant hygiene and regulations to maintain/control and enhance safety before and upon consumption is highly necessary. Application of Hazard Analysis and Critical Control Point (Hazard Analysis and Critical Control Point, HACCP) principle in food production and service areas is a requirement especially in global trade (Walker *et al*, 2003). Successful implementation of the procedures based on the HACCP principles requires the full cooperation and commitment of food handlers' requiring employees to undergo training. According to (FAO, 2016). The specific practices are not endeared, thus the reason for there being so much experiences of food contaminations both internationally and locally.

Food-borne illness sometimes mis-labelled "food-borne disease, food-borne infection," or "food poisoning) is a common, costly and yet a preventable public health problem caused through contamination of different disease-causing microbes (pathogens), poisonous chemicals and other harmful substances. Other diseases such as poisoning are caused by harmful toxins or chemicals that have

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contaminated the food, like poisonous mushrooms. These different diseases have many different symptoms, so there is no one "syndrome" that is food-borne illness. However, when the microbe or toxin enters the body through the gastrointestinal tract, and often nausea, vomiting, abdominal cramps and diarrhoea are common symptoms in many food-borne diseases (Tansey & Worsley, 2014).

According to Nguz, (2007), Stated that Food poisoning and contamination has become a major issue in our public institutions, with so many incidences being reported and some still in the hidden by food consumers. Hygiene practices covers proper acquisition and storage of food items, maintenance of clean environment during food preparation and serving, and assurance that all equipment and serving dishes are clean/ free from pathogens and further contaminants (Lee *et al*, 2012). Failure to protect the safety of food leads to a decline in consumer confidence in the safety of many food products and threatens the health and wellbeing of any given individual. This creates the need to investigate how institutional culture influences food safety in Kenya. In addition, strategies need to be developed to improve and curb food safety throughout the food system in any learning or training institution especially those serving a huge number of individuals since any food infection could affect thousands of individuals. Furthermore, gaps exist in terms of unreported illnesses and on the extent to which HACCP principles are adhered to in these institutions (Shukla & Singh, 2014).

The main objective of this study was to determine effects of hazard analysis and critical control points principles on food safety at National Youth Service in Nakuru County; Kenya.

The specific objectives are (i) determining the effect of Critical Limits n Procedures and catering policies on food safety at the National Youth Service in Nakuru County, Kenya, (ii) investigating the influence of Corrective Actions on food safety at the National Youth Service in Nakuru County, Kenya, and (iii) assessing documentation, records management and their effect on food safety at the National Youth Service in Nakuru County, Kenya.

Literature review

Hazard Analysis Critical Control Points Principles

HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product. Hazard Analysis and Critical Control Point (HACCP) is a system that helps food business operators look at how they handle food and introduces procedures to make sure the food produced is safe to eat (CDC, 2015). Says that there should be development of a range of food safety management packs for different sectors of the food industry to help food production operators manage their food safety management procedures. The HACCP system can be used at all stages of a food chain, from production and preparation processes including purchasing, preparation, cooking, packaging and presentation .However, food safety programs should be designed to help food handlers identify and manage hazards to food safety All food production and processing food handlers must develop, own and implement a documented food safety program (FSP) for this will help curb food contamination issues According to Al Busaidi & Jukes, (2015).food safety programs that identify potential hazards that may occur in all food handling operations carried out in the business should identify where these hazards can be controlled; monitor these control methods, provide corrective actions when a hazard is found to be not under control, establish, document and verify detailed pre-requisite programs; and regularly reviewed for adequacy. This would be the most appropriate one to any given food production sector (Jabbar & Grace,2012).

Food handlers' practitioners should keep record and retain copies of action taken demonstrating compliance with the food safety program and ensure it is audited by a food safety auditor (Shravani, 2012). HACCP being a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, manufacturing, distribution and consumption of the finished product. For successful implementation of a HACCP plan, , (Dawso ,2012).), management must be strongly committed to the HACCP concept and adhere to its implementation at all levels. Aagaard, (2016).noted that top management provides company employees with a sense of the importance of producing safe food and thus should support implementation of HACCP. HACCP is designed for use in all segments of the food industry from growing, harvesting, processing, manufacturing, distributing, and merchandising to preparing food for consumption. Food safety systems based on the HACCP principles have been successfully applied in food processing plants, retail food stores, and food service operations. the seven principles of HACCP have been universally accepted by government agencies across divides, trade associations and the food industry around the world.

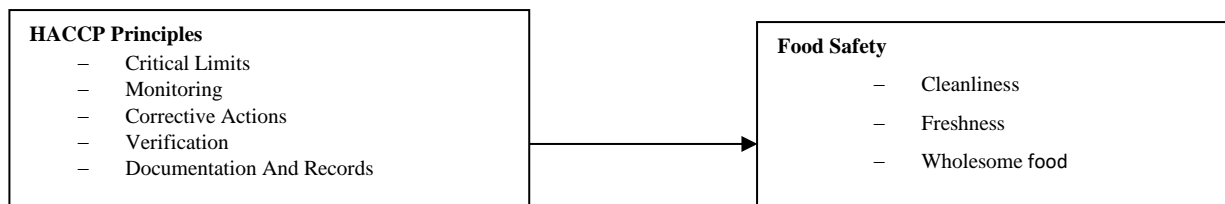
HACCP allows each business to focus on their operation and its unique characteristics rather than having a standardized inspection process that may not offer the flexibility to consider the uniqueness of each food production unit and each food product(Al Yousof& Taylor,2015). The focus of HACCP is not on having a standardized production process but on having a monitoring process that is adequate to assure each food handler is producing a safe product by minimizing the risk of a food safety problem. However all must be guided by the HACCP seven principles: conduct a hazard analysis; determine the critical control points (CCPs); establish critical limits (CL); establish monitoring procedures; establish corrective actions; establish verification procedures and establish record-keeping and documentation procedures (Powell & Chapman, 2011).

Theory of Food Poisoning

The theory of food poisoning is 100% preventable as proposed by the WHO (2007). According to WHO (1989), in the theory food poisoning is 100% preventable, the theory has five principles of food hygiene that have to be practiced in any food production area. This principles aid in preventing contamination of food with pathogens spreading, separating raw and cooked foods, cooking foods for the appropriate length of time and temperature, storing food at the proper temperature and using safe water and raw materials. By implementing the five said principles, any food handler is able to present a wholesome meal for consumption to the consumers. This is indeed a very relevant theory to the current study as it aims at presenting a meal free from contamination. This is against an increase public conscious of food hygiene being an integral activity linked to the efficient production of safe, quality food that is fit for human consumption. The food industry is increasingly subjected to scrutiny and testing to ensure compliance with food safety regulations and to protect public health. The theory puts a responsibility on food handlers on the premise that it is possible to have zero food poisoning as opposed to the current situation in Kenya where food poisoning is common place. The study thus sought to determine what the food handlers were doing at the Gilgil NYS catering units to ensure this level of food safety is attained within the precepts of the theory of food poisoning is 100% preventable.

The second theory anchored to this study is the behaviour-based food safety training model proposed by (Yiannas, 2008). According to Yiannas (2008) in his theory, behavior-based food safety training, presents five phases model and argues that if practiced can lead to presentation of wholesome meal. These phases include; Phase 1: Human influence on critical control points, Phase 2: Safe food handling fundamentals, Phase 3: Understanding current behaviors and the reasons for them, Phase 4: Interventions to bring about change and Phase 5: Monitoring. This issues that were investigated in this study included food catering policies, food handling practices and the Hazard Analysis Critical Control Points (HACCP) that are all be linked to the five phases. This model was used as framework to understand numerous factors thought to influence behaviors and behavioral change, specifically associated with education and training. This model supports the contention that factors other than knowledge, education, and training influence safe food handling behaviors or practices and ought to be considered more fully (Yiannas, 2008).

Conceptual Framework



Independent variables

Dependent variable

Figure 1: Conceptual framework

Methodology

This study adopted a census method; reason being the total population was 121 as described by Abowitz & Toole,2010). census approach as the use of the entire population. The study used structured questionnaire and interview guide as instruments of data collection. According to Kothari, (2004) the most suitable research instrument for mixed method research design is a questionnaire. A questionnaire was developed for the Messing/Catering Officer, Cooks, Assistant cooks, Storekeepers. On the other hand, an interview guide was developed for NYS Health Officer, Chief Messing Officer, Assistant Messing Officer and Chief Ratio Officer. The questionnaire tool included both open and closed ended questions for ease of analysis. The questionnaires were disseminated to the respondent through the help of their supervisors and collected from the same individual in two weeks' time. A follow up phone calls and electronic mail were sent to respondents to remind them before the two weeks were over. A pilot study was conducted on 12 individuals at the Kenya Education Management institute. The findings were not included in the actual study. The main purpose was to check on suitability and the clarity of the questions on the instrument design, relevance of the information being sort out, the language used and the content validity of the instruments from the responses that were given. Data collected was analyzed using descriptive and inferential statistics. According to Creswell and Plano (2011), data analysis in mixed methods research consists of analyzing the quantitative data using quantitative methods and the qualitative data using qualitative methods. The response from the quantitative data from the questionnaires were tabulated, coded and processed by use of the statistical package for social sciences (SPSS). Analysis of quantitative data was accompanied with tabulations, graphs and percentages. Both descriptive and inferential statistics were used to analyze the data.

Data analysis, presentation and interpretation

Response Rate

Out of 121-targeted respondents, 93 filled and returned the questionnaires resulting to 76.9 percent response rate. According to (Fowler, 2013).a response rate of 50 percent is considered adequate, 60 percent good and above 70 percent very good. Therefore, the

response rate of 76.9 percent was considered very good and exceeded the threshold postulated by Best and Khan. On the basis of this, the researcher went ahead to analyze data as presented in the tables.

In addition, qualitative responses were obtained from the key informants in the staff management. The key informants were chosen based on the researcher’s judgement through a purposive method. The was guided by consideration such as specialist knowledge of the research issue, capacity and willingness to participate in the research as well as participants likelihood to contribute appropriate data both in terms of relevance and depth (Silver & Lewins, 2014).. These included Chief messing Officer, Assistant Chief messing officer, chief ratio Officer, NYS Health Officer and designated as K1, K2, K3 and K4 respectively. These were individuals with deep knowledge and insight about food catering at the study location. The interview involved conducting a loosely structured conversation with the respondents. The responses were analysed thematically where the following themes emerged food Catering Policies and food handling practices.

Length of Time Respondents have worked in Food Service

The study also sought to determine the length of time respondents have worked in any type of food service. The length of service of respondents was important as it implies knowledge, experience and familiarity with the organization. A length of service implies knowledge and familiarity of the organization due to the accrued experience; it is an important factor to reliability and validity of the responses. The results are presented in Figure 2. The findings in Figure 2 show that most of the respondents 69.9 percent had experience of less than 5 years, 17.2 percent had experience between 5-10 years 7.5 percent had experience of over 20 years while 5.4 percent fall in the bracket of 10-20 years. This implies that majority of the respondents have low number of years’ experience in the food service. This could suggest that the department has undergone high labour turnover or it has expanded its workforce in the recent past (Abowitz & Toole,2010).

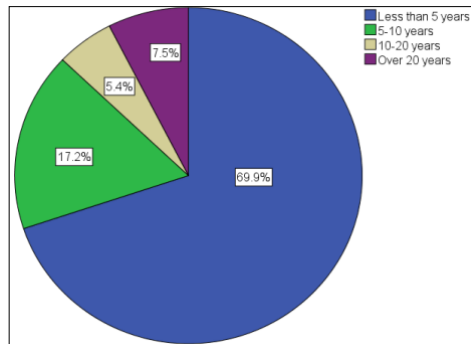


Figure 2: Length of Time Respondents have worked in Food Service; *Source:* Author

Respondents Statuses on Training on Food Safety Program

The study sought data on whether the respondents have been trained in any food safety program. Training has numerous advantages to both the workers and the organization since it leads to an increase in job satisfaction, morale, motivation for employees that leads to efficiencies in processes, and ultimately financial gain. Workers get to add knowledge through training on the field of work, while the organization gains from better service performance by employees. The results are presented in Figure3. The findings in Figure 3show that a reasonable number of the respondents 53.8 percent disagreed that they been trained on food safety while 46.2 percent agreed they have received training during their time with the organization (Clayton & Griffith,2008). This implies that majority of the respondents have not been trained on food safety. This suggests a need on further training for the personnel working at the NYS Gilgil catering department.

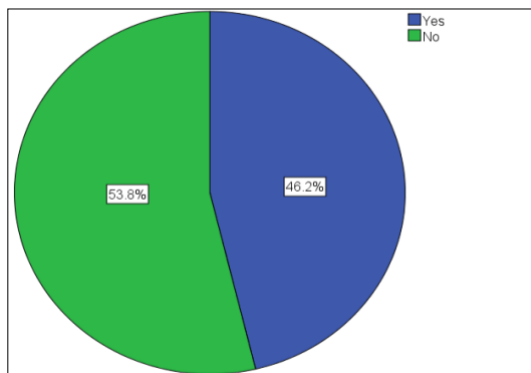


Figure 3: Respondents Statuses on Training on Food Safety Program; *Source:* Author, 2019

Freedom to Express Against Something that May Affect Food Safety

The study sought data from respondents on whether they can freely speak up if they saw something that affect food safety. This is important in determining whether there is freedom of expression within the respondent’s organization. The results are presented in Table 1. The findings in the Table 2 show that a good number of the respondents agreed with a mean value of 1.47 and a standard deviation of 0.716 that they could freely speak up if they saw something that may affect food safety. This implies that majority can speak up freely and there is freedom of expression within the respondent’s organization.

Table 1: Freedom to Express Against Something that May Affect Food Safety

Background of Response	N	Mean	Standard Deviation
Freedom to express against something that may affect food safety	93	1.47	0.716

Source: Author

Respondents Encouraged Offering Suggestions on Improving Food Safety

The study sought data from respondents on whether they are encouraged to provide suggestions for improving food safety practices. This is important in determining whether there is active participation by all the staff within the respondent’s organization. The results are presented in Table 2 Table 2 shows that most of the respondents disagreed with a mean value of 3.51 and a standard deviation of 0.91 that they were being encouraged to provide suggestions for improving food safety practices. This implies that a good number of respondents are not encouraged to provide suggestions for improving food safety practices since the organization discourage active participation in decision makings (Dawso ,2012).

Table 2: Respondents Encouraged Offering Suggestions on Improving Food Safety Practices

Background of Response	N	Mean	Standard Deviation
Respondents encouraged offering suggestions on improving food safety practices	93	3.51	0.91

Source: Author, 2019

Implementation of HACCP Principles

The third objective of the study aimed at assessing the implementation of HACCP principles and their effect on food safety. This was measured by both open-ended questions and closed ended question. 6 questions were used in the study and the responses and findings are presented in Figure 4. Aspects of examination were awareness, training and inspection of food. The study sought data on whether the respondents have ever heard of HACCP or any other food safety standards. The findings are presented in Figure 4. The findings in the Figure4 show that a bigger number of the respondents 54.8 percent have not heard of HACCP or any other food safety standards while, 45.2 percent agreed to have heard of HACCP or any other food safety standards. This implies that most of the respondents have not heard HACCP or any other food safety standards since they had not been trained on the food safety standards (Taylor, 2011).

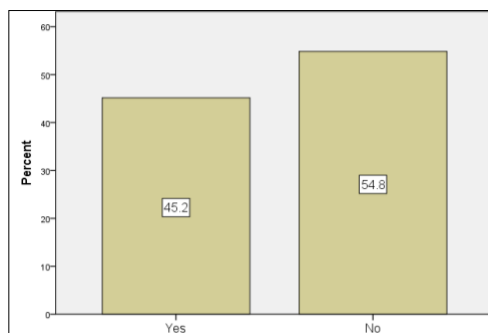


Figure 4: Knowledge of HACCP or Any Other Food Safety Standards; Source: Author

Implementations of Continuing Education Courses on HACCP and Food Hygiene

The study sought data on whether there are continuing education courses on HACCP and food hygiene for food-handler. The findings are presented in Figure 5. The findings in the Figure 5 show that a higher percentage of the respondents 71.0 percent disagreed that there are continuing education courses on HACCP and food hygiene for food-handler being implemented while 29.0 percent agreed that there are continuing education courses on HACCP and food hygiene for food-handler being implemented. This implies that popular of the respondents did not think that there were continuing education courses on HACCP and food hygiene for food-handler being implemented (Dzwolak, 2014).

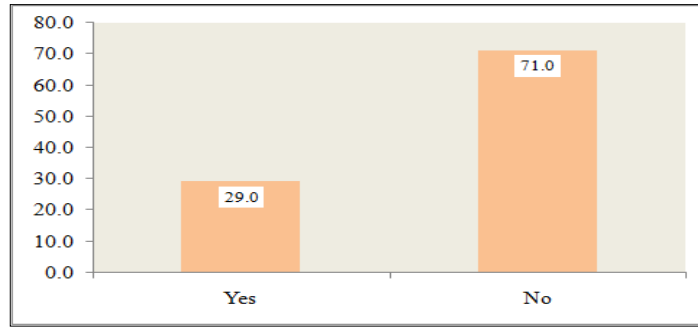


Figure 5: Implementations of Continuing Education Courses on HACCP and Food Hygiene; *Source:* Author

Implementation of HACCP Principles

The study also sought data from respondents on whether food safety inspections by health inspectors help to ensure safe food handling practices. The study revealed a statistical mean range between 1.34 and 3.49 and a standard deviation range between 0.48 and 1.38 as indicated in Table 3. This shows fairly low distribution of data from around the mean value and limited skewness. Data further revealed that more than half of the respondents agreed with a mean value of 3.49 and a standard deviation of 1.16. This implies that mostly, respondents were of the opinion that food safety inspections by health inspectors aid in ensuring safe food handling practices are followed. This suggests the importance of frequent inspection as a strategy of improving adherence to safe food handling practices (Garayoa, et al.,2014).

Table 3 reveals that majority of the respondents agreed that food-hygiene operating procedure had been documented while a good number disagreed with a mean value of 1.34 and a standard deviation of 0.48. This implies that a greater number of the respondents were of the view that food-hygiene operating procedure has been documented. On whether employees are rewarded for following safe food handling practices, the study showed that most of the respondents disagreed with a mean value of 2.81 and a standard deviation of 1.30. This implies that a good number of respondents were of the opinion that employees are not rewarded for following safe food handling practices (Sharif, & Al-Malki,2010).

It implies that there is need for management to consider rewarding as a motivating measure to improve safe food handling practices at NYS Gilgilt catering units. The findings in Table 3 show that majority of the respondents disagreed with a mean value of 3.17 and a standard deviation of 1.38. This implies that more than half of respondents were of the opinion that they do not follow well food safety practices as part of their annual work performance evaluation. This further suggests that measures for safe food handling need strengthening as part of annual work performance evaluation (WHO ,2015).

Table 3. Implementation of HACCP Principles

Implementation of HACCP Principles	N	Mean	Standard Deviation
Food safety inspections by health inspectors ensure Adherence to safe food handling practices	93	3.49	1.16
Any documentation of food hygiene handling procedures	93	1.34	0.48
Employees are rewarded for following safe food handling practices	93	2.81	1.30
Adherence to food safety practices part of annual work performance evaluation	93	3.17	1.38

Source: Author

Results and discussion

To majority, not all the necessary information for handling food safely is readily available. Managers are actively involved in making sure safe food handling is practiced and in most of situations, new employees and experienced employees work together to ensure food safety practices are in place while training/education on food safety is provided by management, which help improve practices. Most staffs don't use food gloves when preparing food items and don't use detergent water when cleaning vegetables. Staffs go for food handling medical check-ups, but most have not attended any in-service training. Most uses menu and procedures for food production and do record what is received for preparation in the kitchen. They also they do take temperature measurements and keep records of all food temperature during service. The staffs think handling practices are standardized and institutionalized across NYS catering units and there are measures put in place to prevent food contamination and poisoning. Majority of staff have not heard about HACCP or any other food safety standards though they think there are continuing education courses on HACCP and food

hygiene for food-handlers. All the key informants showed that there have never been incidences of food contamination or food poisoning in NYS. This means there are low food poisoning incidences in the institution (Al Yousuf & Taylor, 2015).

Regression

In order to determine how the independent variables are related to the dependent variable the study conducted regression analysis and presented the results in the section below. The regression model in Table 4 shows the R and R² value representing the simple correlation. The R value is 0.232 which indicates a fair correlation. The R² value indicates how much of the dependent variable (Catering and Food Safety practices), can be explained by the independent variable, (Implementation of HACCP Principles). In this case, 16.1% can be explained, which is fairly strong. This therefore implies that there is a fairly low association between Catering and Food Safety practices and the Implementation of HACCP Principles.

Table 4: Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.232 ^a	.161	-.010	.045

a. Predictors: (Constant), Implementation of HACCP Principles

Source: Author

Regression Coefficient of Implementation of HACCP principles

The study determined the strength of the relationship between Implementation of HACCP Principles and Catering and Food Safety practices and results presented in Table 3. The Table 3 provides the information needed to predict Catering and Food Safety practices at NYS from Implementation of HACCP Principles in which the constant and the Food Catering Policies variable are significant. The regression equation is presented as follows; Catering and Food Safety practices = 1.798+ 0.235(Implementation of HACCP Principles)

Table 3: Regression Coefficient of Implementation of HACCP principles on Catering and Food Safety Practices

Coefficients^a						
Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients		
1	(Constant)	1.798	.231		7.792	.000
	Implementation of HACCP Principles	.235	.117	.032	.294	.039

a. Dependent Variable: Catering and Food Safety

Source: Author

Implementation of HACCP Principles

A bigger percentage of the respondents have no information and knowledge on hazard analysis and critical control points principles and their effect on food safety, because of inadequate training. Food-hygiene operating procedures had been documented although the food safety practices are hardly followed. Fundamental role of health inspectors on food handling practices was highly noted by the respondents. A report by WHO (2015) on Estimates of the Global Burden of Food-borne Diseases that comprehensive reported the impact of contaminated food on health and well-being of individuals estimated that each year as many as 600 million, or almost 1 in 10 people in the world, fall ill after consuming contaminated food out of which, 420 000 people die. The report further cited 31 agents of food-borne diseases that include bacteria, viruses, parasites, toxins and chemicals. This report emphasizes the importance of ensuring zero incidences of food poisoning by ensuring stringiest adherence to hygienic food handling . (Todd& Bartleson., (2010).

Implications

This section presents a summary of findings of the study based on the objectives of the study. Information of the respondents indicated that 65.6% being below the age of 25 years and a further 21.5% between the ages of 26 to 50 shows the staffs working at the catering units are youthful, with 64.5% being female meaning that the gender is skewed in favour of female staff. In addition, majority had an experience of less than 5 years within the catering department. Further, majority had not been trained on food safety implying a need for further training for the personnel working at the NYS Gilgil catering department.

The study revealed that 54.8 percent of the respondents had not heard about HACCP or any other food safety standards, though 71 percent of the respondents assumed that continuing education courses on HACCP and food hygiene for food-handler was being implemented as revealed in Figures 4:5 and 4:6. Further, respondents showed that a mean of 3.49 and a standard deviation of 1.16 thought that food safety inspections by health inspectors helped ensure safe food handling practices were followed as in Table 4:6. In addition, 1.34 of the staff thought that food-hygiene operating procedures were documented. The study further revealed that a mean of 3.17 of respondents was of the opinion that they did not follow well food safety practices as part of their annual work performance evaluation.

On the regression results, the model summary showed that 16.6 percent of HACCP principles can be explained by variance in food safety. ANOVA results showed that the model applied was statistically significant to predict the outcome variable. The coefficient of implementation of HACCP principles showed that a unit change in implementation of HACCP principles causes negative change in food safety. This was explained by the lack of education and lack of awareness of the policy. The null hypothesis that stated that implementation of HACCP principles do not have statistically significant effect on the food safety at the National Youth Service Catering Units in Gilgil, Kenya was rejected.

Conclusions

This study concludes that 54.8 percent of the respondents have not heard HACCP or any other food safety standards though they think there are continuing education courses on HACCP and food hygiene for food-handlers. There is food-hygiene operating procedure that is documented and awareness too that food safety inspections by health inspectors help to ensure safe food handling practices are followed. However, employees are not rewarded for following safe food handling practices. They do not follow food safety practices as part of their annual work performance evaluation. The study rejected all the null hypotheses which mean that all the variables statistically have an effect on the food safety.

The theory was supported by this study because the findings from the study are in harmony with both theories of the theory of food poisoning is 100% preventable and the behaviour-based food safety-training model. On theory that food poisoning is 100% preventable, the study recommends that management at the institution should strive to always provide adequate and timely information about current food safety rules and regulations and should also offer more in-service training (within the precepts of behaviour based food safety training model) for all staff. It should also ensure 100% compliance to HACCP principles because adherence to the principles can prevent food poisoning totally. The management should also make the staffs to be more aware of HACCP and other safety standards, and should reward employees for following safe food handling practices.

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