

Survey of cooking utensils and dishes microbial contamination rate in the cafeteria of Zahedan University of medical sciences, 2015

Marzieh Rakhshkhorshid¹, Ataollah Rakhshkhorshid² and Davoud Belarak³

¹Master of Midwifery, area of study: Reproductive Health, professor of midwifery, Department of nursery and midwifery, faculty of nursery and midwifery, Pregnancy Health Research Center, Zahedan university of medical sciences, Zahedan, Iran

²Master of environment health engineering, professor of environment health, Department of Environmental Health, Faculty of Health, Research Center Promotion Health, Zahedan university of medical sciences, Zahedan, Iran

³Department of Environmental Health, Faculty of Health, Research Center Promotion Health, Zahedan university of medical sciences, Zahedan, Iran

Corresponding author: Marzieh Rakhshkhorshid, Zahedan, Mashahir Square, faculty of nursery and midwifery, fax: 05433295803,

Abstract

Background & Objectives: A large variety of microorganisms contribute to development of food-borne illness with different mechanisms. The present study was designed to evaluate the rate of cooking utensils and dishes contamination with heterotrophic bacteria, coliform and *Escherichia coli* in Zahedan University of medical sciences.

Materials & Methods: In this cross-sectional study, 339 samples taken from the cooking utensils and dishes in the university's cafeteria based on census and simple random sampling were studied. Samples were cultured and tested using the standard method for contamination with heterotrophic bacteria, total coliform and *Escherichia coli*. Data were analyzed using descriptive statistics in SPSS 16.

Results: The results showed that the dishes were not contaminated with *Escherichia coli*, but the total coliform heterotrophic bacteria were found on the washed and ready to use dishes in cafeteria. The total coliform and heterotrophic bacterial contamination of dishes were observed (86. 67% and

33. 3%) for skimmers, (81% and 27%) for spoons and forks, (79% and 30%) for kebab skewers, (70% and 65%) for pots, and (68% and 23%) for food trays respectively.

Conclusion: Despite being free of contamination with *E. coli*, the dishes in the university's cafeteria have a relatively high contamination with heterotrophic bacteria and total coliform, which probably is due to the lack of health compliance by kitchen staffs or inadequate washing and disinfection of dishes.

Key words: cooking and eating utensils, bacterial contamination, *Escherichia coli*, cafeteria

INTRODUCTION

Human needs food to survive (1) and the access to healthy and sufficient food safety is one of the certain rights of human that should be considered as the main priority. (2) Food consumption provides lots of transfer of Pathogens (bacteria, viruses and Parasites) to the body that can play a role with different mechanisms in the creation of food-borne illnesses. According to the estimates conducted by Center for Disease Control and Prevention in the United States, annually 75 million people suffer from food-borne illnesses (3). Thus, it is necessary to perform the stages of production, maintenance and distribution of foods according to health principles. (1)

Among the variety of microorganisms that play a role in the creation of food borne illnesses, bacteria cause the highest rate of illnesses. (3) Some of these bacteria include heterotrophic bacteria, coliform and *Escherichia coli*. Heterotrophic bacteria can be found everywhere such as water and dust particles in the air (4) and also live naturally in human body and excreted through feces. (5) Various studies on heterotrophic bacteria have shown that these bacteria have Pathogenic factors and are considered as a main risk for children's health and cause secondary infection in the patients who have poor defensive mechanisms (4). Also, some of them like *E. coli* O175 HV are Pathogenic and *Aeromonas* (gastroenteritis factor) are opportunistic (5). Coliforms were proposed as a Specific Reagent of Fecal contamination in 1982. (6) And their presence in food and environment is a reason for contamination through feces. The high presence of coliform in foods and environment is dangerous, causes Poisoning and Intestinal illness and have animal and Herbal origin. (7) *Escherichia coli* is one of the coliform that lives in human Intestine in a large number (8) and its associated illnesses are considered as the most common food Poisoning. (9)

Most health experts examine kitchens only by looking and do not pay attention to their microbiology. (10) Thus, it is necessary to pay attention to the performance units like cafeteria that directly affects the health of users especially students. (1) The present study was designed to study contamination with heterotrophic bacteria and total coliform especially *Escherichia coli* in the cafeteria's dishes of Zahedan university of medical sciences in order to take a step toward more compliance with health principles and promote students' health.

MATERIALS AND METHODS

This cross-sectional and descriptive study was conducted to study contamination with heterotrophic, total coliform and *Escherichia coli* in the cooking dishes used in the cafeteria of Zahedan University during the last 3 months of 2014. Sample size was obtained 334 by the following formula and referring to previous studies. (10) ($p= 0.32$, $d= 0.05$, $z= 1/96$)

$$n = \frac{z_{1-\alpha/2}^2 \times p(1 - p)}{d^2}$$

Among all dishes that were a large number like trays, kebab skewers, spoons and forks, 300 dishes were selected by sample random sampling and the other dishes that were a few number like skimmers, chopping board, pots were selected by census ($n=34$)

To determine the presence or absence of heterotrophic contamination, HPC (heterotrophic plate count) was used. So that, the petri of the dishes containing Nutrient agar medium was put between two Flames and a line with Spiral moves was drawn on the medium. The cultured Medium was put in incubator with the temperature 35 ± 0.5 for 48 hours. After incubation, the petri of dishes were taken out of the incubator. In case of Colony growth, the number of created bacteria were counted by using Colony Counter device and recorded in the table of microbial report. In laboratory, the taken sample was Diluted (Dilution =50) and 9-tube culture was done with Dilution 1, 0, 1, 10 inside Lactose broth medium and put inside the incubator for 24-48 hours in order to determine the presence or absence of total coliform and *Escherichia coli*. The creation of gas inside the Durham tube and Opaque Lactose broth means its contamination. From positive samples, 2 drops were collected by Loop inside the Brilliant Green medium and *E. coli*. After 48 hours of incubation, the creation of gas inside Durham tube in confirmation stage showed contamination with total coliform. Also, the samples cultured in *E. coli* medium were put in bain marie (water bath) for 24 hours with the temperature of 44 degrees. The creation of gas inside Durham tube showed contamination with *Escherichia coli*. The results were recorder in microbial contamination table.

The obtained results were analyzed by using descriptive statistics methods in SPSS 16 software.

RESULTS:

The results of this study that was done on 334 samples of cooking dishes used in the cafeteria of the university showed that 76/11 % of cooking dishes and utensils had heterotrophic contamination among which skimmers with 86/67% had the highest heterotrophic contamination and Meat Grinder with 50% had the least heterotrophic contamination. (Table 1) Among the studied dishes, 30/09% had total coliform contamination. The highest rate of total coliform contamination was related to chopping board and Meat Grinder (100%) and the least contamination was related to trays (23%). (Table 2) The studies showed that all cooking dishes had contamination with *Escherichia coli*.

Table 1: Frequency distribution of heterotrophic contamination in the cooking dishes of the cafeteria (Fu/cm²)

Dishes	number	The number of Heterotrophic bacteria colonies			
		Minimum contamination	Maximum contamination	mean (SD)	percentage of contamination
Kebab skewer	100	0	271	24/9 (49/240)	79
tray	100	0	87	7/4 (14/34)	68
Spoon and fork	100	0	865	50/8 (158/21)	81
Pot	20	0	131	45/45(51/66)	70
skimmer	10	0	102	46/13(38/23)	86/67
Chopping board	2	33	67	50 (24/04)	100
Meat grinder	2	0	54	27 (38/18)	50

Table 2: Frequency distribution of total coliform contamination in the cooking dishes of the cafeteria (MPN/100ml)

Dishes	number	total coliform contamination			
		Minimum contamination	Maximum contamination	mean (SD)	percentage of contamination
Kebab skewer	100	0	550	72 (214/17)	79
tray	100	0	450	47 (95/29)	68
Spoon and fork	100	0	450	58/5 (158/21)	81
Pot	20	0	450	175(163/43)	70
skimmer	10	0	350	66/7(108/01)	86/67
Chopping board	2	150	350	250 (141/42)	100
Meat grinder	2	150	150	150 (0)	50

DISCUSSION

The results of the present study that was done to examine contamination with heterotrophic bacteria, total coliform and *Escherichia coli* in the cooking dishes of the university's cafeteria showed that despite the lack of *Escherichia coli* contamination in all dishes, heterotrophic bacteria and total coliform could be seen in all washed and ready-to-use dishes and utensils in the cafeteria. So that, among the mentioned dishes and utensils in table 1, spoons and forks had the highest rate of heterotrophic

contamination. One of the factors that causes high rate of heterotrophic contamination in spoons and forks is the large number of spoons and forks and washing them with low accuracy. Kebab skewers with 30% contamination with total coliform had the highest rate of contamination with total coliform and none of them showed contamination with *Escherichia coli*.

According to the study by Nowrouzi as “bacterial contamination in the kitchen of some hospitals in 2004”, the results showed that about 31/5% of washed dishes had bacterial contamination and most of them were of heterotrophic bacteria and 4% were contaminated with *Escherichia coli* (10) and the results are consistent with the present study in terms of contamination with heterotrophic bacteria.

Skimmers with 86/67% had a higher rate of heterotrophic contamination than pots. Although, heterotrophic contamination of pots was less than skimmers, pots showed 65% of contamination with total coliform. (Table 2) The presence of heterotrophic bacteria and total coliform on the dishes and utensils of the cafeteria can show the lack of compliance with kitchen staffs or insufficient washing and disinfection of dishes.

According to the study of Al Buyeh et al (2014), cooking dishes had the highest contamination with a variety of heterotrophic bacteria (40%) while contamination with *Escherichia coli* was 8% (11). In another study by Wonafo et al in Cameroon in 1996, using undrinkable water in washing dishes and non-compliance with health principles during the process of production causes 71/3%% of ice cream samples to Fecal bacteria. Accordingly, there is a probability that one of the reasons of contamination in the cooking dishes and utensils of the university’s cafeteria is the contaminated water used in washing dishes.

Chopping boards had higher heterotrophic and total coliform contamination than meat grinders. The study results of Nasr et al entitled “the evaluation of risk in the creation of bacterial contamination in hospital foods by cooking dishes in 2014” showed that among the studied samples of cooking dishes, the most contaminated samples in terms of coliform contamination was related to knife and chopping board. Also, the contamination rate of cooking dishes with coliform was 57% and *Escherichia coli* was 17%. (13)

The reasons of high contamination in chopping boards was the usual copping of raw ingredients especially meat and creating gaps by knife on their surface. Another reason of contamination in chopping board is the lack of removing contamination and microbes in these gaps by normal washing and disinfection. In a study by Rodriguez et al (2011), the most contaminated surfaces were reported as chopping board and the reason to their high contamination was the lack of cleansing and their too much frazzle, (14) Also, the study of Sinclair et al in Cambodia in 2010 showed that the contamination rate with heterotrophic bacteria in table and counter was 5730, coliform contamination was 39 and *Escherichia coli* contamination was 5. Also, the heterotrophic contamination of chopping board and food products was 15000 and coliform contamination was 1 and *Escherichia coli* contamination was reported as less than 1. (15)

The reason for heterotrophic and total coliform contamination of meat grinder was the presence of inaccessible gaps that can be associated with deficits of disinfection. The

results of the study by Zarei et al (2014) show that respectively 23% and 4% of grinders' blades of sausages had unsatisfactory status in terms of general counting of bacteria and coliform. None of the blades had *Escherichia coli* (16) that is consistent with the present study.

CONCLUSION

The results showed that contamination rate with heterotrophic and total coliform bacteria on washed and ready-to-use dishes and utensils was high in cafeteria and increases the probability of contamination with Pathogenic bacteria. This issue indicates that more accuracy should be applied in washing and disinfection of dishes at the compliance with health principles and also the supervisors of the cafeteria should apply more monitoring in this regard. At the end, it is suggested to re-examine the method of washing dishes in order to reduce the rate of microbial load and improve the status of cafeteria and kitchens. More accuracy in washing and disinfection of cooking dishes and utensils, using gloves while moving dishes, using meat grinder instead of chopping board, encouraging students to use personal spoon and fork, using washing machine and not using handkerchief to dry dishes should be taken into consideration.

ACKNOWLEDGEMENTS

This study is the result of a research project entitled "Survey of cooking utensils and dishes microbial contamination rate in the cafeteria of Zahedan University of medical sciences in 2015 with the code 7163 that was supported by Zahedan University of medical sciences and Health services.

REFERENCES

- [1] Dobaradaran S, Bina B, Nasr Esfehiani B. The effect of some physical and chemical parameters on regrowth of *Aeromonas* bacterium and Heterotrophic bacteria in Isfahan drinking water system. *Journal of Water and Wastewater*. 2006; 17(1):8-13.
- [2] Faramarzi T, Jonidi Jafari A, Dehghani S, Mirzabeygi M, Naseh M, Rahbar Arasteh H. A survey of bacterial contamination of food supply in the west of Tehran. *Journal of Fasa University of Medical Sciences*. 2012; 2(1):11-18.
- [3] Gholammostafaei F, Alebouyeh M, Jabari F. Prevalence of Antibiotic Resistant Bacteria Isolated from Foodstuff in Kitchen of a Hospital in Tehran. *Journal of Ilam University of Medical Sciences*. 2014; 22(2):1-9.
- [4] Institute of Standards and Industrial Research of Iran. *Microbiology of food and animal feeding stuffs-Horizontal method for the enumeration of coliforms-Colony-count technique*. 1st ed. Karaj; 2006.
- [5] Khatib haghghi S, Ghane A, Nahrvar M. Survey the Coliform pollution in the Shafarood river of Guilan Province. *Journal of Shilat*. 2008; 2(1):1-11.

- [6] Majlesi Nasr M, Jabbari F, Alebouyeh M, Torabi P, Balvayeh M, Zali MR. Risk assessment of cooking utensils role of the bacterial contamination in the hospital kitchen. *Iranian South Medical Journal*. 2014; 17(3):336-344.
- [7] Mokhtari M, Babaii a. *Housing and Institutional Health*. 1rd ed. Tehran: Sobhan; 2006.
- [8] Mokhtarian Dalouii H, Mohsenzadeh M, Khezri M. The survey on the bacterial contamination of traditional ice cream produced in Mashhad city. *Quarterly of Horizon of Medical Sciences*. 2004; 10(1):42-46.
- [9] Mosaferi M, Shakerkhatibi M, Mehri Badloo A. Heterotrophic bacteria in drinking water in Tabriz, Iran. *Journal of School of Public Health and Institute of Public Health Research*. 2011; 8(4):83-92.
- [10] Norozi J. Study on bacterial contamination of environment kitchen in some hospitals. *Journal of Health Administration*. 2005; 8(19):50-54.
- [11] Rodriguez M, Valero A, Carrasco E, Pérez-Rodríguez F, Posada GD, Zurera G. Hygienic conditions and microbiological status of chilled Ready-To-Eat products served in Southern Spanish hospitals. *Food Control*. 2011; 22:874-882.
- [12] Sinclair RG, Gerba CP. Microbial contamination in kitchens and bathrooms of rural Cambodian village households. *Letters in Applied Microbiology*. 2011; 52(2):144-9.
- [13] Soltan Dallal MM, Fazelifard P, Tabatabaei Bafroei A, Rashidi S, Zarrin M. Determination the rate of microbial contamination of cream pastry from confectionaries in south of Tehran. *Journal of Microbial Biotechnology*. 2010; 2(6):7-12.
- [14] Soltan Dallal MM, Khaksar R, Tabatabaei Bafroei A, Norouzian Sh, Fazeli Fard P, Fakharian F, et al. The survey of packaged drinking water contamination in supply level by filtration method. *Journal of Microbial Biotechnology*. 2009; 1(1):14-17.
- [15] Wouafo MN, Njine T, Tailliez R. Hygiene and microbiologic quality of ice creams produced in Cameroon. A public health problem. *Bulletin de la Societe de Pathologie Exotique*. 1996; 89(5):358-62.
- [16] Zarei S, Ehrampoush MH, Mazloomi SM, Ghaneian MT, Hajimohammadi B, Dehghan A. Evaluation of microbial quality of sausage slicers at food retail food stores in Shiraz, Iran. *Journal of Toloo-e-Behdasht*. 2014; 13(3):54-63.

