Microbial Evaluation of Cooked Foods Served in the Central Restaurant of Tehran University of Medical Sciences in Winter and Summer 2015

Ali Salehi *[1,2], Gholamreza jahedkhaniki[1], Kaveh Shoghi[3], Daryoush sanaei[4], Ehsan haghi[2]

1) Research Committee of Tehran University of Medical Sciences. Tehran university of medical sciences, Tehran, Iran
2) Department of Environmental Health Engineering, Division in Food Safety and Hygiene. Tehran university of medical sciences, Tehran, Iran
3) Department of food science, Division in food science design & material engineering. Ayatolah Amoli's science and Research University, Tehran, Iran
4) Department of Environmental Health Engineering, Division in Environmental Health Engineering. Tehran university of medical sciences, Tehran, Iran

**Author for Correspondence:* salehia15@gmail.com

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ABSTRACT

Food-borne pathogens are the most important thing cause of illness and death in developing countries. Food safety is essential for central university kitchens because of the high number of meals served every day. These central university kitchen systems are of special interest as students are at relatively high-risk of developing serious complications from exposure to food bacterial contamination hazards.

A total of 144 samples of cooked foods, collected in winter and summer 2015 from the restaurants of Tehran University of Medical Sciences, were studied to determine the microbiological quality of these products. Results were analyzed through SPSS 22.0 and t-test. According to coliform count, the highest rate of contamination was in Kebab (1.17×102 CFU/g) and lowest was in fish (0.8×102 CFU/g) and also the highest rate of contamination of *Escherichia coli* (*E.coli*) was in Kebab (6 samples), and the lowest contamination level was in fish and in this regard no sample was reported to be positive. According *to staphylococcus aureus*, the highest contamination rate was in rice (0.97×102 CFU/g) and lowest was in fish (0.63×102 CFU/g). Kebab had the highest contamination of coliforms and *staphylococcus aureus* (*S. aureus*) in summer. None of the tested samples was confirmed with respect to salmonella, *clostridium perfringens* and *staphylococcus aureus*. Among the foods served in the university restaurants, Kebab had the highest bacterial contamination and fishes the lowest. Improved methods of cooking and food processing, prevention of secondary bacterial contamination, continuous monitoring and surveillance of food processing are the most important measures to prevent food contamination.

Key words: Microbiological Quality; Contamination; Food; University Restaurant

INTRODUCTION

Foodborne diseases especially food poisonings have been introduced as a public health problem in developed and developing countries [1]. According to the reports from World Health Organization, the trend of foodborne diseases has increased. The rate of incidence of foodborne diseases in the European and developing countries is 38.3 and 915.8 in hundred thousand populations, respectively [2-4]. About 76 million foodborne diseases occur in U.S. annually. According to the reports of Centers for Disease Control (CDC), about 77% of food poisoning occurs in restaurants, 20% in homes and 3% from commercial foods [5]. In developing countries like Iran, the intensity and frequency of these diseases are higher than developed countries due to the level of public health and unfavorable conditions of the production, storage, distribution and consumption of foods [2, 5]. According to the codex alimentarius classification, meat, protein-rich foods and salads are high-risk foods. These foods are known as the most vulnerable nutrition for microbial growth [5-8]. Studies in Iran indicate that hygienic quality of foods and ready to eat salads has not been desirable [2, 9]. This issue is more important in academic centers, because staff and students will eat at least one meal in restaurants of university. Moreover, several studies reported that microbial contamination of foods and salads in Iran was higher than the standard limit. Tavakoli *et al.* [5] reported that grilled ground meat

samples are the most contaminated food in Tehran University's restaurants. Lack of hygiene in the kitchen of universities can be expected to result in food poisonings among students and personnel. Therefore, maintaining health among students and staff is very important in any country. Also, an important aspect of human health is consumption of healthy food. Due to the importance and necessity of this issue, this study evaluated the microbiological quality of foods served at the restaurants of Tehran University of Medical Sciences. The main purpose of this study was to determine the microbial contamination including coliforms and pathogenic bacteria in food cooking and serving center of Tehran University of Medical Sciences.

MATERIALS AND METHODS

Samples

A total of 144 samples were randomly obtained from six restaurants of Tehran University of Medical Sciences in winter and summer 2015. The samples included chicken, grilled chicken, Kebab, mince stew, eggplant stew, vegetable pot roast, fish and rice. All of the foods were collected in three innings, and at every turn three samples were collected in both winter and summer (8×3×3×2=144). Then, the samples were transmitted to the food laboratory for microbiological tests.

Microbiological analyses

Before the experiments were performed, samples were mixed and homogenized. Microbial tests included coliform count, *E.coli, staphylococcus aurous, salmonella, clostridium perfringens* and *bacillus cereus* which were performed according to the American Public Health Association [10] and Institute of Standards and Industrial Research of Iran (ISIRI NO. 8923-1, 6805-3, 9263, 6806-3, 1810, 2197 and 2324).

The total coliforms were enumerated by using coliform agar plate and incubating the plates at 37° C for 48 h. most probable number method (MPN) was used for the enumeration of *E. coli.* For *S. aureus* enumeration, serial dilutions of vegetarian food homogenates were plated on Baird Parker agar and incubated at 37 °C for 48 h. The number of B. cereus was determined by using the surface plating technique on KG Agar Base. A *Salmonella-shigella* agar plates were used for the enumeration of *salmonella spp.* and for *Clostridium perfringens* determination SPS agar plate was used.

Statistical analyses

SPSS software (ver. 22.0) was employed in this study. All the experiments were triplicated. All results were expressed as mean ± SD. Data obtained from the tests were analyzed using Kruskal–Wallis and Mann-Whitney tests to find significant differences among coliforms and pathogenic bacteria.

RESULTS AND DISCUSSION

In this study, the highest total coliform was in kebab and eggplant stew (1.17 × 102 and 1.07 × 102 CFU/g) and the lowest was observed in fish and chicken (0.8 × 102 and 0.83 × 102 CFU/g), respectively (See Fig.1). Also, *E.coli* contamination of foods is presented in Fig. 2. The highest *E.coli* contamination was detected in kebab (6 positive samples). The *E.coli* contamination was not observed in fish (no positive sample). Results of statistical analysis for coliform and *E. coli* showed a significant difference ($P < 0.05$). The coliform contamination in kebab, stewed eggplant and vegetable pot roast was more than standard (>102). Moreover, comparing the results of the microbial load of foods in winter and summer showed that coliform contamination for all foods except vegetable pot roast was higher in summer than winter (see Fig.3). According to Fisher's Exact Test results, there was no significant difference between *E.coli* contamination in summer and winter (See Table 1). The reason of coliforms and E. coli contamination in foods can be due to the contamination of raw materials, manipulation of the staff and the inappropriate cooking and curing conditions. And the lack of sanitary conditions in summer can raise contamination. The results were in agreement with those reported by Hoseinzadeh *et al.* [2] and Tavakoli *et al.* [9].

S.aureus contamination of foods is shown in Fig. 4. The highest *s.aureus* contamination was in rice and kebab (0.97 × 102 and 0.96 × 102 CFU/g, respectively) and the lowest were observed in fish (0.63 × 102 CFU/g). However, in the present study *s.aureus* contamination rate in all foods was less than the standard limit (<102). The results of comparison between the *s.aureus* contamination of foods in winter and summer are presented in Fig. 5. In winter, the highest *s.aureus* contamination was observed in rice (1.2 × 102 CFU/g) while the highest rate of *s.aureus* contamination in summer was related to kebab (0.9 × 102 CFU/g). Kebab is suitable for the growth of *staphylococcus aureus* and the presence of bacteria is dangerous in summer. Nevertheless, there was no significant difference between *s.aureus* contamination in summer and winter. Similar results were reported by Fang *et al.* [12] and Aycicek *et al.* [11, 12]. Lengthy gaps between preparations are among the most important reasons for food contamination. In addition, cooking temperature and heat distribution in entire food could be considered as

influencing factors in food contamination. Hence, food cooking temperature is an important criterion; as some studies have shown that bacterial growth may begin only within two hours after cooking (15). Therefore, preventive measures for removing secondary contamination should be considered in such stages.

The results of the present study are comparable to other studies conducted in Iran. Also in the studies carried out by Nemati *et al.* [13] and Tavakoli *et al.* [13, 14], Kebab was the most contamination food. Also, in this study, all samples were negative from pathogenic bacteria such as salmonella, *clostridium perfringens* and *bacillus cereus*. No contamination with these pathogenic bacteria reflects the health conditions of employees and containers of foods.

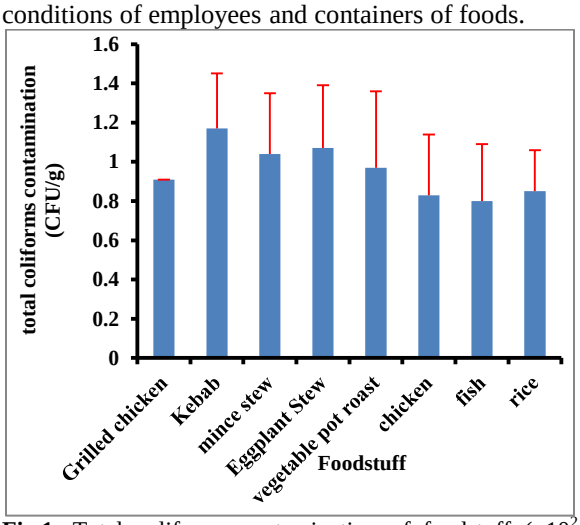

Fig.1. Total coliforms contamination of foodstuff ($\times 10^2$ CFU/g)

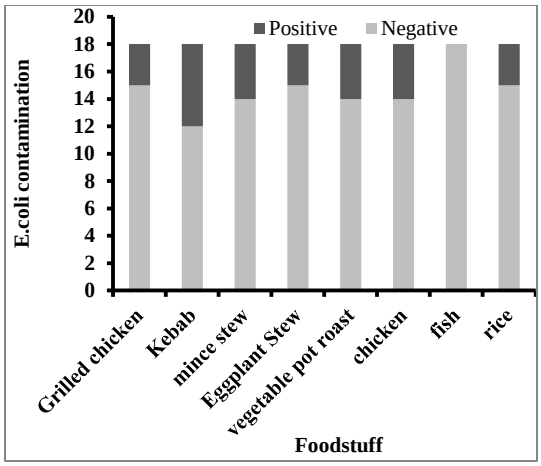

Fig.2. *E.coli* contamination of foodstuff

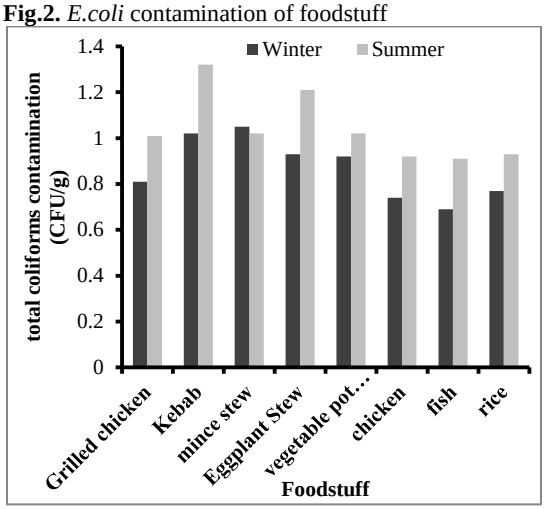

Fig.3. Coliform contamination of foodstuff in summer and winter ($\times 10^2$ CFU/g)

Table 1: E.coli contamination of foodstuff in summer and winter ($\times 10^2$ CFU/g):

Foodstuff	Seasons	Samples (%)		P-value
		positive	negative	
Grilled chicken*	winter	1 (11.1)	8 (88.9)	1.00
	summer	2 (22.2)	7 (77.8)	
Kebab**	winter	3 (33.3)	6 (66.7)	---
	summer	3 (33.3)	6 (66.7)	
mince stew**	winter	2 (22.2)	7 (77.8)	---
	summer	2 (22.2)	7 (77.8)	
Eggplant Stew*	winter	1 (11.1)	8 (88.9)	1.00
	summer	2 (22.2)	7 (77.8)	
Vegetable pot roast*	winter	1 (11.1)	8 (88.9)	0.58
	summer	3 (33.3)	6 (66.7)	
Chicken*	winter	1 (11.1)	8 (88.9)	0.58
	summer	3 (33.3)	6 (66.7)	
Fish**	winter	0 (0.00)	(100.0)	---
	summer	0 (0.00)	(100.0)	
Rice*	winter	1 (11.1)	8 (88.9)	1.00
	summer	2 (22.2)	7 (77.8)	

* No significant difference (P-value > 0.05), ** Non-use of Fisher's exact test due to the same distribution

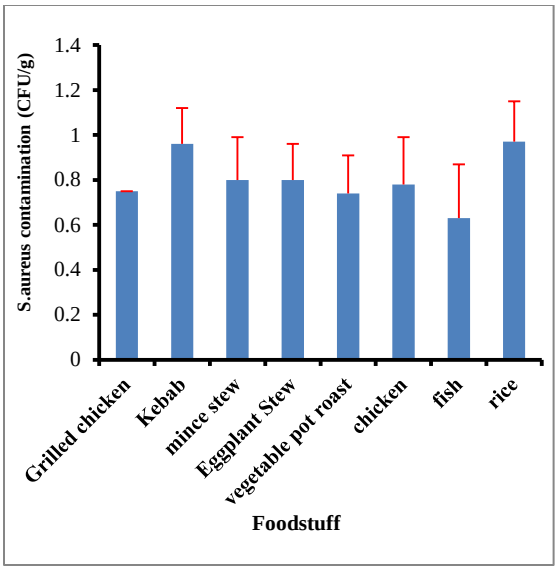

Fig.4. *S.aureus* contamination of foodstuff (×10^2 CFU/g)

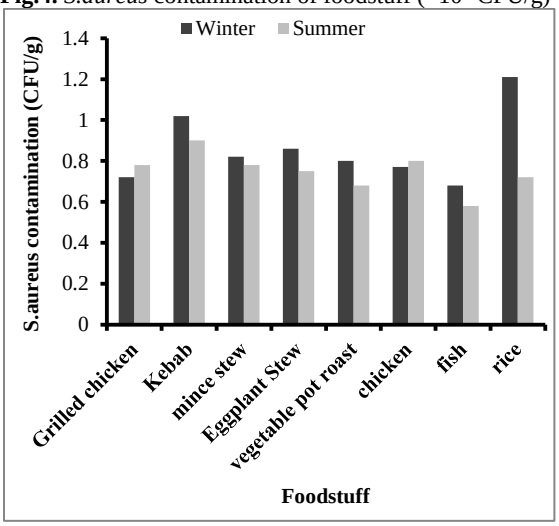

Fig.5. *S.aureus* contamination of foodstuff in summer and winter (×10^2 CFU/g)

CONCLUSION

Among the foods tested, just kebab, mince stew and eggplant stew were more than the standard limit. It is suggested that the authorities should remove kebab as one of the high-risk foods, especially in the summer, modify cooking and food processing methods, use safe raw materials, and continuously monitor the processes in order to reduce contamination.

ETHICAL ISSUES

Ethical issues such plagiarisms have been observed by the authors.

CONFLICT OF INTEREST

We declare that we have no conflict of interest

AUTHORS' CONTRIBUTION

All authors have equal contribution for this article.

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