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Food Handlers' Knowledge of Food Hygiene Practices and the Bacteriological Quality (*Staphylococcus aureus)* of Vegetable Salad in Private Hospitals in Mombasa County

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Abstract

Fresh vegetable salad is an essential and important ingredient to ensure a healthy diet. Many hospitality establishments also serve a wide range of vegetable salad to their guests while nutritionists have emphasized the importance of fresh vegetables in maintaining a healthy diet. Although fresh vegetables are good for health, their consumption is also related to the risks for the consumer. This study examined the relationship between the food handlers' knowledge of food hygiene practices and the bacteriological quality of vegetable salad in private hospitals in Mombasa County. The study was conducted in registered private hospitals in Mombasa County. These hospitals offer vegetable salad to patients and are referral centres for both domestic and international tourists who need medical attention. Due to the high temperatures in Mombasa (average being 32°C), cold dishes especially salad is preferred. Multiple Regression analysis was used to test the causal relationship between knowledge and awareness of food and hygiene practices of 135 food handlers and the bacteriological quality of 180 vegetable salad samples which comprised of carrots, lettuce and tomatoes. The result of multiple linear regression analysis was used to explain the causal relationship between the food handlers' knowledge of food hygiene practices and the bacteriological quality (*Staphylococcus aureus* level) of vegetable salads in private hospitals in Mombasa County. The overall model explained 72% of the variation in the dependent variable (*Staphylococcus aureus).* This was significantly useful in explaining the food handlers' knowledge of food hygiene practices and the bacteriological quality (*Staphylococcus aureus* level) of vegetable salad in private hospitals in Mombasa County, with Analysis of

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Variance (ANOVA) indicating Significance Level F= 36.4253, P<0.0001. There were six independent variables that had significant effect on bacteriological quality (*Staphylococcus aureus* level) of vegetable salad. These included: cleaning of food contacts (scale 5-1) t = 2.149, P < 0.0336; Sinks for washing vegetables (scale 5-1) t = 5.578, P <0.0001; Wearing of gloves (scale 5-1) t = -2.620< 0.0097; Food Hygiene practices (scale 5-1) t = - 4.729, P < 0.0001; Covering of salads (scale 5-1) t = -5.706, P < 0.0001 and Washing of Vegetables (scale 5-1), t = -3.673< 0.0004. The study concluded that the presence of *Staphylococcus aureus* in vegetable salad samples can also be used as an indicator of improper handling of vegetables. Stringent measures and control strategies to reduce the contamination should be put in place. The study recommended that Pre-requisite programmes and standard operation procedures on safe food handling and production should be put in place in all hospitality food production establishments. This can be achieved by organizing regular workshops and seminars and sensitization programs.

Keywords: *Food Handlers' Knowledge, Vegetable Salad & Bacteriological Quality & Staphylococcus aureus.*

1.1 Background of the Study

Fresh vegetable salad is an essential and important ingredient to ensure a healthy diet (Mritunjay & Kumar, 2017). Therefore, the demand for vegetable salad has increased in recent years. Many hospitality establishments also serve a wide range of vegetable salad to their guests while nutritionists have emphasized the importance of fresh vegetables in maintaining a healthy diet. Researchers and government organizations recommend an intake of at least five servings of vegetables and fruits daily (Kariuki, Ng`ang`a & Wanzala, 2017). Although fresh vegetables are good for health, their consumption is also related to the risks for the consumer (Weldezgina & Muleta, 2016).

Vegetable salads are generally eaten raw therefore, food handlers must wash them thoroughly. If washing is not done correctly, the vegetable salad becomes a carrier of pathogenic microorganisms related to human diseases (Said, 2012). Exposure to soil, dust and contaminated water during harvest or post-harvest processing can lead to microbial contamination of vegetables. They contain a variety of microorganisms, including plant and human pathogens (Hardoim *et al*., 2015). Vegetables contain many types of microorganisms, such as *Staphylococcus* (Kariuki *et al*., 2017). These pathogens have been identified as the most common ones found in raw vegetable salad due to poor food handling practices (Mritunjay and Kumar 2017). Therefore, their presence in the vegetable salad was used to assess the bacteriological quality of the vegetable salad served in the private hospitals in Mombasa County, Kenya.

A transparent approach should be adopted to ensure that food handlers receive training and information on food safety issues. Besides, the relevant government agencies responsible for setting standards for food safety should ensure that they are adhered to it (Oloo 2010). This can be done through regular inspections and non-compliance should be dealt with. In Kenya, various laws provide for the protection of consumers from harmful food. They include the Food, Drugs and Chemistry Substance Act, Chapter 254; the Public Health Act, Chapter 242; and the Meat Control Act, Chapter 316 of the Kenyan Law (Oloo, 2010). The Department of Public Health under the Ministry of Health enforces these regulations, while the Kenya Bureau of Standards (KEBS) develops and enforces specific product standards for processed foods.

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In Kenya, diarrhoea is rated among the highest cause of outpatient morbidity (CDC Annual Report, 2018). Food borne diseases especially those caused by pathogens continued to prevail with incidences being reported each year in National morbidity and mortality reports (Ministry of Health [MOH], 2000). Public hospitals in different parts of the country revealed 13,158 cases leading to 1779 deaths of *Staphylococcal* food poisoning (MOH, 2000). In 2017, a diarrhoeal outbreak broke out in Kenya whereby 3,967 cases were reported in 20 counties (43%) of the 47 counties in the country including 76 deaths (CDC Kenya, 2017).

The hospitality industry in Kenya has also witnessed the extensive expansion of the outside catering (Rotich, Yego, & Korir, 2012). This is because more and more commercial clients and public organizations are outsourcing their ancillary services. The increased demand for vegetable salad has led to poor hygienic handling practices in the country and hence poses health risks to the consumers (Rotich, Yego, & Korir, 2012). Food hygiene in hospitals can be of great concern given that patients are more susceptible to microbiological risks than healthy people. In a hospital environment, food handlers can play an important role in foodborne disease outbreaks, especially when they do not have adequate understanding of food safety and personal hygiene practices. Patients who receive food from food handlers who do not handle food properly may develop food-borne infections, which may also lead to a hospital-wide outbreak (Tomohide, 2010). It is against this background that this study assessed the relationship between the food handlers' knowledge of food hygiene practices and the bacteriological quality of vegetable salad in private hospitals in Mombasa County.

1.2 Objective of the Study

To establish the relationship between the food handlers' knowledge of food hygiene practices and the bacteriological quality of vegetable salad in private hospitals in Mombasa County.

1.3 Null Hypothesis

H_0: There is no significant relationship between the food handlers' knowledge of food hygiene practices and the bacteriological quality of the vegetable salad in private hospitals in Mombasa County.

2.0 Literature Review

2.1 *Staphylococcus aureus (S. aureus)*

Staphylococcus aureus a pathogenic bacterium causes food borne disease and various other diseases (Chiang et al. 2008). Staphylococcus aureus (S. aureus) has also been reported as the most common bacteria that can cause foodborne illness worldwide (Saifullah *et al*., 2018). Fresh vegetable salads are eaten raw therefore if they are contaminated with microbial pathogens, they can cause serious food-borne diseases.

Staphylococcal food poisoning is not caused by ingesting bacteria, but by ingesting toxins produced by bacteria that are already present in contaminated food (Boyce, 2019).

Approximately 30% of *Staphylococcus aureus* is temporarily present on the nose and 20% on the skin of healthy adults (Bush, 2021). Although this percentage may be higher for patients or people who work in hospitals. Typical symptoms of *Staphylococcus aureus* include severe

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nausea and vomiting starting 2 to 8 hours after eating contaminated food (Boyce, 2019). Other symptoms can include abdominal cramps, diarrhoea, and sometimes a headache and fever.

Careful food preparation and handling can prevent *Staphylococcal* food poisoning. Food handlers with skin infections should not prepare ready-to-eat foods and should also pay attention to the appropriate temperature.

2.2 Knowledge and Awareness of Food and Hygiene Practices of food handlers

Knowledge and awareness of food and hygiene practices is a crucial factor in the quality of vegetable provided to people (Yeleliere *et a*l., 2017b). In addition, training is important as it helps the food handler understand the importance of hygienic food handling practices (Githiri *et al*., 2013). This also includes proper storage, handling, and cleaning, and pest control. Educating and training food handlers also helps in reducing mistakes, significantly amplify profits, and boost food handlers' morale. A report of a quantitative survey on food safety management training trends conducted in Australia showed that effective education and training programs are the best way to increase the safety awareness of food handlers (Symes, Goldsmith, and Haines 2015). Besides, personnel who are well trained in food safety and hygiene, establish better kitchen management by ensuring that kitchen procedures are well monitored.

Lee, Halim, Thong and Chai (2017) evaluated the knowledge, attitudes, self-assessment practices (KAP) in food safety and microbial hand hygiene of 85 food handlers from a university in Kuala Lumpur, Malaysia. Testing for total aerobic, coliform, *Escherichia coli*, *Staphylococcus aureus*, *Salmonella*, and *Vibrio parahaemolyticus* was done on 85 hand swabs. The survey results showed that 61.7% of food handlers had an intermediate level of understanding of food safety, while 51.9% had a good attitude, and their self-reported practice was 53.2/60. However, positive self-reporting practices were not reflected in the microbiological evaluation of the hands of food handlers. 65% of the food handlers inspected had a total aerobic count ≥20 CFU/cm^2. *Salmonella* was also detected in the hands of 48% of food handlers. The results indicated that the food handlers had sufficient knowledge about food safety, but they did not translate the perceived knowledge into work practices.

Chellaiyan, Fasna, and Mallika (2018) conducted a cross-sectional study of 200 participants among the rural population of Tamil Nadu, India. The focus was on the assessing food safety awareness and practice at home. Using a previously tested semi-structured questionnaire, the survey results showed that 33% of the participants lacked knowledge of the correct way to clean vegetables, while 36% of the participants knew that not eating freshly prepared foods would lead to food poisoning. Based on the survey results, the study concluded that raising community awareness by systematically teaching basic food safety guidelines is necessary to prevent foodborne diseases.

Githiri *et al*. (2013) conducted a study on food hygiene knowledge and hygiene practices of 95 food handlers in a public referral hospital in Nairobi, Kenya. Simple random sampling was used in the selection of the sample and a questionnaire was used to assess the level of knowledge of hygiene practices. An observation check-list was used in capturing the non-verbal events. The results showed the average survey score at college-level was 80.8%. The secondary level respondents and primary level respondents accounted for 63.4% and 50.8% respectively. Based on the above this study sought to establish to establish the relationship between the food handlers'

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knowledge of food hygiene practices and the bacteriological quality of vegetable salad in private hospitals in Mombasa County.

3.0 Methodology

This study was carried out in five registered private hospitals with a bed capacity of 80 and above. 135 food handlers knowledge of food hygiene practises was established. An informal experimental design was used to measure the bacteriological quality of the vegetable salad. 180 vegetable salad samples which included lettuce, carrots and tomatoes were collected, tested, observed, and documented. Observation of the food handlers' practices was done from the time the vegetable items were received/delivered from the approved suppliers to the time it was served to the patients.

3.1 Data Collection Techniques and Procedure

During sample collection, clean protective clothing approved by the hospitals was used and correct personal hygiene observed. Samples were collected before washing/cleaning from the individual containers using sterile gloves to avoid any cross-contamination.

The vegetable item was then mixed after washing/shredding or slicing and a sample of not more than 25 grams collected using the food handlers' equipment. Each vegetable item was held in individual bowls before plating. A sterile scoop was used to collect samples before service. All the prepared vegetable salad was arranged in individual plates. The collected samples were put in labelled sterile leak-proof containers and coded appropriately according to location, date, and sample number. A cooler box that had been sterilized using 70% ethanol and, containing ice cubes with temperatures not exceeding 8°C was used to hold the samples. This was to prevent bacterial multiplication during sample transportation to the laboratory. The samples were immediately transferred to a refrigerator at a temperature not higher than 4°C upon arrival at the laboratory. Microbiological analysis was started within 24 hours after the samples were collected.

Vegetable salad samples were tested and the bacteria identified using the morphological characteristic, colony characteristic, and biochemical test. The acceptable microbial load chart as propounded by Centre for food safety (2014) was used to report the findings (Table 1). Vegetable samples were collected on the same day as the participant observation. Permission to check the policy documents and records was obtained from the administration

Table 1: Acceptable Microbial Load Chart

Result (colony-forming unit (cfu)/g)

Criterion	Satisfactory	Borderline	Unsatisfactory: potentially injurious to health and/or unfit for human consumption
Staphylococcus aureus and other coagulase-positive staphylococci	< 20	20 - $<10^4$	> 10^4

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3.2 Data Analysis

Regression analysis (a statistical method used to test the relationship between the dependent variable Y and two or more independent variables Xi.) was used to test the relationship between knowledge and awareness of food and hygiene practices of food handlers and the bacteriological quality of vegetable salad. Shapiro – wilk test was used to test if the data was normally distributed, when the test value was greater than 0.05, the data was considered to be normally distributed, on the other hand, if it was below 0.05, the data was considered significantly deviated from the normal distribution. From ANOVA results, when the significance level for the F-test was found to be small (less than 0.05), then the hypothesis that there the food handlers' knowledge of food hygiene practices and the bacteriological quality of the vegetable salad in private hospitals in Mombasa County was rejected

Results and Findings

Results and findings are presented in the subsequent sections.

Table 2: Results of the isolation and identification of *Staphylococcus aureus* from the fresh vegetable salad in private hospitals in Mombasa County.

VEGETABLE SALAD	BACTERIA	TESTING STAGES	BACTERIA POSITIVE CULTURE RESULTS																BACTERIA POSITIVE (%)	
			Hospital 1				Hospital 2				Hospital 3				Hospital 4				Hospital 5				Per Testing Stage	Overall
			Month 1		Month 2		Month 1		Month 2		Month 1		Month 2		Month 1		Month 2		Month 1		Month 2			
			V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V		
Tomato	*Staphylococcus aureus*	**Before *(S1)***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	**0%**
		Preparation *(S2)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	
		Service *(S3)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	
Lettuce	*Staphylococcus aureus*	**Before *(S1)***	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	8.3%	**13.3%**
		Preparation *(S2)*	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3.3%	
Carrots		**Service *(S3)***	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1.7%	
	Staphylococcus aureus	**Before *(S1)***	0	1	1	1	1	1	0	1	1	0	1	0	1	1	1	0	1	0	1	1	23.3%	**53.3%**
		Preparation *(S2)*	1	0	0	0	1	0	1	0	0	1	0	0	0	1	0	1	0	1	0	0	11.7%	
		Service *(S3)*	1	1	0	0	1	1	0	1	1	0	0	1	0	1	0	1	0	1	0	1	18.3%	

1. Results were taken as positive when; *Staphylococcus aureus* $\geq 10^4$ cfu /g.
2. S1, S2 and S3=Sample 1, Sample 2 and Sample 3 respectively.
3. V1 and V2 = Visit 1 and Visit 2 respectively.

1=Positive culture; and 0= Negative results as per criteria stated in 1 above

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Table 2 shows the results of the isolation and identification of *Staphylococcus aureus* from 180 samples tested from tomatoes, lettuce and carrots. Cultures were only considered positive when unsatisfactory limits were met, that is ,*Staphylococcus aureus* $\geq 10^4$ cfu /g. as per the Microbiological Guidelines for Food ,For ready-to-eat food in general and specific food items, Centre for food safety, (2014).

From table 2, the study isolated and identified *Staphylococcus aureus* in the Lettuce before washing/cleaning 8.3 (%), preparation stage 3.3(%) and service stage 1.7(%) In carrots the level was before washing/cleaning 23.3(%); preparation stage 11.7 (%) and service stage 18.3(%). However, *Staphylococcus aureus* was within acceptable levels in tomatoes at the stages tested. The findings therefore show that some of the samples tested were contaminated. Findings of other studies have depicted that, despite the health benefits of fresh vegetables, their consumption has also been associated with risk for consumers (Weldezgina & Muleta, 2016). On the other hand, *Staphylococcus aureus* in lettuce: before washing/cleaning 8.3 (%); preparation stage 3.3 (%) and service stage 1.7(%), concurred with another study by Kariuki et al., (2017), indicating that vegetables can harbour a large variety of micro-organisms such as *Staphylococci*.

Finally, in carrots: *Staphylococcus aureus* isolated in carrots: before washing/cleaning 23.3 (%); preparation stage 11.7 (%) and service stage 18.3 (%). The service stage, had the highest number of *Staphylococcus aureus* bacteria; 0 (%) in tomato, 8.3 (%) in lettuce and carrots 23 (%). Fresh vegetable samples before cleaning were found to be contaminated with viable aerobic bacteria in a study by Dhiraputra et al., (2005b).

Furthermore, the culture results indicated that in all of the five hospitals sampled, two of the three vegetable salads (Lettuce and Carrots) had *Staphylococcus aureus*. *Staphylococci aureus* was isolated from lettuce in 13.3(%) of the sample tested and 53.3(%) in carrots. No *Staphylococci aureus*, was isolated from tomato samples. From this study, carrots had the highest positive culture 53.3(%), followed by Lettuce 13.3(%). These findings concur with those of Mritunjay and Kumar (2017), who found these pathogens as being the most common ones in raw vegetable salad due to poor food handling practices. In addition, carrots had a higher mean count of coliforms in the study. Other studies have revealed the potential hazard of ready-to-eat salads even after being washed three times (Kuddus et al., 2016.) Tomato had the lowest positive culture whereby *Staphylococci aureus* was 0(%).

Findings by Berrada et al., (2016) stated that a high number of salads of all categories classified as unsatisfactory as they were contaminated. Vegetable salad sampled from the restaurants located within Okadatown, Edo state, also harboured a high microbial load (Osamwonyi et al. 2013). A study on Microbiological Quality of Mixed Fresh-Cut Vegetable Salads andMixed Ready- to-Eat Fresh Herbs in Mashhad, Iran**,** *Staphylococcus aureus* was found in 94.9% of samples, and coagulase-positive staphylococci were detected in 23.6% of samples (Najafi, Mohammad, and Bahreini 2012).

In contrast, microbial levels detected in ready-to-eat foods examined in a study by Rodríguez-Caturla et al., (2012) indicated the absence of pathogens in the vegetable samples analysed**.**

Generally, this study concurs with the findings of Weldezgina and Muleta (2016) that, despite the health benefits of fresh vegetables, their consumption has also been associated with risk for consumers. If vegetable salad is not prepared hygienically, it can become a vehicle for the transmission of pathogenic micro-organisms associated with human diseases as also mentioned in other studies (Said, 2012).

4.1 The causal relationship between the food handlers' knowledge of food hygiene practices and the bacteriological quality of vegetable salad *(Staphylococcus aureus* level*)*.

Multiple regression analysis was used to test the causal relationship between the personal hygiene of the food handlers' independent variables (scale 5-1): Cleaning of contacts, covering of salads, Food Hygiene practices, keeping of raw foods, Safe food handling, Sinks for washing vegetables, Use of kitchen towels, Washing of Vegetables, Wearing of gloves and the dependent variable Staphylococcus aureus level.

Table 3 shows the results of the causal relationship between the food handlers' knowledge of food hygiene practices and the bacteriological quality of vegetable salad (*Staphylococcus aureus* level) in private hospitals in Mombasa County. Shapiro-Wilk test for normal distribution indicated that the independent variables were not normally distributed {reject normality ($P<0.0001$)}.

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Table 3: Results of the causal relationship between the food handlers' knowledge of food hygiene practices and the bacteriological quality of vegetable salad *(Staphylococcus aureus level)* of vegetable salad

Regression Equation				**Least squares multiple regression**			**Analysis of Variance**		**Test for Normal distribution** (Shapiro-Wilk test)
Independent variables	Coefficient	T	P	N	Coefficient of determination R^2	Multiple correlation coefficient	F-ratio	Significance level	
(Constant)	45.4035			135	0.7240	0.8509	36.4253	**P<0.0001**	Reject Normality (P<0.0001)
Cleaning of contacts scale 5-1	3.7993	2.149	**0.0336**						
Covering of salads scale 5-1	-9.9555	-5.706	**<0.0001**						
Food Hygiene practices scale 5-1	-6.3247	-4.729	**<0.0001**						
Keeping of raw foods Scale 5-1	3.3969	1.967	0.0514						
Safe food handling Scale 5-1	-0.9266	-0.600	0.5497						
Sinks for washing vegetables Scale 5-1	10.9495	5.578	**<0.0001**						
Use of kitchen towels Scale 5-1	-3.4263	-1.977	0.0503						
Washing of Vegetables Scale 5-1	-6.1524	-3.673	**0.0004**						
Wearing of gloves Scale 5-1	-4.3613	-2.620	**0.0099**						

Multiple regression, dependent Y is Staphylococcus aureus ≥10 ^{4} cfu /g Positive and in X are nine food handlers' knowledge of hygiene practices independent variables in Scale 5-1.

4.2 Discussion of Results

The result of multiple linear regression analysis was used to explain the causal relationship between the food handlers' knowledge of food hygiene practices and the bacteriological quality (*Staphylococcus aureus* level) of vegetable salads in private hospitals in Mombasa County. The overall model explained 72% of the variation in the dependent variable (*Staphylococcus aureus).* This was significantly useful in explaining the food handlers' knowledge of food hygiene practices and the bacteriological quality (*Staphylococcus aureus* level) of vegetable salad in private hospitals in Mombasa County, with Analysis of Variance (ANOVA) indicating Significance Level F= 36.4253, P<0.0001.

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There were six independent variables that had significant effect on bacteriological quality (*Staphylococcus aureus* level) of vegetable salad. These included: cleaning of food contacts (scale 5-1) t = 2.149, P < 0.0336; Sinks for washing vegetables (scale 5-1) t = 5.578, P <0.0001; Wearing of gloves (scale 5-1) t = -2.620< 0.0097; Food Hygiene practices (scale 5-1) t = - 4.729, P < 0.0001; Covering of salads (scale 5-1) t = -5.706, P < 0.0001 and Washing of Vegetables (scale 5-1), t = -3.673< 0.0004.

Findings of a study by Soares**,** Almeida**,** Cerqueira. Carvalho and Nunes **(2012)**, pointed out that even if the handlers had been trained (92.2%), the level of knowledge was still insufficient. Coagulase-positive *Staphylococci* was present in the hand samples. However, significant improvement was noted on *Staphylococcus aureus* load in ready to eat (RTE) after the staff had been trained on hygiene knowledge and practice (Ababio, Taylor, Swainsona & Daramola, 2016).

The following three independent variables showed no significant effect on the bacteriological quality (*Staphylococcus aureus* level*)* of vegetable salads: Keeping of raw foods (scale 5-1) t = 1.967. P < 0.0514 and Safe food handling (scale 5-1) t = -0.600, P < 0.5497 and Use of kitchen towels (scale 5-1) t = -1.977, P < 0.0503. In a study on food safety knowledge, attitudes and practices as well as the presence of coagulase-positive staphylococci in the hands of food handlers at Camacari School in Brazil, there was no significant associations between the knowledge attitudes and practices of food handlers and the presence of coagulase- positive *Staphylococci* on the hands (Soares et al. 2012).

5.1 Conclusion

The presence of these microorganisms in vegetable salad samples can be used as an indicator for the need to increase awareness of the health hazards that can be caused by improper handling of vegetables. The presence of the *Staphylococcus aureus* pathogen in the salad cultures tested demonstrated a potential health risk. This pathogen is associated with foodborne illnesses in many cases around the world. Stringent measures and control strategies to reduce the contamination should be put in place.

6.1 Recommendations

The study recommends that Pre-requisite programmes and standard operation procedures on safe food handling and production should be put in place in all hospitality food production establishments. This will ensure safe production of all foods items especially the ready-to-eat ones in hospitals. There is need for regular training for food handlers on safe food handling practices and personal hygiene. This can be achieved by organizing regular workshops and seminars and sensitisation programs.

References

Ababio, P. F., Taylor, K. D. A., Swainson, M., & Daramola, B. A. (2016). Effect of good hygiene practices intervention on food safety in senior secondary schools in Ghana. *Food Control*, *60*, 18–24. https://doi.org/10.1016/j.foodcont.2015.07.013

Abakari, G., Cobbina, S. J., & Yeleliere, E. (2018). Microbial quality of ready-to-eat vegetable salads vended in the central business district of Tamale, Ghana. *International Journal of Food Contamination*, *5*(1), 3. https://doi.org/10.1186/s40550-018-0065-2

Akusu, O. M., Kiin-Kabari, D. B., & Wemedo, S. A. (2016). Microbiological quality of selected street vended foods in Port Harcourt metropolis, Rivers State, Nigeria. *Sky J Food Sci*, *5*(2), 008–011.

Angelillo, I. F., Viggiani, N. M. A., Rizzo, L., & Bianco, A. (2000). Food Handlers and food borne Diseases: Knowledge, Attitudes, and Reported Behavior in Italy. *Journal of Food Protection*, *63*(3), 381–385. https://doi.org/10.4315/0362-028X-63.3.381

Aryal, S. (2020). Isolation, characterization, and screening of antimicrobial-producing actinomycetes from soil samples. *International journal of microbiology*, *2020*. https://doi.org/10.1155/2020/2716584

Bakobie, N., Addae, A. S., Duwiejuah, A. B., Cobbina, S. J., & Miniyila, S. (2017). Microbial profile of common spices and spice blends used in Tamale, Ghana. *International Journal of Food Contamination*, *4*(1), 1-5. https://doi.org/10.1186/s40550-017-0055-9

Baş, M., Ersun, A. Ş., & Kıvanç, G. (2006). The evaluation of food hygiene knowledge, attitudes, and practices of food handlers' in food businesses in Turkey. *Food control*, *17*(4), 317-322. https://doi.org/10.1016/j.foodcont.2004.11.006

Boyce, J. M., & Donskey, C. J. (2019). Understanding ultraviolet light surface decontamination in hospital rooms: A primer. *Infection Control & Hospital Epidemiology*, *40*(9), 1030-1035. https://doi.org/10.1017/ice.2019.161

Buccheri, C., Casuccio, A., Giammanco, S., Giammanco, M., La Guardia, M., & Mammina, C. (2007). Food safety in hospital: Knowledge, attitudes and practices of nursing staff of two hospitals in Sicily, Italy. *BMC Health Services Research*, *7*(1), 45. https://doi.org/10.1186/1472-6963-7-45 https://doi.org/10.1186/1472-6963-7-45

CDC Kenya Annual Report 2017. (n.d.). 44.

Chellaiyan, V. G., Fasna, L., & Mallika, S. V. (2018). Food safety awareness and food handling practices among rural population of Tamil Nadu. *International Journal Of Community Medicine And Public Health*, *5*(4), 1441–1447. https://doi.org/10.18203/2394-6040.ijcmph20181214

Chiang, Y.-C., Liao, W.-W., Fan, C.-M., Pai, W.-Y., Chiou, C.-S., & Tsen, H.-Y. (2008). PCR detection of Staphylococcal enterotoxins (SEs) N, O, P, Q, R, U, and survey of SE types in Staphylococcus aureus isolates from food-poisoning cases in Taiwan. *International Journal of Food Microbiology*, *121*(1), 66–73.

Correia, L. B. N., Possebon, F. S., Yamatogi, R. S., Pantoja, J. C. de F., Martins, O. A., Amaral, G. P., & Biondi, G. F. (2017). Microbiological profile of different types of salads from hospital kitchens. *Arquivos Do Instituto Biológico*, *84*. https://doi.org/10.1016/j.ijfoodmicro.2007.10.005

Faour-Klingbeil, D., Murtada, M., Kuri, V., & Todd, E. C. (2016). Understanding the routes of contamination of ready-to-eat vegetables in the Middle East. *Food Control*, *62*, 125-133. https://doi.org/10.1016/j.foodcont.2015.10.024

Gaytán, M. O., Singh, A. K., Woodiga, S. A., Patel, S. A., An, S. S., Vera-Ponce de León, A., ... & King, S. J. (2021). A novel sialic acid-binding adhesin present in multiple species contributes to the pathogenesis of Infective endocarditis. *PLoS pathogens*, *17*(1), e1009222. https://doi.org/10.1371/journal.ppat.1009222

Githiri, M., Kimiywe, J., & Okemo, P. (2013). Knowledge in food hygiene and hygienic practices differ-in food handlers at a hospital in Nairobi, Kenya. *African Journal of Food Science and Technology*, *4*(1), 19–24.

Hardoim, P. R., Van Overbeek, L. S., Berg, G., Pirttilä, A. M., Compant, S., Campisano, A., Döring, M., & Sessitsch, A. (2015). The hidden world within plants: Ecological and evolutionary considerations for defining functioning of microbial endophytes. *Microbiol. Mol. Biol. Rev.*, *79*(3), 293–320. https://doi.org/10.1128/MMBR.00050-14

Isara, A. R., Aigbokhaode, A. Q., Onwusor, V. O., Onyeulo, E. C., & Orumwense, S. O. (2013). Food hygiene and safety practices of food service staff in University of Benin Teaching Hospital, Benin city, Nigeria. *Journal of Medicine and Biomedical Research*, *12*(2), 69–76.

Karimi G. (2017). The slow and silent killers in our kitchens. Retrieved from https://ulizalinks.co.ke/news/the-slow-and-silent-killers-in-our-kitchens/

Kariuki, E. N., Ng'ang'a, Z. W., & Wanzala, P. (2017). Bacteriological Contamination Of Street Foods Among Street Food Vendors In Githurai And Gikomba Markets-Nairobi County, Kenya. *International Journal of Innovative Research and Advanced Studies*, *4*(1), 337–346.

KNBS (2012).Retrieved from https://www.knbs.or.ke/

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd rev. Edition). New International[p] Limited, Publishers.

Lee, H., Abdul Halim, H., Thong, K., & Chai, L. (2017). Assessment of food safety knowledge, attitude, self-reported practices, and microbiological hand hygiene of food handlers. *International Journal of Environmental Research and Public Health*, *14*(1), 55. https://doi.org/10.3390/ijerph14010055

MFMER (2021). Mayo Foundation for Medical Education and Research. Retrieved from https://www.mayo.edu/research

MOH (2000). Ministry of Health. Kenya

Mohammad B. Habibi Najafi and M. Bahreini (2012). Microbiological Quality of Mixed Fresh-Cut Vegetable Salads and Mixed Ready- to-Eat Fresh Herbs in Mashhad, Iran *International Conference on Nutrition and Food Sciences IPCBEE vol. 39*

Mritunjay, S. K., & Kumar, V. (2017). A study on prevalence of microbial contamination on the surface of raw salad vegetables. *3 Biotech*, *7*(1), 13. https://doi.org/10.1007/s13205-016-0585-5

Oloo, J. E. O. (2010). Food safety and quality management in Kenya: An overview of the roles played by various stakeholders. *African Journal of Food, Agriculture, Nutrition and Development*, *10*(11). https://doi.org/10.4314/ajfand.v10i11.64283

Rotich, D. J., Yego, J., & Korir, J. (2012a). *Factors that affect the Outcome of Outside Catering in Kenya*. https://doi.org/10.1016/j.ajme.2012.05.005

Said, D. E. S. (2012). Detection of parasites in commonly consumed raw vegetables. *Alexandria Journal of Medicine*, *48*(4), 345–352. https://doi.org/10.1016/j.ajme.2012.05.005

Saifullah, S., Abbas, F., Samad, D., Rizwan, M., Bugti, F., Saima, Roomeela, Yousaf, M., Mykhaylo, T., & Raziq, A. (2018). Staphylococcus aureus prevalence in the fresh salad and vegetables of the Quetta city. *Pure and Applied Biology*, *7*. https://doi.org/10.19045/bspab.2018.70031

Soares, L. S., Almeida, R. C. C., Cerqueira, E. S., Carvalho, J. S., & Nunes, I. L. (2012). Knowledge, attitudes and practices in food safety and the presence of coagulase-positive staphylococci on hands of food handlers in the schools of Camaçari, Brazil. *Food Control*, *27*(1), 206–213. https://doi.org/10.1016/j.foodcont.2012.03.016

Symes, S., Goldsmith, P., & Haines, H. (2015). Microbiological safety and food handling practices of seed sprout products in the Australian State of Victoria. *Journal of Food Protection*, *78*(7), 1387–1391. https://doi.org/10.4315/0362-028X.JFP-14-566

Tomohide, Y. (2010). Food safety regulation in the United States: an empirical and theoretical examination. *In Independent Review*, 15, 210-226.

World Health Organization. (2018). *The state of food security and nutrition in the world 2018: building climate resilience for food security and nutrition*. Food & Agriculture Org.

Yeleliere, E., Cobbina, S. J., & Abubakari, Z. I. (2017a). Review of microbial food contamination and food hygiene in selected capital cities of Ghana. *Cogent Food & Agriculture*, *3*(1), 1395102. https://doi.org/10.1080/23311932.2017.1395102