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Bacterial Contamination and Hygienic Practices Followed by Restaurant's Workers at Basra City Center

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ABSTRACT

Globally, microorganisms cause the majority of foodborne diseases, causing disease burden and mortality. Insufficient food hygienic practices by restaurants workers contributed to microorganism contamination during food handling and processing. The purpose of this study was to evaluate the workers' commitment to food hygiene practices and the level of bacterial contamination in Basra city restaurants. A total of 299 forms were distributed to different sociodemographic characteristics of food handlers (cooks and waiters). The statistical analysis found significant associations between sex, level of education, number of food hygiene orientation attendance and the level of commitment to hygienic practices during work hours. 90 samples taken from cooked food samples, hands of the cookers and waiters, meat cutting knifes, meat cutting boards, trays, working surfaces, refrigerator's hand and shelfs at the kitchen for bacterial identification. Our study revealed that, 50% of the samples were contaminated with E. coli. Salmonella spp. and Shigella spp. contamination were relatively have same incidence of 15% and 14.4%, respectively. Staphylococcus spp. and Klebsiella spp. contamination were relatively have same incidence of 11.1% and 10%, respectively. The analysis revealed the presence of Pseudomonas spp., Proteus spp., B. cereus onto a small number at the food contact surfaces. According to this study, contamination was high maybe due to poor food hygienic practices followed by site workers and the absence of an attendance contract for food hygiene practices.

1. Introduction

Microorganisms are the most common cause of foodborne diseases that affect the human population worldwide, causing disease burden and mortality. In addition, a number of sectors, including tourism and trading, are negatively impacted by foodborne diseases (Todd ECD, 2017). Some foodborne diseases are acquired in restaurants through dishes, plates, and other kitchen equipment. Poor sanitation contributes to food contamination by several types of microorganisms during handling and processing. Most cross-contamination of food comes from humans touching, breathing, coughing, and sneezing near the food (Stein and Chirilã, 2017). Various microorganism species residing in the kitchen, refrigerators, utensils, and cutting surfaces can be a direct source of food borne disease. The most common illnesses caused by cross contamination include respiratory tract infections, the common cold, fever, sore throats, and intestinal disorders (Bintsis, 2017). It is estimated that there are over two hundred types of viruses, parasites, and bacteria that can cause food-borne diseases. However, the vast majority of food poisoning occurs as a result of contamination with bacteria. Shigellosis, typhoid fever, and staphylococcal food poisoning can occur when a worker who is sick handles the food in the wrong way (Bintsis, 2017; Antunes et al., 2020). Most episodes of food poisonings have an abrupt onset and resolve into a simple illness within 72 hours. There are a number of bacteria commonly associated with food poisoning such as S. aureus, C. perfringens, Salmonella, Campylobacter, B. cereus, Listeria, V. parahaemolyticus, and E. coli (Todd, 2017; Bintsis, 2017; Antunes et al., 2020). In this study, we investigated the contamination level in multiple instruments in the kitchen and the hygienic practices followed by restaurant food handlers at Basra city center. In addition, find any correlation between the sex, level of education, and number of food hygiene orientation attendance and hygienic practices routine followed by restaurant food handlers at Basra city center.

2. Methodology

Study Setting and Data Collection

1. The questioner

Data collected between July 2022 and October 2022 regard to the hygiene and safety in food service units, aiming specifically at the assessment of hygiene status of hands of food handlers and surfaces. We collected data from six restaurants in the center of Basra city by asking the waiters and cooks to fill out a questionnaire form. A total of 299 forms contain questions regarding factors related to food hygiene practices, such as gender, educational level, work experience, and orientations. Furthermore, questions regarding food hygiene practices, such as how often you wash your hands during working hours, whether you wear gloves, and whether you cover your head.

2. Microbiological sample collection, culturing, and assessment

Technicians collected 90 samples from cooked food samples, hands of the cookers and waiters, meat cutting knifes, meat cutting boards, trays, working surfaces, refrigerator's hand and shelfs. In order to collect samples, swabs moistened with buffered peptone water (BPW) placed at a 30-degree angle with the surface where they were to be taken.

The microbiological analyses were carried out in the microbiology laboratory of community health department/ Basra Technical Institute/ Southern Technical University. In an aseptic environment, each collected swab was thoroughly vortexed using 1 ml BPW. 0.01 ml of the suspension was transferred to Blood agar and MacConkey Sorbitol agar Petri dishes, and also into Selenite F-broth media. These were sub-cultured after 6 hours on solid Xylose Lysine Deoxycholate Agar (XLD agar). All plates incubated at 37 °C for 24 to 48 h. Then, the results were reported as the number of colony forming units (CFU/cm2). Microbiological identification was performed with a Vitek 2 compact.

3. Statistical analysis

Excel sheets were used to plot the collected data and display the results. SPSS software was used for statistical analysis. Variables were analyzed by the Chi-squared test or Fisher's exact test. Association was declared at p-value< 0.05.

3. Results and Discussion

The information extracted from the distributed questioner indicated that, the percentage of working male 84.3% in this business is higher than the female 15.7%. Majority of the participants of the questioner were waiters 65.9% compared to cookers 34.1%. There were 41.5% of participants with a primary level of education, followed by 39.5% with a high school diploma and 19.1% with a college degree. When it comes to the food hygiene orientation, 79.9% of participants received no orientation on food hygiene, while 12.4% received it annually, and 7.7% received it biannually (Table 1).

Table 1 Sociodemographic characteristics of the study population

Characteristic	Frequency	Percent
Sex:		
Male	252	84.3
Female	47	15.7
Occupation:		
Cooker	102	34.1
Waiter	197	65.9

Education level:		
Primary	124	41.5
High school	118	39.5
College	57	19.1
Food hygiene orientation		
None	239	79.9
Annually	37	12.4
Biannually	23	7.7
Total	299	100.0

Regarding the hygienic practices, 84.3% of the participants washed their hands 2 times or less during the working hours, 91% wore no gloves, 78.6% wore no head cover (Table 2).

Table 2 Hygienic practices in the study population

Practice	Frequency	Percent
Washing hands:		
Less than 2	252	84.3
From 2 to 3	24	8.0
Four or more	23	7.7
Wearing gloves:		
Yes	27	9.0
No	272	91.0
Wearing head cover:		
Yes	64	21.4
No	235	78.6
Total	299	100.0

Statistical analysis of the variables found that females wash their hands and wear headcovers more often during working hours than males, 0.002, 0.0001 respectively (table 3). The results revealed high significant differences between the groups when it came to number of times washing hands toward higher education 0.0001 (Table 4). In addition, the results showed significant associations between following hygienic practices and attending food hygiene practices orientations. Participant who attended more orientations practiced hand washing, wearing gloves, and wearing a headcover significantly more often (Table 5).

Table 3 The association of sex with food hygienic practices

Practice		Sex		Total	Sig.
		Male	Female		
Washing hands	Less than 2	205	47	252	0.002*
		81.3%	100.0%	84.3%	
	From 2 to 3	24	0	24	
		9.5%	0.0%	8.0%	

	Four or more	23	0	23	
		9.1%	0.0%	7.7%	
Wearing gloves	Yes	26	1	27	0.094*
		10.3%	2.1%	9.0%	
	No	226	46	272	
		89.7%	97.9%	91.0%	
Wearing head cover	Yes	26	38	64	0.0001**
		10.3%	80.9%	21.4%	
	No	226	9	235	
		89.7%	19.1%	78.6%	
Total		252	47	299	
		100.0%	100.0%	100.0%	

* Fisher's Exact Test

** Chi-Square Test

Table 4 The associations of education level with food hygienic practices

Practice		Education level			Total	Sig.
		Primary	High school	College		
Washing hands	Less than 2	110	91	51	252	0.0001*
		88.7%	77.1%	89.5%	84.3%	
	From 2 to 3	13	6	5	24	
		10.5%	5.1%	8.8%	8.0%	
	Four or more	1	21	1	23	
		0.8%	17.8%	1.8%	7.7%	
Wearing gloves	Yes	9	16	2	27	0.063
		7.3%	13.6%	3.5%	9.0%	
	No	115	102	55	272	
		92.7%	86.4%	96.5%	91.0%	
Wearing head cover	Yes	23	26	15	64	0.485*
		18.5%	22.0%	26.3%	21.4%	
	No	101	92	42	235	
		81.5%	78.0%	73.7%	78.6%	
Total	124 100.0%	118	57	299		
		100.0%	100.0%	100.0%		

* Chi-Square Test

** Fisher's Exact Test

Table 5 The associations of food hygiene orientation with food hygienic practices

Practice		Food hygiene orientation			Total	Sig.
		None	Annually	Biannually		
Washing hands	Less than 2	203	26	23	252	0.0001*
		84.9%	70.3%	100.0%	84.3%	
	From 2 to 3	24	0	0	24	
		10.0%	0.0%	0.0%	8.0%	
	Four or more	12	11	0	23	
		5.0%	29.7%	0.0%	7.7%	
Wearing gloves	Yes	18	2	7	27	0.006**
		7.5%	5.4%	30.4%	9.0%	
	No	221	35	16	272	
		92.5%	94.6%	69.6%	91.0%	
Wearing head cover	Yes	54	2	8	64	0.016**

		22.6%	5.4%	34.8%	21.4%	
	No	185	35	15	235	
		77.4%	94.6%	65.2%	78.6%	
Total		239	37	23	299	
		100.0%	100.0%	100.0%	100.0%	

* Fisher's Exact Test

** Chi-Square Test

Regarding the bacterial contamination, E. coli was the most prevalent pathogen, detected in 45/90 (50%) of examined food contact surfaces. Salmonella spp. and Shigella spp. contamination were relatively have same incidence of 15% and 14.4%, respectively. Staphylococcus spp. and Klebsiella spp. contamination were relatively have same incidence of 11 % (10/90) and 10% (9/90), respectively. The analysis of the 90 collected samples, revealed the presence of Pseudomonas spp., Proteus spp., Bacillus cereus onto a small number of food contact surfaces: 3.3%, 2.7%, 2.2%, respectively (Figure 1).

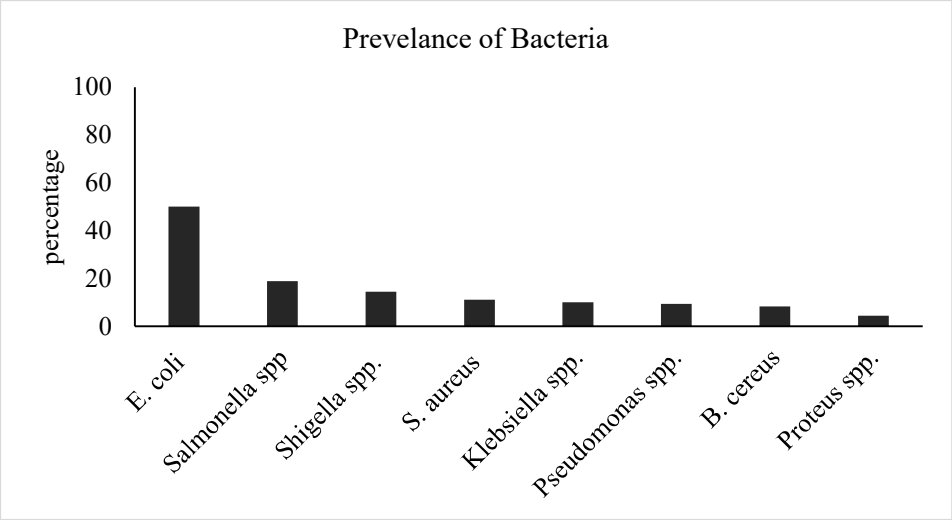

Figure (1) Prevalence of bacteria. Prevalence of bacterial contamination from samples taken from hands of the cookers and waiters, meat cutting knifes, meat cutting boards, trays, working surfaces, refrigerator's hand and shelfs. E. coli represented 50% of the bacterial contamination.

Food cross-contamination is a major problem caused by humans' hands, breath, hair and secretion contaminate food such as coughing and sneezing (Stein and Chirilã, 2017). Following hygiene routine by the food handlers at the restaurants could decrease the chance of the cross-contamination. Studies reveled that, sex, and educational level consider factors effected the food hygiene practices among food handlers (Lema et al., 2020; Negassa, 2022). Men with primary education were the dominant in this field (Lema et al., 2020). In our study, the majority of the workers in this field were men with level of education ranged from primary to high school. In addition, the majority of the workers did not receive any hygiene practices orientation. When it comes to washing hands and wearing head cover, female showed more commitment to the food hygienic practices than men. In addition, workers with better level of education wash their hands more often.

Knowledge of food hygienic practices was significantly related to food handling practices. Compared to non-trained food handlers, trained food handlers were four times more likely to have good food handling practices (Negassa et al., 2022; Azanaw et al., 2019). Our study showed high association between the number of food hygienic orientations and the practices by the workers towards more orientation attendance. The workers who attended more orientations practiced hand washing, wearing gloves, and wearing a headcover more often. It had been recommended by several studies in this field that, owners, managers, and health professionals embed an obligation on workers to attend food safety practices (Lema et al., 2020; Negassa et al., 2022; Azanaw et al., 2019).

In a study to determine bacteriological quality for 7 restaurants in Yola, Nigeria, the researchers' revealed a profile of several bacteria including S. aureus, P. vulgaris, S. typhi, E. coli and the species of Shigella, Klebsiella and Bacillus (Maori and

De, 2010). In another study, researchers assessed the microbiological quality of restaurant's food of Makkah city. They detected high incidence of Klebsiella and E. coli. in addition, other microorganisms with a lower percentage such as, Staphylococcus aureus, Pseudomonas spp., Proteus spp., Bacillus cereus, and Candida sp. had been detected (A Bukhari et al., 2021). In our study, 8 different bacteria species detected, where E. coli had the highest percentage of them. Cross-contamination with E. coli during food preparation is considered an indication of poor hygienic conditions or fecal contamination (Odonkor and Mahami, 2020). High percentage of food contamination with bacteria maybe related in the first place to the poor hygienic practices of the food handlers. In addition, restaurants should also be monitored for food hygienic practices by proficiently inspectors (Negassa et al., 2022;A Bukhari et al., 2021). A continuous microbiological assessment is also necessary to ensure standard sanitation levels in restaurant's kitchens (A Bukhari et al., 2021).

4. Conclusion

This study highlights the low commitment to the food hygienic practices in 7 restaurants at Basra city by the food handlers. The overall findings indicated a high incidence of potential pathogens, therefore; we recommended to increase the frequency of periodical microbiological assessment, including the food contact surfaces in restaurants.

Authors' declaration:

The author declare that the research was conducted in the absence of any commercial or financial relationships that could be taken as a possible conflict of interest.

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