

Microbiological Quality of Food Contact Surfaces in A Hospital Kitchen in Shiraz, Iran, 2014

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Abstract

Background: The consumption of healthy food is considered as an essential need to devoid the physical, chemical, and biological hazards. The importance of this issue is more conspicuous in places such as hospitals where people with somehow compromised immune systems are under treatment. Therefore, this research aimed to evaluate the microbiological quality of food contact surfaces in a kitchen in one of the hospitals of Shiraz University of Medical Sciences.

Methods: In the present study, samples were taken from 48 food contact surfaces according to ISO 18593:2004(E) and placed into the bags containing diluting solution; they were then transferred to the laboratory for microbial analysis in the cold chain. The microbial analysis was carried out according to ISO 4833-1:2013 and BS ISO 4832:2006 for enumeration of total bacterial count and coliform.

Results: Based on the results presented here, 39.6% and 85.7% of the samples showed acceptable contamination with regard to the enumeration of total bacterial and coliform count. Besides, 18.2% and 72.7 % of work surfaces groups (cutting board, table, and hand) showed acceptable contamination with regard to the enumeration of total bacterial count and coliform in comparison to the standards. Furthermore, 45.9% and 89.2% of other surfaces showed acceptable total bacterial and coliform count, respectively.

Conclusion: The results showed that safe management of the kitchen, education of the staff and also improvement of the equipment used are necessary.

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Introduction

One of the main reasons of mortality, diseases, hospitalization, and economic losses is consumption of contaminated food with pathogenic microorganisms and their toxins.¹ However, “the majority of food-borne diseases occurring all around the world are not reported”.² According to the report by World Health Organization (WHO), millions of people grapple with food-borne diseases every year. Mitigation of these diseases is one of the main objectives of national and international

programs of food safety.³ This entails application of food safety management system based on Hazards Analysis and Critical Control Points (HACCP).¹

“In most hospitals, patients' food is prepared in the hospital kitchen and is then distributed throughout the wards”.⁴ Patients are more prone to infections in comparison to healthy individuals.⁵ Even duration of hospitalization can be influenced by factors such as malnutrition, food toxicities, and hospital infections.⁶ Thus, outbreak of microorganisms in hospitals can result in more serious outcomes for

patients.⁴ Therefore, one of the principal objectives of hospitals is provision of safe food for patients who are susceptible to infections and complications.⁵

Factors such as unsafe origins, insufficient cooking, preservation at improper temperature, and poor personal hygiene are important factors in the incidence of food-borne diseases.^{1,7}

Instruments and equipment such as knives, tables, and cutting boards are food contact surfaces. If the washing process is not done properly or the dishes and equipment are not dried after washing, they can be considered as direct sources of contamination. In order to reduce cross-contamination and prevalence of food-borne diseases, cleaning and hygienic methods are proposed as effective measures.⁸ Due to the significance of controlling the outbreak of pathogenic microorganisms, food contact surfaces in food production and catering establishments are the main concern.⁶ Considering the importance of this issue, the present research aimed to assess the microbiological quality of food contact surfaces in a kitchen in one of the hospitals of Shiraz University of Medical Sciences, Shiraz, Iran.

Materials and Methods

This survey was conducted in one of the hospitals of Shiraz University of Medical Sciences. The materials used in this study included peptone (QLab, Canada), sodium chloride, sodium thiosulfate, Plate-Count-Agar (PCA) medium, and Violet Red Bile Lactose Agar (VRBL) (Merck, Darmstadt, Germany). The samples were taken from 48 food contact surfaces according to ISO 18593:2004 (E) from 6:30 to 7:30 A.M. before the beginning of the work shift in summer in 2014.⁹ In doing so, a sterile cloth dragged on the food contact surfaces was placed in a bag containing diluting solution of 1 g/L peptone, 8.5 g/L sodium chloride, and 5 g/L sodium thiosulfate. Then, the samples were transferred within 1 h to the microbiology laboratory at refrigerated temperature. The samples were homogenized using a smasher (AES CHEMUNEX, France) within 30 s. Through decimal method, the samples were further

diluted. Total bacterial count was performed using PCA medium and pour plate technique according to ISO 4833-1: 2013 and incubation was done at 30 °C for 72±3 h.¹⁰ In addition, coliform count was performed using VRBL culture medium and pour plate technique according to BS ISO 4832:2006 and incubation was done at 37 °C for 24 h.¹¹ The results were finally reported based on log CFU/cm². Food contact surfaces were divided into two groups (work surfaces and Other surfaces).

The collected data were analyzed using SPSS statistical software, version 16. In order to describe the results, descriptive statistics including mean and standard deviation were used. Microbiological quality of the food contact surfaces was determined by the proposed standards.¹ According to the standards of total bacterial count and coliform count, values lower than 1.3 log CFU/cm² and 1 log CFU/cm² are considered acceptable in terms of hygienic and cleaning statuses, respectively.

Results

In this research, the samples were taken from the washed instruments available in one of the hospitals affiliated to Shiraz University of Medical Sciences for enumeration of total bacterial count and coliform count. According to the results, 39.6% and 85.7% of the samples (regardless of the type of the food contact surface) were acceptable in terms of total bacterial and coliform count, respectively (Table 1).

Additionally, 18.2% and 72.7% of the group samples (work surfaces) were acceptable in terms of total bacterial count and contamination with coliform, respectively. Finally, 45.9% and 89.2% of the samples of other surfaces were acceptable in terms of total bacterial count and coliform in comparison to the standard (Table 2).

The mean of total bacterial count and coliform is shown in (Table 3).

Discussion

Surfaces and equipment are important because

Table 1: Conformity of microbiological quality of food contact surfaces to standards

	Total bacterial count		Coliform	
	Unacceptable ≥1.3 log CFU/cm ²	Acceptable <1.3 log CFU/cm ²	Unacceptable ≥1 log CFU/cm ²	Acceptable <1 log CFU/cm ²
Food contact surfaces (n:48)	60.40%	39.60%	14.30%	85.70%

Table 2: Conformity of microbiological quality of 48 food contact surfaces to standards

	Total bacterial count		Coliform	
	Unacceptable ≥1.3 log CFU/cm ²	Acceptable <1.3 log CFU/cm ²	Unacceptable ≥1 log CFU/cm ²	Acceptable <1 log CFU/cm ²
Work surfaces*	81.80%	18.20%	27.30%	72.70%
Other surfaces	54.10%	45.90%	10.80%	89.20%

*Cutting board, table, and hand

Table 3: Microbiological levels in 48 food contact surfaces

	Total bacterial count (log CFU/cm ²)			Coliform (log CFU/cm ²)		
	Mean±SD	Max	Min	Mean±SD	Max	Min
Work surfaces*	2.33±0.87	3.23	0.60	0.51±0.68	2.07	0.00
Other surfaces	1.37±1.18	4.24	0.00	0.30±0.89	3.55	0.00

*Cutting board, table, and hand

food products are in direct contact with them during processing, cutting, and preparation. If these surfaces are contaminated, there is a potential for food to be contaminated when in contact with the surfaces. In this research, the microbiological quality of food contact surfaces was investigated in a kitchen in one of the hospitals of Shiraz University of Medical Sciences.

Based on the obtained results, total bacterial count indicated an acceptable level in 39.6% of the samples (regardless of the type of food contact surface) whose contamination level was lower than 1.3 log CFU/cm². However, the study by Domenech-Sanchez and colleagues revealed that 76% of food contact surface samples collected in the kitchen of Spanish hotels were acceptable in terms of total bacterial count.¹² Similarly, Marzano and colleagues reported that only 17.1% of the food contact surface samples collected in Italian caterings did not follow the standard of bacterial count.¹ In the hospital under the present study, washing with detergents was done once a day after cooking the dinner and the samples were collected before beginning of work shift. Definitely, one of the factors influencing the microbiological quality of the surfaces is the method of daily washing that might not be done properly. This might be due to the lack of sufficient and proper knowledge, negligence of kitchen staff, and shortage of skillful staff. Likewise, the results of the study by Marzano and colleagues indicated the effectiveness of cleaning and sanitation procedures applied by food operators. Accordingly, their microbial assessment indicated a high level of hygiene with respect to food contact surfaces and the workers' washed hands. These points are important for prevention of cross- contamination.¹

The findings of the present study indicated that total bacterial count was acceptable in 18.2% of the samples of the group of work surfaces. In contrast, Legnani and colleagues found that 22.2% of the critical surfaces, such as tables and cutting boards, had unsatisfactory conditions in terms of total bacterial count, and 16.7% were contaminated with *E. Coli* in catering establishments of Italy.¹³ Doménech-Sánchez and colleagues showed that cutting boards had the highest level of contamination among other instruments, but the average of contamination was still below the standard limit (1.3 log CFU/cm²).¹² The fiberglass cutting boards used in the current hospitals are among the frequently used instruments that are utilized for many hours a day and washed at the end of the work shift. Microorganisms attach

to these food contact surfaces and form biofilm. This is of particular importance since it is a nest for pathogenic bacteria, facilitating their proliferation at the contact surfaces and thus transferring them to the foods under process.⁸ As the surface of these boards becomes damaged due to frequent use, some grooves and cracks are created on them, making them a suitable place for growth and proliferation of microorganisms. Therefore, timely washing and replacement can decrease the possibility of biofilm formation and cross-contamination.⁷ In addition, some studies have mentioned the ability of bacteria to form biofilm on the dishes made of stainless steel, glass, polycarbonate, polystyrene, polypropylene, titanium, aluminum, and ceramic.¹⁴ Hence, application of these boards and improper dishes as well as insufficient washing, particularly for dishes and surfaces used for preparation of salads and breakfast which do not receive further heat treatment demonstrates the significance of attention to their hygiene.

Contamination with coliform was acceptable in 85.7% of the samples (irrespective of the type of food contact surface) in the studied hospital where contamination was lower than 1 log CFU/cm². On the other hand, Marzano and colleagues reported 7.9% contamination with coliform, and microbial analysis of the workers' hands indicated no contamination with coliform.¹ Similarly, the results of microbial evaluation of Italian restaurants revealed an acceptable level of safety hygiene of cleaned surfaces and washed hands, and only 7.9% of food contact surfaces were contaminated with coliform.¹⁵ In our study, contamination with coliform was acceptable in 72.7% of the instruments categorized in the group of work surfaces as well as in 89.2% of other surfaces. Achieving food safety necessitates constant attempts on the part of the commercial operators, scientists, and consumers.¹⁶ Factors such as personal hygiene, proper kitchen design, and sanitation and cleaning methods according to scientific instructions are considered as the main principles to reduce the contamination of food contact surfaces.¹² Microbial analysis has been proven as an effective method for evaluation of cleaning activities carried out in the kitchen as well as for promotion and perpetuation of workers' hygienic behavior.¹⁷ Until no systematic and continuous program is available for monitoring the hygienic status, bearing in mind that this would not be possible but with regular microbial tests, no information about quality would be obtained and no measure can be

taken for modification and improvement. Numerous pieces of research have indicated that application of HACCP and prerequisite programs improves food safety. Successful usage of methods based on the principles of HACCP requires total cooperation and commitment of workers in the food section.¹⁸ In the study by Garayoa and colleagues, a decreased level of contamination was observed after training the staff about food contact surfaces, thanks to understanding the importance of cleaning as the key prerequisite for implementation of HACCP.¹⁷ Sadeghifar and colleagues investigated Nutrition Departments of the Selected Hospitals of Tehran University of Medical Sciences in 2012 and showed that as a whole none of them was qualified for HACCP certification. They also did not have a plan for its implementation. Since the most important principle in food processing and food preparation is safe food, HACCP is the most efficient method to guarantee the health and food quality control in caterings and food establishment.¹⁹ A research on Enteral Feeds in an Iranian Teaching Hospital was done by Badri and colleagues showed, improvement of guidelines and protocols for cleaning is essential.²⁰

In the hospital under the current study, the workers have to have general hygiene certificates and participate in periodic training courses according to the hospital's schedule. Also, continuous training, development of standards, more intensive supervision, modification of behavior, designing food-producing units in hospitals according to scientific principles, and implementation of food safety management systems such as HACCP and ISO should also be taken into consideration as hygienic measures in food preparation and distribution centers, especially hospitals.

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