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HYGIENE PRACTICES IN URBAN RESTAURANTS AND CHALLENGES TO IMPLEMENTING FOOD SAFETY AND HAZARD ANALYSIS CRITICAL CONTROL POINTS (HACCP) PROGRAMMES IN THIKA TOWN, KENYA
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ABSTRACT

***Objectives*: To determine the microbial load in food, examination of safety measures and possibility of implementing an Hazard Analysis Critical Control Points (HACCP) system.**

***Design*: The target population for this study consisted of restaurants owners in Thika Municipality (n=30). Simple random samples of restaurants were selected on a systematic sampling method of microbial analysis in cooked, non-cooked, raw food and water sanitation in the selected restaurants.**

***Subjects*: Two hundred and ninety eight restaurants within Thika Municipality were selected. Of these, 30 were sampled for microbiological testing.**

***Results*: From the study, 221 (74%) of the restaurants were ready to eat establishments where food was prepared early enough to hold and only 77 (26%) of the total restaurants, customers made an order of food they wanted. 118 (63%) of the restaurant operators/staff had knowledge on quality control on food safety measures, 24 (8%) of the restaurants applied these knowledge while 256 (86%) of the restaurants staff showed that food contains ingredients that were hazard if poorly handled. 238 (80%) of the resultants used weighing and sorting of food materials, 45 (15%) used preservation methods and the rest used dry foods as critical control points on food safety measures.**

***Conclusions*: The study showed that there was need for implementation of Hazard Analysis Critical Control Points (HACCP) system to enhance food safety. Knowledge of HACCP was very low with 89 (30%) of the restaurants applying some of quality measures to the food production process systems. There was contamination with Coliforms, Escherichia coli and Staphylococcus aureus microbial though at very low level. The means of Coliforms, Escherichia coli and Staphylococcus aureas microbial in sampled food were 9.7 × 103CFU/gm, 8.2 × l03CFU/gm and 5.4 × l03 CFU/gm respectively with Coliforms taking the highest mean.**

INTRODUCTION

Food safety plays a significant role in the economic and health development of any nation by safe guarding the nation's health, enhancing bi-lateral and international trade, the production, consumption, distribution and consumption of safe food (1). Despite all these, there seems to be few quality control systems to safe guard against food related illness.

In developing countries some food borne diseases may be fatal while others can lead to expensive medical care. The magnitude of food borne diseases is illustrated by various statistics (2). Illness from food related diseases outnumber illness from all other environmental factors combined. Over 66% of food-borne illnesses are caused by bacterial pathogens (3).

Over the world, incidences of diarrhoeal diseases alone have been estimated to be 400 million cases per year, which indicates a serious underlying food safety problem (3). In Kenya, incidences of food borne illnesses reported from 1997 to 2003 were 1,492,690 cases that caused 604 deaths (4). In the year 2004, there were 11,849 reported cases. In Thika District Hospital, diarrhoea, intestinal worms and typhoid are among the top ten leading causes of hospitalisation (5).

While these statistics point to the possible hazards of poor food safety guidelines, research shows that the food safety regulations and risk management measures in developing countries are not wellimplemented (6). Dhamija attributes this to lack of understanding of the regulations and measures for the food industry by consumers and other stakeholders in the society.

FAO/WHO (7) main objective is to ensure nutritional and safe food for all people at all times for

productive and healthy life. Food service operators have a major responsibility since their actions can affect the health of many people. Food-borne diseases are major public health problem estimated to affect up to 10% or more of the population in the industrialised countries (8). Food and water-borne diseases in the developing countries are prevalent and epidemiological examinations have indicated large proportions of food-borne diseases which result from poor food sanitation and unhygienic handling of foods in restaurants and other eating outlets (9).

Urban populations in Kenya comprise some 20% of people concentrated in six rapidly expanding cities and large towns (10). Nearly 50% ofthe Kenya urban populations live in unplanned low quality settlements poor infrastructure and health service. In developing countries, it has been suggested that lack of knowledge and skills on the good manufacturing practices (GMPs), have contributed to poor hygienic practices in food service establishments. Studies on food safety have led to health administrative departments taking the evaluation of food safety and hygienic practices of food establishments (11). These reports show that about 80% of all diseases and more than 113 of all deaths in developing countries are caused by contaminated food and water (12). This study therefore attempted to establish whether the scenario is the same in Thika District.

Hazard Analysis Critical Control Points (HACCP) has been endorsed by the National Academy of Sciences, the Codex Alimentarius Commission which is an international food standard setting organization, and the National Advisory Committee on microbiological criteria for foods (13). The systems are available for designing programme to assist food firms in producing foods that are safe to consume (14). The biggest advantage of HACCP over the other systems is that it pre-empts all the activities in the food process thus reducing risks in food-borne diseases. According to Taber (15), the hazard of any material is determined by its chemical, physical and biological properties.

Hazard Analysis Critical Control Points (HACCP), a system for ensuring food safety, was developed in 1971 in a cooperative effort by the United States Army Natick Laboratories, the National Aeronautics and Space Administration and the Pillsbury Company (16). The system was endorsed as an effective and rational means of assuring food safety from harvest to consumption. Preventing problems from occurring is the basis of the HACCP system. It is termed superior to all the conventional food microbiological quality control procedures in the market because it only addresses significant food safety hazards.

The system employs to meet the stated goals, include hazard analysis, identification of Critical Control Points, establishing critical limits, monitoring procedures, corrective actions, verification procedures and record keeping and documentation. When organiSing:and setting up HACCP programme, all steps are important and necessary for the assurance of a safe, high quality finished product(s) (17). An estimated value in 20 years of HACCP-program benefits Fanged from $1.9 to $171.8 billion dollars in 1995. These were mainly cost saving benefits, in terms oflives saved (18).

The Ministry of Realth and major local authorities have put very few policies in place to ensure that the risk of disease communication is contained and food safety is enhanced (19). For instance, they have tended to rely on legislation that seeks to provide a framework for food safety inspection which, unlike a HACCP system, is not proactive and preventive. The Foods, Dmgs and Chemical Substance Act, cap 242 of Kenya, may not provide an adequate supervisory framework for food establishments that clearly need to improve on their efforts to enllance product quality (12).

This may be as a result of inadequate food safety inspections and controls by the government agencies and lack of awareness and participation by stakeholders such as consumers, NGO's, print and electronic media publications that would otherwise facilitate the understanding of food safety. The importance of investigating the possibility of introducing a HACCP system of monitoring and evaluating food safety, in urban restaurants, was clear from their role in the food chain in large urban populations.

Reports from Thika Municipal council office indicate that there are about 298 formal restaurants in Thika Town, which offer meals to urban dwellers (5). They recommend that food establishments embrace safe food chains so that the outbreak of food-borne diseases or illnesses may not be transmitted within the town or to the rural areas where most of the workers live. This suggests that there was need to explore the possibility of restaurants embracing food safety systems, based on the HACCP principles that have been successfully applied in food service operations and are universally accepted by government agencies, trade associations and the food industry around the world. HACCP system is proactive and it can predict possibility of food poisoning or contamination. It has food safety control system that has simple control features which ensure immediate corrective action, costeffective and can be applied to all food operations.

Perhaps the introduction of a HACCP system could 'improve and reduce the incidence of food poisoning in urban restaurants. It can also aid inspection by regulatory authorities and promote international trade by increasing confidence in food safety. It provides a more specific and critical approach to the control of microbiological hazards in foods than that provided by traditional inspection and quality control approaches (20).

The research question for tIns is: whether the HACCP

system on food safety are adopted in the restaurants and if not what measure are taken to ensure that food consumed in urban restaurants, meets the required safety standards.

MATERIALS AND METHODS

The methodology used in this study involved combination of descriptive and quantitative research and included the use of descriptive analysis, chi-square, simple regression and correlation as data processing methods.

The target population was 298 restaurants within Thika Municipality. For microbial testing, 30 restaurants, approximately 10 % of the total popUlation were stratified into hotels and formal restaurants. Data were collected through open ended questionnaires schedules and observations.

A series of in- depth interviews were conducted through owners/staff, customers and public health officers. Questionnaire was developed based on research question and literature review. The questionnaire was divided into several sections. The first section was designed to gather information about personal characteristics of respondent. The second section was designed to measure the knowledge of quality control systems wrnle the last part covered the receipt of food material, storage, preparation, production and services.

The validity and reliability of the questionnaire were conducted through a pilot study in areas outside the study but in restaurants using the HACCP systems. The reliability coefficient was determined by test-retest technique.

RESULTS

The results of demographic statistics showed that 65% of respondent were male while female were 35%. The reason was that male workers are more flexible to work and didn't have complicated social living styles as their female counterparts. In order to find the perception of respondents about their education background, 44 % had college education, 22% secondary level and 26% post secondary education and therefore formal education was relatively rngh among the staff interviewed in Thika restaurants, however 44% of the respondents were most likely aware of HACCP system. The staff working in the restaurants, 60% didn't have basic formal training relevant to food production, while 40% were trained in catering, Table 1.

Still on Table 1, the designation of staff in the restaurants showed that 30% managed their restaurants, while 37% were ran by hired managers, Head cooks were 26% and cooks 8%.

Among the respondents, 40% lmew quality control strategies with little or no application, when 60% had no understanding of any quality control. As can be seen 10% left food not covered or well stored, 60% stored them in high temperature and only 30% in cold temperatures. The perception of respondent in information on quality control was displayed. 92% of the public health office disseminates information on quality control but with no specifics way to improve food safety standards while the council provide 8% of this information. On the application of quality control, 92% used sorting and weighing as quality control measures while 8% were cooking food with no specific monitoring oftime and temperature.

On type of establishment, 74% had food ready for consumption while 26% were prepared on orders fl.-om customers and therefore these showed that there was need to enhance food safety in all premises for better health. In relation to the preservation methods, 70% used refrigeration, dry storage 15%, while the used freezer. The total restaurant that received food materials in bulk were 20%, while 80% received in small quantities from the suppliers. This implied that most of the restaurants did not have adequate storage facilities. Most of the restaurants which received perishables food such as meats, vegetables and milk etc from the supplier/market were 92% and those who received non-perishable (dry foods) materials were 8%, meaning that details of the material specifications on quality and quantity were in place Table 2.

Inferential statistics were used with calculation of mean, range and standard deviation. The microbial loads of food in raw, non cooked and cooked foods samples are were calculated with total Coliform counts ranged from 1.5×10^2 CFU/g to 8.9×10^3 CFU/g with the highest mean of 9.7×10^3 CFU/gm, S. Aureus counts varied from 1.3 × 102 CFU/g to 6.3×10^3 CFU/g with the highest mean of $5.4 \times l0^3$ CFU/gm and the counts of E.coli ranging from $1:6 \times 10^1$ CFU/g to 9.2×10^2 CFU/g with the highest mean of $8.2 \times l0^3$ CFU/gm. The treated water supplied by the municipality contributed to the highest number of bacterial counts with a mean of Aerial Plate Count of 4.7×10^3 CFU/mi. The average bacterial counts were relatively low and this was an indication that hygiene practices in Thika restaurants are not of high quality and therefore the need to enhance food safety standard through the application of HACCP safety systems Table 3, 4 and 5 respectively. All the samples in the study showed Coliforms and E. coli counts which could be a reflection of the inadequate hygiene and sanitary standards prevailing at different stages of food production process. raw cooked The chi -square test carried out shows that there is no sufficient evidence to suggest that there is a relationship between safety control measures applied and microbial loads of food consumed in this study (test statistic=2.73, tabulated=dfl, 0.05=3.841), while a relationship existed between the awareness of SSOP by restaurant workers and microbial loads of

food consumed in the restaurants (test statistic=19.28, tabulated=dfl, 0.05=3.841) Table 6 and 7.

Table 8 shows the result for simple regression analysis. There was significant relationship on the perception of respondent awareness of SSOP by workers and microbial loads of foods consumed in restaurants. The results indicate that 35% of the variance in awareness of SSOP by worker can be used to explain microbial loads of foods. The unhygienic habits of some of the personnel involved in the actual preparation may have led to contamination from the hands to the work-places or vice versa. The variable "awareness of SSOP by workers" (Beta coefficient: 0.350, sig.:0.007) determines the microbial load in the food consumed. The samples counted revealed that the products are capable of inducing outbreaks of staphylococcal food poisoning if poorly handled.

Table 1
Demographic profile of respondents

Demographic variable	Number	Percentage, n=30
Sex		
Male	11	65
Female	19	35
Education		
Primary	1	4
Secondary	7	22
Post secondary	8	26
College	13	44
Others	1	4
Training		
Trained	12	40
Untrained	18	60
Designation		
Owners	9	30
Managers	11	37
Head cook	8	26
Cook	2	8

Table 2
HACCP Quality systems

HACCP variable	Number	Percentage, 1l=30
Understanding of QC strategy		
Knew	12	40
Don't know	18	60
Storage methods		
High temperature	18	60
Cold temperature	9	30
No precaution	3	10
Source of QC information		
Public health staff	28	92
Council staff	2	8
Application of QC strategy		
Receiving	28	92
Kitchen	2	8
Type of food establishment		
Not prepared	8	26
Already prepared	22	74
Preservation methods		
Dry storage	5	15
Freezing	5	15
Refrigeration	20	70
Reception perishable		
Bulle reception	6	20
Small quantity	24	80
Reception perishable & non perishable		
Perishable foods	28	92
Non-perishable	2	8

Table 3
Bacterial counts in the cooked food samples

Food Type	Mean	APC Range	SD	Mean	S.aurells Range	SD	Mean	E.coli Range	SD
		1.5×10^2		3.1×10^1			3.8×10^2		
	4.2×10^3		2.4×10^2			5.7×10^2			
Beef stew		6.0×10^3	0.5912		3.3×10^2	0.1210		7.6×10^3	0.3121
		2.0×10^3			3.1×10^2			3.3×10^2	
Cooked vegetable	3.3×10^3			2.0×10^2			2.6×10^2		
		5.3×10^4	0.7630		3.7×10^3	0.8761		4.0×10^3	0.612
		4.5×10^2			6.3×10^1			1.6×10^1	
Nyama choma	5.8×10^3			4.5×10^2			2.6×10^3		
		3.8×10^3	0.6710		2.6×10^4	0.5511		3.7×10^3	0.5600
		1.8×10^1			2.0×10^2			2.3×10^2	
	3.0×10^3			4.1×10^3			4.3×10^3		
Chips		5.0×10^3	0.651		6.8×10^3	0.8981		7.0×10^3	0.7761
		1.7×10^1			2.0×10^2			9.2×10^2	
	4.0×10^3			4.6×10^2			4.5×10^2		
Bhajia		6.3×10^3	0.875		6.1×10^3	0.8971		3.0×10^3	0.6765
		3.8×10^2			1.5×10^2			3.2×10^2	
	4.2×10^2			3.5×10^2			3.2×10^2		
Githeri		4.6×10^3	0.8761		6.8×10^3	0.7631		3.7×10^3	0.5530

Table 4
Bacterial counts in the non-cooked food samples (CFU/gm)

Variable	Mean	APC Range	SD	Mean	S.aurells Range	SD	Mean	E.coli Range	SD
		2.3×10^3			1.3×10^1			3.2×10^2	
	4.2×10^3			3.4×10^2			8.2×10^3		
Personnel		6.7×10^4	0.871		5.2×10^3	0.671		15.0×10^3	0.6512
		5.3×10^2			2.3×10^2			6.7×10^2	
	9.7×10^3			3.8×10^2			7.6×10^2		
Workplace		12.3×10^4	0.7612		5.3×10^3	0.6070		8.5×10^3	0.8127
		3.7×10^2			5.2×10^1			1.8×10^1	

	4.7×10^3			2.6×10^3			4.8×10^2		
Water (ml)		5.7×10^3	0.5051		3.0×10^4	0.6151		7.9×10^3	0.6055
		1.7×10^1			1.6×10^1			1.0×10^2	
	4.1×10^3			3.5×10^3			2.6×10^2		
Plate		6.6×10^3	0.6021		6.0×10^2	0.8021		2.6×10^3	0.5060

Table 5
Bacterial counts in the raw food samples (CFU/gm)

Food Type	**Mean**	**A P C Range**	**SD**	**Mean**	**S.aurells Range**	**SD**	**Mean**	**E . c o l i Range**	**SD**
		1.5×10^3			4.6×10^1			2.6×10^2	
	4.0×10^4			4.5×10^2			4.5×10^3		
Kacumbari		6.5×10^4	0.5005		4.3×10^2	0.6172		6.5×10^3	0.7112
		3.0×10^3			1.5×10^3			2.8×10^2	
Vegetable	3.3×10^4			3.4×10^4			5.6×10^3		
salad		3.6×10^4	0.7721		5.2×10^4	0.6991		7.6×10^3	0.9821
		8.9×10^2			2.4×10^1			2.3×10^2	
Fruit salad	2.0×10^3			2.2×10^2			3.2×10^2		
		4.0×10^3	0.7112		4.8×10^2	0.7721		3.1×10^3	0.9231
		1.2×10^1			2.6×10^1			1.8×10^1	
Passion	2.2×10^3			5.4×10^2			3.7×10^2		
fruit		2.3×10^3	0.4451		9.4×10^3	0.5561		5.6×10^3	0.8732
		2.5×10^3			3.4×10^2			2.8×10^1	
	5.2×10^4			3.4×10^3			4.6×10^2		
Fresh meat		5.4×10^4	0.3242		7.3×10^3	0.2343		6.3×10^2	0.9182
Coleslaw		1.6×10^3			3.8×10^2			2.2×10^2	
salad	2.6×10^4			3.5×10^3			2.9×10^2		
		3.6×10^4	0.5423		3.8×10^3	0.5421		3.7×10^3	0.8723
		2.1×10^1			1.5×10^2			2.8×10^1	
Chef's	3.1×10^3			2.5×10^3			4.5×10^2		
salad		6.1×10^3	0.3425		3.5×10^3	0.6787		6.0×10^2	0.8001

Table 6
Safety control measures and Microbial loads of foods

Cell	O_i	λ_i	$O_i - \lambda_i$	$(O_i - \lambda_i)^2$	$\frac{O_i - \lambda_i}{\lambda_i}$
1,1	8	10.2	–2.2	4.84	0.47
1,2	10	7.8	2.2	4.84	0.62
2,1	9	6.8	2.2	4.84	0.71
2,2	3	5.2	–2.2	4.84	0.93

$(x^2_C) = 2.73$, at the 95% confidence level and a degree of freedom = (2-1) (2-1) = 1, $x^2_a = 3.841$

Table 7
Awareness ofSSOP and Microbial loads offoods

Cell	O_i	λ_i	$O_i - \lambda_i$	$(O_i - \lambda_i)^2$	$\frac{O_i - \lambda_i}{\lambda_i}$
1,1	1	7	–6	36	5.14
1,2	13	7	6	36	5.14
2,1	14	8	6	36	4.5
2,2	2	8	–6	36	4.5

$(x^2_c) = 19.28$, at the 95% confidence level and a degree offi'eedom = (2-1) (2-1) = 1, $x^2_a = 3.841$

Table 8
Simple Regression analysis (MICRNDEX as dependent variable)

	Un-standardised Coefficients		Standardised Coefficients	t	Sig.
Model	B	Std. error	Beta		
(Constant)	.228	.094		2.429	.018
SSOPNDEX	.412	.146	.350	2.822	.007

$R^2 = 0.353$, Y= 0.350x.

DISCUSSION

All the restaurants had been issued with food trade licenses from the Municipal Public Health Authorities. Just a few knew HACCP as a strategy of quality control and it was either the owner or mangers were implementing the strategy at one point or the other in their establishments. Sorting and weighing of raw food materials after reception is a major critical control point and this study showed that about 60% applied them and therefore contamination was most like to occur.

On preservation of perishable foods, 75% of the restaurants applied it as a critical point. Proper food storage after preparation was fairly done and quite evident in most premises because this was stored in very high temperatures. TIns contradicts a study done in some cities in some developed countries, which found that most people who ate food prepared il} the eating premises were served with cold foods which led to food poisoning.' This study demonstrated that all samples had contamination load according to the total coliform count and the presence of other bacteria. Lengthy gaps between preparation and consumption of foodstuffs and lack of attention to the essential temperature required for cooking foods are among the most common causes of food contamination.

Maintenance of general hygiene standards in most premises was not well-observed similar to studies done in Nairobi, wInch showed that 70% of most restaurants were below the required hygiene standards. Most of the liquid and solid waste was fairly managed. Availability of hot water was lacking in some restaurants and therefore, cleaning of crockery and utensils was poorly done. Similar study was done in China which showed that some customers

had food poisoning after been served with poorly washed equipment in a restaurant (21, 22).

Similar information was sourced from Kenya Bureau of Standards which has a standardized mark of quality of products. It is necessary to use HACCP system in restaurants for prevention of food-borne diseases. In the study, 894 samples were examined and showed that the implementation of the HACCP system together with training in personnel hygiene lowered aerobic plate counts.

The water in all the restaurants is supplied by the municipal council through ground piped water which sometimes can be contaminated due to sewerage pipe bursting in some occasions. It is recommended that any water for human consumption must not contain more than 3 x 101 CFU/ml and none should be of faecal contaminated.

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