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Hygienic practices and occurrence of coliforms and Staphylococcus on food at a public hospital in Kenya

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ABSTRACT

Objective: To establish the food hygiene practices that are associated with occurrence of Coliform and *Staphylococcus* pathogens on fried chicken at a public hospital in Kenya.

Methodology and results: Samples of fried chicken were collected immediately after preparation and 15 min before service from the four kitchens at the Kenyatta National Hospital.The samples were analysed for total viable counts (TVC) of coliforms, *Escherichia coli* and *Staphylococcus aureus*, in order to assess the levels of contamination and relate this to the food handling practices. The total counts were obtained by multiplying the average counts with the dilution factor. This was then expressed as colony forming units per gram of food. The results indicated that pathogens were not present on food immediately after cooking. However, before service, 10% of the food samples exceeded the acceptable TVC limit of 10^6 CFU/g while 7.5% exceeded coliform limit of 10^2 CFU/g and 10 CFU/g of *E. coli*, respectively. *S. aureus* was found in one out of forty samples and this was significant since the organism is often implicated in food poisoning. ANOVA tests indicated no statistical difference between the TVC, mean coliform count and mean *E. coli* counts from the four kitchens ($p>0.05$).

Conclusion and application of findings: These results indicate that there is higher probability of food being contaminated before service. Contamination may result from handling cooked food with contaminated hands, equipment or utensils. The findings have implications for all institutions that handle food including hospitals, schools, colleges, hotels and restaurants. It is concluded that food requires special handling in hospital environment since there is a higher chance of contamination. Cooks, cateresses and people handling food in hospitals must be well trained and should be careful so as to avoid contaminating food which could lead to sickness or poisoning of patients.

Key word: Hygienic practices, occurrence of coliforms, Staphylococcus, public hospital**,** contamination.

INTRODUCTION

Data on risk factors for foodborne diseases indicate that the majority of outbreaks result from inappropriate food handling practices (Jones & Angulo, 2006). Food handlers play an important role in food safety and in the occurrence of food poisoning because they may introduce pathogens into food during production, processing, distribution and/or preparation (Green *et al*., 2005). According to Taylor *et al*. (2002) there is evidence from the food industry showing that microorganisms are transferred to the hands in the process of handling food and through poor personal hygiene after visiting the lavatory, resulting in the hands being heavily contaminated with enteric pathogens.

E. coli and *S. aureus* are amongst the most common pathogens found on hands (Shojaei *et al*., 2005). A study by Oteri and Ekanemi (1989) revealed that most hospital food handlers were carriers of *Staphylococcus aureus*. Food poisoning by *Staphylococcus* affects hundreds of thousands of people each year (Haziriwala, 2002). In many countries Staphylococcus food poisoning has been ranked second or third causative agent often associated with food borne disease outbreaks (Atanassova *et al*., 2001). In 1998 at Minas Gerais in Brazil, a Staphylococcus food poisoning outbreak affected 4000 individuals of whom 20% were hospitalized (Debess *et al*., 2008). In 1997, 81 cases of *E.coli* food poisoning and one outbreak of the same were reported in Sweden (Lindquist *et al*., 2000). *E.coli* food poisoning was also amongst 62 food borne disease outbreaks reported in Oregon public health division, attributed to poor food handling practices (Lynch *et al*., 2006).*Staphylococcus* and *E.coli* pathogens have been associated with food borne illnesses and even death of many people each year (Borch & Arinda, 2002).

In Kenya, incidences of food borne disease outbreaks have been reported each year (MOH, 2003). However few studies related to food hygiene practices and occurrences of pathogens in ready to eat foods have been conducted in hospitals. The objective of this study was to collect data on food hygiene practices, and presence of Coliforms and *Staphylococcus* in fried chicken in hospitals, in order to determine the causes of food poisoning occasionally observed in the institutions.

MATERIALS AND METHODS

Food handling practices: Kenyatta National Hospital is the largest hospital in Kenya with the most reported cases of food poisoning (MOH, 2003). Eleven food handlers (handling fried chicken) out of ninety five from the four kitchens of the hospital (KNH) were observed for 3 months. The kitchens sampled included three kitchens catering for staff (Rahimtulla kitchen, Sisters wing kitchen, Canteen kitchen) and one kitchen catering for private patients (Private Wing kitchen).An observation checklist was used to capture non verbal occurrences. The food handlers were observed on daily bases during lunch and supper time. The practices observed included keeping of long nails by food handlers, wearing of clean uniform, cleaning of hands, chewing / coughing over uncovered food, working while having discharge from the eye, nose, ear and repeated use of the same chopping board without cleaning. One point was awarded to each correct practice. Points were then added and transformed into percentages.

Collection of food samples: Eighty samples of fried chicken from the four kitchens (Canteen, Rahimtulla, Private wing and Sisters mess) were collected, 20 from each kitchen. Ten samples of fried chicken were collected- immediately after cooking, while the other ten samples were collected 10 – 15 minutes before service. Each sample collected weighed approximately 150 grams. The samples were collected from the serving dishes using sterile tongs. They were then labelled according to the date, time of sampling (i.e. after cooking – AC or before service - BS), code number of food handler and sample number. The samples were stored in a sterile cooler and transported to the laboratory for analysis.

Sample preparation: In the laboratory 25g of the chicken samples were aseptically transferred into a sterilised container. A volume of 225 ml of buffered peptone water was added to make a 1:10 dilution. Each chicken sample was blended using a sterile blender for 2 min, and then serially diluted using buffered peptone water up to the 10^{-6} dilution.

Total viable counts: One millilitre (1 ml) volume of each dilution starting at the 10^{-2} dilution level was transferred and spread on medium in a Petri plate, with two duplicate plates per dilution. For each Petri-dish, 15 ml of plate count agar medium (M1108, Himedia, Mumbai) was melted, added to the plate and mixed well to ensure an even distribution of colonies after incubation. The agar was allowed to set before incubating at 30^{o}C for 72 h. Colonies formed after incubation were counted (30 – 300) and the data used to determine the colony forming units per gram (cfu/g) of food.

Test for Coliforms: Three inverted Durham tubes tubes containing Mac-Conkey Broth (Lab M. Lancashire BL9 6AU, UK) were inoculated with 2 ml each of the previously prepared dilutions of 10^{-2} and 10^{-3} of the sample and incubated at 37^{o}C for 48 h. The tubes showing acid and gas productions (in the Durham tube) were recorded as positive for presence of coliform. The population was estimated from the Most Probable

Number (MPN) chart (Horwitz, 1985).

Test for *Escherichia coli*: All Mac Conkey Broth tubes showing acid and gas production within 48 h were sub-cultured in peptone water and Mac Conkey Broth. They were then incubated at 44 ^{o}C in a water bath for 48h. A volume of 0.3 ml of Kovacs reagent was then added to each tube. Appearance of a purple ring on the surface of the mixture indicated the presence of *E. coli*. The Most Probable Number chart was used to estimate the counts.

Test for *Staphylococcus*: One ml of the 10^{-2} and 10^{-3} homogenate dilution were each pipetted into a bottle containing Robertson's Cooked Meat (RCM; M1108, Himedia, Mumbai) medium of single strength. Ten millilitre of 1:10 dilution of food sample was pipetted into a bottle containing 10 ml of RCM double strength. One ml of the chicken sample (1:10 dilution) was also pipetted into a 1g bottle containing 10 ml of RCM (single strength) and a bottle of 1g RCM plain. All were incubated at 37^{o}C for 48 h. Various RCM dilutions of single strength (10^{-1} to 10^{-3}) were sub-cultured onto the corresponding labelled sheep blood agar (SBA; M118, Himedia,Mumbai) and incubated aerobically at 37^{o}C for 24 h. Plain and double strength RCM were also sub-cultured on SBA plates aerobically at 37^{o}C for 24 h. Colonies were picked with a sterile loop and mixed in a solution of plasma and 1 ml of peptone water and incubated at 37^{o}C for 24 h. Coagulation indicated the presence of *S. aureus.*

Statistical analysis: Data were analysed using the statistical package for social sciences (SPSS Inc.; Chicago, IL, USA) software. One way analysis of variance (ANOVA) at 95% level of confidence was done to determine significant differences in the bacterial counts in food in the four kitchens.

RESULTS

Three out of eleven people handling fried chicken were found to have contaminated the food. One other food handler, who had not contaminated any food sample but had scored the least scores in hygienic practices, was also included in the study. Out of the four food handlers, two had an average of 58% scores on correct food handling practices while two had 75%.One of the food handlers with lower score (58 %) had 2 contaminated samples while the other with the same scores had not contaminated any sample. Those with 75% score had contaminated one sample each (Table 1).

Table 1: Relationship of food handling practices and food contamination levels in Kenyatta hospital kitchens, Nairobi, Kenya.

Mean score (%) in food hygienic practices	Contamination level		P- Value
	Samples not contaminated	Contaminated samples	
58	8 (20%)	2 (5%)	1.0
58	10 (25%)	-	
75	9 (22.5%)	1 (2.5%)	
75	9 (22.5%)	1 (2.5%)	
Total	*36 (90%)*	*4 (10%)*	

Each food handler handled 10 food samples. There was no significant association between hygienic practices and contamination (P value = 1.0).

Total viable counts: Mean total plate counts of the organisms on food samples at the Private Wing kitchen were higher at 7.3 x 10^{7}cfu/g compared to 1.2 x 10^{6}cfu/g , 5.2 x 10^{5}cfu/g and 1.8 x 10^{5}cfu/g in the Canteen kitchen, Sister mess kitchen and Rahimtulla kitchen, respectively. The average TPC was 1.9 x 10^{7}cfu/g in all kitchens (Table 2).

Total Coliform count: Mean coliform count at the Private Wing kitchen was 3.2 x 10^{2} cfu/g. This was followed by the Canteen kitchen at 2.9 x 10^{2} cfu/g,

Rahimtulla kitchen with 3.3 x 10^1 cfu/g and the Sisters wing kitchen with 3.2 x 10^1cfu/g. The mean coliform count of all kitchens was 1.9 x 10^2 cfu/g (Table 2). ***Escherichia coli****:* Mean *E. coli* contamination was higher 9.2 cfu/g at the Canteen kitchen, Private wing kitchen followed with 40cfu/g and lastly Rahimtulla kitchen with 14cfu/g. The mean average of *E. coli* contamination was 24cfu/g. *E. coli* was not isolated from the kitchen at Sister's wing. *Staphylococcus aureus* was only isolated in one sample at the Canteen kitchen (Table 2).

Table 2: Mean of Total Plate Count, Coliform, *E.coli* and *Staphylococcus aureus* expressed per gram sample of fried chicken in different kitchens at Kenyatta Hospital, Kenya.

Type of Food (Fried Chicken)	Total Plate Count	Coliform	*E.coli*	*S. aureus*
Canteen (n = 10)	$1.2x10^6$	$2.91x10^2$	$9.2x10^0$	$9.0x10^0$
Amenity (n = 10)	$7.3x10^7$	$3.2x10^2$	$4.0x10^0$	NIL
Sisters Mess (n = 10)	$5.2x10^5$	$3.2x10^1$	NIL	NIL
Rahimtullah (n = 10)	$1.8x10^5$	$3.3X10^1$	$1.4X10^1$	NIL
Overall (n = 40)	$1.9x10^7$	$1.91X10^2$	24.0	1 sample contaminated

DISCUSSION

Studies by Howe *et al.* (1996) have indicated that increased knowledge of food hygiene practices does not always result in a positive change in food handling behaviour. In this study the P-Value of 1.0 (Table 1) indicated that there was no statistical relationship between food handling practices and contamination. The food handlers who scored the highest in hygienic practices were also found to have contaminated a sample each. Failure to adhere to food hygiene practices was the main reason of food contamination.

Any cooked food should contain no more than 10^6 viable counts per gram upon analysis (KEBS, 2003). In our study, the Private wing kitchen and Canteen kitchen had exceeded the maximum limit while Sisters mess kitchen and Rahimtulla kitchen were within the acceptable limits. The hands of food handlers should avoid contact with food whenever possible as this can lead to contamination (Lillquist *et al.,* 2005). For many foods especially those that are sold ready-to-eat, the cleanliness of food contact surfaces have been identified as critical to food safety (Moore & Griffith, 2002).

The detection of coliforms is widely used as a means of measuring the effectiveness of sanitation programmes. The presence of coliforms indicates a substantially increased risk of the presence of pathogens and any cooked food should not have coliforms exceeding 100 CFU/g and *E. coli* exceeding 10 CFU/g (KEBS, 2003).The presence of *E. coli* is thought to give a better indication of faecal contamination than the entire group of coliforms in the study (De wit & Rombouts, 1992). Only one food sample from the Canteen kitchen had 9 CFU/g of *S. aureus*. *S. aureus* causes *Staphylococcal* food poisoning outbreaks, which occur when cooked foods are handled by persons who carry the pathogen in their nares or on their skin (Protocarrero *et al*., 2002). This finding indicated the potential of an explosive food poisoning situation. There was no significant difference in the mean total plate counts, Coliforms and *E. coli* between and within the four kitchens studied.

CONCLUSION

The mean scores in food hygiene practices indicated that none of the food handlers scored 100%, which suggests opportunities exist for food contamination. The contamination of some samples confirmed that some of the food handlers were negligent on some of the vital hygiene practices. Food handlers should therefore be encouraged to use safe food handling practices as it takes only one event of contamination with undesirable pathogenic microbiota to have disastrous consequences.

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