Original Article

Journal of Food Safety and Hygiene

Journal homepage: http://jfsh.tums.ac.ir

Identification of pathogenic bacteria from food handling surfaces (tabletops) from different areas with demonstration of their drug resistance properties

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ARTICLE INFO

Article history:

Received 11 May. 2019
Received in revised form
23 Aug. 2019
Accepted 29 Aug. 2019

Keywords:
Foodborne disease;
Pathogenic bacteria;
Contamination;
Food handling surfaces;
Sanitation;
Disinfection;
Antibiotic resistance

ABSTRACT

Foodborne illness is generally caused after consumption of food contaminated with pathogenic microorganisms. Food contamination often caused by contact with tabletops or food handling surfaces where the pathogenic microbes are present due to unhygienic condition of people working there and the overall environment of the food serving area. In current study, four areas (local restaurants, fast food shops, university canteens and hospital canteens) were selected for collection of swab sample (per cm^2 area) from the tabletops. Five samples from each area were taken for further studies. After microbiological analysis we found ten different types of bacteria (*Esherichia coli, Klebsiella pneumonia, Klebsiella oxytoca, Corynebacterium xerosis, Staphylococcus aures, Salmonella* spp., *Proteus mirabilis, Enterobacter aerogenes, pseudomonas aeruginosa* and *Alcaligenes fecalis*) which are already considered to be pathogenic bacteria causing different health issues in immune-compromised and also in healthy consumers. These bacteria were then subjected to antibiotic sensitivity test using ten antibiotics-Vancomycin (30 µg), Cotrimoxazol (30 µg), Azithromycin (15 µg), Gentamicin (10 µg), Amoxycillin (10 µg), Cephradine (30 µg), Ceftriaxone (30 µg), Cefuroxime (30 µg), Cefoxitin (30 µg) and Tetracycline (30 µg). Bacterial isolates collected from university and hospital canteens showed most resistance towards these antibiotics. Strict maintenance of proper sanitation and hygiene starting from personal aspects to the overall environment of food handling service should be maintained to reduce the food contamination and foodborne disease.

Citation: Paul A, Rahman MdM, Ahmed T*. **Identification of pathogenic bacteria from food handling surfaces (tabletops) from different areas with demonstration of their drug resistance properties.** J food safe & hyg 2019; 5(3):165- 174

1. Introduction

Foodborne illness is a very common health issue all around the globe (1,2). Lack of proper sanitation in a food handling area is a major responsible factor for such incident (3). Maintenance of proper cleanliness in every possible area of a food handling setting is important which can alone drastically reduce the rate of foodborne illness. This is equally important for household kitchen or dining facility, canteens in office/schools/colleges/universities, hospital canteens as well as restaurants (4).

In different studies the acceptable cleanliness criteria varied among different investigators where some suggested the degree cleanliness in one condition can be acceptable where the same condition might not be acceptable. On the other hand, general people consider the visual sign of sanitation and cleanliness is the key criteria to be a good food handling surface (5-10). The entry of pathogenic bacteria can be introduced into the food handling surfaces directly from raw or under processed foods, water, unsanitized hands of the people, packaging materials, contaminated or poorly washed kitchen wares, cleaning wipes etc.

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Among all these, improperly washed hands are the most common and easiest way of transporting microorganisms into and out of surfaces (11, 12). When pathogenic microbes from the handling surfaces come into the food by unhygienic hands, this can initiate foodborne illness, neurologic problems, hepatic and renal diseases and so on to the consumers (13).

The pathogenic strains of *Escherichia coli*, *Salmonella* spp., *Shigella* spp., *Serratia* spp., *Aeromonas* spp., *Staphylococcus aureus*, *Campylobacter* spp., parasites and even viruses are the most common contaminants causing health problems (14-19). Foodborne illness is mostly dangerous for the children (<five years of age), pregnant women, old people, and/or compromised people (20-22). Microorganisms can get attached with the food handling surfaces with the organic matters present that has not been washed properly with detergent, can start producing biofilm which is even more difficult to eradicate. This biofilm is responsible to continuous spread of infectious microbes like *Escherichia coli*, *Proteus* spp., *Salmonella* spp., *Pseudomonas* spp., *Klebsiella* spp. to the people. The presence of organic matter supports with nutrition for the survival of the microbes on the surfaces as well (23-25). Following proper hand washing method and the appropriate sanitization of food handling surfaces with disinfectants is very necessary to reduce the transmission of pathogenic microorganisms into the food chain resulting in reduced foodborne diseases (26-28).

Such unhygienic condition prevails mainly due to lack of proper knowledge about sanitation, lack of sincerity and dedication to work, improper investment in sanitation program etc. (29). In a report of WHO in 2015, Foodborne Disease Burden and Epidemiology Reference group found approximately 582 million foodborne illness with 351,000 deaths globally (30). The purpose of the current study was to investigate the microbiological load on the tabletops in different food handling areas with the identification of the microorganisms as well as their resistance towards antibiotics.

2. Materials and Method

2.1. Study area and sampling

For this study four different sectors were selected to collect the samples from tabletops- local restaurant tables, fast food restaurants, hospital canteens and canteens of academic institutions. Five samples from each sector were collected resulting in total twenty samples. The study was carried out from December, 2019 to February, 2020.

Sterile cotton swab was used for the collection of samples from food handling tabletops from each area which was moistened with sterile normal saline and then aseptically transferred to the microbiology laboratory as early as possible for further analysis. Samples were collected per square inch from the surface.

2.2. Sample processing inoculation

After collection of sample the swabs were dipped in 3 ml sterile peptone broth tubes. 100 µl from the peptone broth was introduced onto nutrient agar, MacConkey agar, Sabouraud Dextrose agar (SDA), *Pseudomonas* agar, Mannitol salt agar (MSA), Thiosulfate Citrate Bile salt Sucrose agar (TCBS), *Salmonella-Shigella* agar (SSA) for spreading and then incubated. SDA plates were incubated at 25^{o}C for 48 h and other plates were incubated at 37^{o}C for 24 h (31-35).

2.3. Biochemical identification

After incubation, the isolates were then biochemically identified using Triple Sugar Iron Agar test (TSI), catalase, citrate utilization, oxidase, methyl red (MR), indole test and Voges-proskauer (VP) (36-38).

2.4. Determination of antimicrobial properties of the isolates

Isolates which were collected from the wound samples were tested for antibiotic susceptibility on Mueller-Hinton agar (Difco, Detroit, MI) by Kirby-Bauer method. About ten antibiotics Vancomycin (30 µg), Cotrimoxazol (30 µg), Azithromycin (15 µg), Gentamicin (10 µg), Amoxycillin (10 µg), Cephradine (30 µg), Ceftriaxone (30 µg), Cefuroxime (30 µg), Cefoxitin (30 µg) and Tetracycline (30 µg) were used in this study. After 24 h of incubation, plates were observed for the zones of inhibition were measured in mm (39).

3. Results

Bacterial load was determined from the surfaces of the tabletops from different areas (local restaurants, fast food shops, canteens of academic institutions and canteens of hospitals) to understand about the transmission of pathogenic bacteria from different sources onto the table tops/ food handling surfaces from where they get their chance to enter into the food chain and cause serious health issues. In this study, total bacterial count was highest in the canteens of academic institutions and hospitals (Table 1) up to 10^2/cm^2. Sample 5 from local restaurant also showed such bacterial load. Total fungal count also showed similar results as total viable bacterial

count (highest in the both canteens from academic and hospital background).

Table 1. Microbiological load on different food handling surfaces per cm^2).

Area	Sample	TBC	TFC	*Alcaligenes fecalis*	*Staphylococcus aureus*	*Staphylococcus spp.*	*Pseudomonas aeruginosa*	*Enterobacter aerogen*	*Proteus mirabilis*	*Salmonella cholera*	*Salmonella spp.*	*Escherichia coli*	*Klebsiella pneumo*	*Klebsiella oxutoca*	*Corynebacterium*
Local restaurants	01	8.0×10^1	-	-	-	-	-	-	-	-	-	4.0×10^1		-	-
	02	6.0×10^1	1.0×10^1	-	1.3×10^1	-	-	-	-	-		3.0×10^1		-	-
	03	6.0×10^1	-	-	-	-	-	-	-	-	-	7.5×10^1		-	-
	04	1.0×10^2	3.9×10^1	-	1.8×10^2	-	-	-	1.4×10^1	-	3.0×10^1	1.2×10^2	1.4×10^1	-	-
	05	1.5×10^2	-	-	-	-	-	-	1.1×10^1	-	-	2.2×10^1	4.0×10^1	-	-
Fast food shops	01	2.0×10^1	1.5×10^1	4.4×10^1	7.2×10^1	-	-	1.2×10^1	-	-	-	-	-	-	-
	02	3.0×10^1	3.0×10^1	-	-	1.0×10^1	-	2.0×10^1	2.2×10^1	-	-	-	-	-	-
	03	1.1×10^2	4.4×10^1	-	7.0×10^1	8.0×10^1	7.0×10^1	-	-	-	-	-	-	-	-
	04	8.0×10^1	8.8×10^1	-		1.3×10^1	4.2×10^1	-	-	-	-	-	-	-	-
	05	7.5×10^1	7.7×10^1	-	-	3.5×10^1	1.5×10^2	-	-	1.0×10^1	-	-	-	-	-
Canteens (Academic)	01	2.7×10^2	1.9×10^2	-	-	-	6.0×10^1	-	-	-	-	2.0×10^1	1.0×10^2	5.0×10^1	-
	02	2.7×10^2	1.4×10^2	-	-	-		2.0×10^1		-	-	-	1.2×10^2	-	1.5×10^2
	03	2.8×10^2	2.9×10^2	-	-	-	-	2.1×10^2	-	-	-	-	1.3×10^2	4.0×10^1	-
	04	2.8×10^2	1.6×10^2	-	-	-	2.5×10^1	-	-	-	-	1.5×10^1	-	-	2.2×10^1
	05	2.9×10^2	7.2×10^1	-	-	-	1.4×10^2	4.5×10^1	-	-	-	1.0×10^1	-	-	-
Canteen (Hospitals)	01	2.6×10^2	2.9×10^2	-	-	1.8×10^1	-	1.4×10^1	-	-	-	-	1.8×10^1	-	-
	02	2.3×10^2	7.2×10^1	-	-	1.5×10^1	-	-	-	-	-	-	-	-	-
	03	2.0×10^2	1.2×10^2	-	-	1.5×10^1	-	6.0×10^1	-	-	-	-	6.0×10^1	-	-
	04	2.4×10^2	7.5×10^1	-	-	4.5×10^1	-	1.3×10^2	-	-	-	1.6×10^1	1.3×10^1	-	-
	05	1.5×10^2	1.2×10^1	-	-	1.1×10^1	-	5.0×10^1	-	-	-	-	-	-	-

Table 2. Biochemical identification of isolates collected from food handling surfaces (tabletops).

Source	Isolate No.	TSI				Citrate	Indole	Catalas	Oxidase	MR	VP	Identified bacteria
		Slant	But t	Gas	H_2S							
Local restaurants	01	A	A	-	-	-	-	+	+	-	-	*Alcaligenes fecalis*
	02	A	A	-	-	+	-	+	-	+	+	*Staphylococcus aureus*
	03	K	K	-	-	+	-	+	+	-	-	*Pseudomonas aeruginosa*
	04	A	A	-	-	-	-	+	-	+	+	*Staphylococcus* spp.
	05	A	A	-	-	-	-	+	+	-	-	*Enterobacter aerogenes*
	06	K	K	-	-	-	-	+	+	-		*Proteus mirabilis*
	07	K	K	-	-	+	-	+	-	+		*Salmonella choleraesuis*
	08	K	K	-	-	+	-	+	+	-	-	*Pseudomonas aeruginosa*
Fast Food Shops	09	A	A	-	-	-	-	+	+	+		*E.coli*
	10	A	A	-	-	-	-	+	+	+		*E.coli*
	11	K	A	-	-	+	-	+	-	+		*Salmonella sps*
	12	K	A	-	-	-	-	+	-	-		*Proteus mirabilis*
	13	K	A	-	-	-	-	+	-	-		*E.coli*
	14	K	A	-	-	+	-	+	+	-		*Proteus mirabilis*
	15	A	A	-	-	+	-	+	+	-		*Klebsiella pneumoniae*
	16	A	A	-	-	+	-	+	+	-		*Klebsiella pneumoniae*
Canteen (Academic institution)	17	K	A	+	-	-	-	+	-	-	-	*Corynebacterium xerosis*
	18	K	K	-	-	-	-	+	-	-		*E.coli*
	19	A	A	-	-	-	-	+	-	-		*Enterobacter aerogenes*
	20	A	A	-	-	+	-	+	-	-		*Klebsiella pneumoniae*
	21.	A	A	-	-	+	-	+	-	+		*Klebsiella pneumoniae*
	22.	A	A	-	-	+	+	+	-	+		*Klebsiella oxytoca*
	23.	A	A	-	-	+	+	+	+	+		*Klebsiella oxytoca*
	24.	A	A	-	-	-	-	+	-	-		*Enterobacter aerogenes*
	25.	A	A	-	-	+	-	+	-	+		*Klebsiella pneumoniae*
	26.	A	A	-	-	-	-	+	-	+		*E.coli*
Canteen (Hospitals)	27.	A	A	-	-	+	-	+	-	-		*Klebsiella pneumoniae*
	28.	A	A	-	-	-	-	+	-	+	+	*Staphylococcus spp.*
	29.	A	A	+	-	+	-	+	+	+		*Klebsiella pneumoniae*
	30.	A	A	-	-	-	-	+	-	+	+	*Staphylococcus spp.*
	31.	A	A	+	-	+	-	+	+	+		*Klebsiella pneumoniae*
	32.	A	A	-	-	+	-	+	-	+		*Klebsiella pneumoniae*
	33.	K	A	-	-	+	-	+	-	-		*Proteus mirabilis*
	34.	K	A	-	-	+	-	+	+	+		*Proteus mirabilis*

Table 3. Antibiotic test of the isolates (zone of inhibition in mm) (CLSI guideline, 2016)

Source	Isolate No.	Bacterial isolate	Vancomycin (30µg)	Cotrimoxazol (30µg)	Azithromycin (15µg)	Gentamicin (10µg)	Amoxycillin (10 µg)	Cephradine (30 µg)	Ceftriaxone (30 µg)	Cefuroxime (30 µg)	Cefoxitin (30 µg)	Tetracycline (30 µg)
Local restaurants	1.	*Alcaligenes fecalis*	25(S)	30(S)	(R)	26(S)	23(S)	15(S)	27(I)	(R)	(R)	28(S)
	2.	*Staphylococcus aureus*	25(S)	18(S)	20(S)	(R)	20(S)	(R)	20(R)	(R)	(R)	15(I)
	3.	*Pseudomonas aeruginosa*	25(S)	24(S)	(R)	25(S)	15(R)	(R)	23(R)	(R)	(R)	30(S)
	4.	*Staphylococcus* spp.	28(S)	25(S)	30(S)	25(S)	32(S)	24(S)	30(S)	(R)	32(S)	35(S)
	5.	*Enterobacter aerogenes*	18(S)	25(S)	28(S)	26(S)	28(S)	24(S)	20(R)	(R)	26(S)	28(S)
	6.	*Proteus mirabilis*	27(S)	(R)	20(S)	20(S)	(R)	(R)	15(R)	(R)	(R)	(R)
	7.	*Salmonella choleraesuis*	12(R)	18(S)	23(S)	20(S)	12(R)	(R)	13(R)	(R)	(R)	24(S)
	8.	*Pseudomonas aeruginosa*	(R)	(R)	(R)	27(S)	(R)	(R)	(R)	(R)	(R)	14(R)
Fast Food Shops	9.	*E.coli*	12(R)	25(S)	(R)	20(S)	10(R)	12(S)	20(R)	16(I)	23(S)	24(S)
	10.	*E.coli*	15(I)	18(S)	(R)	20(S)	25(S)	22(S)	18(R)	20(S)	25(S)	25(S)
	11.	*Salmonella spp*	12(R)	20(S)	17(R)	15(S)	10(R)	10(R)	23(R)	(R)	17(I)	22(S)
	12.	*Proteus mirabilis*	30(S)	30(S)	25(S)	25(S)	28(S)	20(S)	24(I)	18(S)	26(S)	25(S)
	13.	*E.coli*	(R)	12(R)	18(S)	14(I)	15(R)	(R)	12(R)	(R)	(R)	26(S)
	14.	*Proteus mirabilis*	(R)	14(R)	17	18(S)	14(R)	(R)	18(R)	(R)	(R)	25(S)
	15.	*Klebsiella pneumoniae*	(R)	18(S)	8(R)	20(S)	14(R)	12(S)	18(R)	(R)	10(I)	13(R)
	16.	*Klebsiella pneumoniae*	(R)	29(S)	35(S)	41(S)	14(R)	9(R)	30(S)	(R)	(R)	26(S)
Canteen (Academic institution)	17.	*Corynebacterium Xerosis*	13(R)	11(R)	11(R)	19(S)	6 (R)	18(S)	10(R)	(R)	13(I)	24(S)
	18.	*E.coli*	33(S)	(R)	28(S)	23(S)	(R)	(R)	(R)	23(S)	35(S)	38(S)
	19.	*Enterobacter aerogenes*	15(I)	18(S)	(R)	20(S)	11(R)	23(S)	24(I)	(R)	24(S)	12(R)
	20.	*Klebsiella pneumonia*	15(I)	17(S)	20(S)	19(S)	7(R)	(R)	14(R)	(R)	(R)	30(S)
	21.	*Klebsiella pneumoniae*	(R)	29(S)	11(R)	30(S)	11(R)	(R)	28(S)	(R)	(R)	19(S)
	22.	*Klebsiella oxytoca*	(R)	28(S)	13(R)	19(S)	(R)	16(S)	28(S)	(R)	16(I)	22(S)
	23.	*Klebsiella oxytoca*	(R)	25(S)	17(R)	15(S)	(R)	14(S)	27(I)	6 (R)	16(I)	19(S)
	24.	*Enterobacter aerogenes*	(R)	20(S)	11(R)	17(S)	18 (I)	8(R)	20(R)	(R)	11(I)	22(S)
	25.	*Klebsiella pneumoniae*	15(I)	25(S)	15(R)	20(S)	29(S)	24(S)	25(I)	(R)	13(I)	27(S)
	26.	*E.coli*	15(I)	29(S)	(R)	20(S)	14(R)	14(S)	16(R)	13(R)	29(S)	12(R)
Canteen (Hospitals)	27.	*Klebsiella pneumoniae*	(R)	22(S)	9(R)	15(S)	(R)	11(R)	28(S)	(R)	(R)	13(R)
	28.	*Staphylococcus spp.*	(R)	21(S)	9(R)	16(S)	18 (I)	(R)	27(I)	(R)	(R)	19(S)
	29.	*Klebsiella pneumoniae*	(R)	22(S)	8(R)	16(S)	(R)	11(R)	29(S)	7(R)	(R)	19(S)
	30.	*Staphylococcus spp.*	(R)	14(R)	(R)	12(R)	(R)	9(R)	11(R)	(R)	(R)	11(R)
	31.	*Klebsiella pneumoniae*	(R)	(R)	9(R)	17(S)	12 (I)	(R)	12(R)	(R)	(R)	27(S)
	32.	*Klebsiella pneumoniae*	(R)	(R)	13(R)	11(R)	6(R)	(R)	14(R)	(R)	(R)	19(S)
	33.	*Proteus mirabilis*	(R)	24(S)	24(S)	20(S)	17 (I)	(R)	12(R)	(R)	(R)	26(S)
	34.	*Proteus mirabilis*	(R)	(R)	22(S)	17(S)	11(R)	(R)	14(R)	(R)	(R)	24(S)

*R=Resistant, S= Sensitive/Susceptible, I= Intermediate

Corynebacterium xerosis and *Klebsiella oxytoca* was found only in sample 01, 03 and 02, 03 respectively from academic canteens. *Staphylococcus aureus*, *Pseudomonas aerugenosa* and *Alcaligenes fecalis* were the most predominant bacteria found in most of the samples. *Salmonella cholerasuis* (sample 5 from fast food shop) and *Salmonella* spp. (sample 04 from local restaurant) was found to be present on one sample each. *Escherichia coli* was mostly found to be present in local restaurants and canteens from academic sector. *Klebsiella pneumonia* was prevalent in hospital canteens (sample 01,03,04), local restaurants (sample 04,05), academic canteens (sample 01,02,03).

Isolate 7 & 8 was resistant to vancomycin and isolate 6 and 8 was resistant to cotrimoxazole. All of these isolates were collected from tabletops of local restaurants (Table 3). Isolate 8 was resistant to all antibiotics except gentamicin. Cefuroxime showed 100% resistance and all isolates except isolate 4 were resistant to ceftriaxone.

Vancomycin, amoxicillin, ceftriaxone, cefuroxim were the least effective to inhibit the isolates collected from fast food shops from Dhaka city (Table 3). All isolates except isolate 13 showed sensitivity against gentamicin and isolate 15 showed resistance towards tetracycline. Most of the other isolates showed greater degree of susceptibility towards cotrimoxazole and tetracycline.

Vancomycin and azithromycine were effective against isolate 18 only from the canteens of academic institutions. Gentamicin is 100% effective against all the isolates from the same sectors. Isolate 19 & 26 were resistant for tetracycline and isolate 18 & 19 were susceptible for cefoxitin (Table 3).

Isolates collected from the hospital canteens showed to be completely resistant towards vancomycin, cefradine, cefuroxime and cefoxitin. Amoxicillin showed both intermediate and resistance result for all the same isolates from hospital canteen. Sensitivity was found for cotrimoxazole and gentamicin (isolate 27,2,29,33), azithromycin (isolate 34,3), ceftriaxone (isolate 27,29), tetracycline (isolate 2,29,31,32,33,34) (Table 3).

4. Discussion

A significant number of people suffer from food poisoning and other diseases starting upon the consumption of contaminated food. Many pathogenic bacteria can get into the food chain by various means. Direct entry of microbes from the food handling surface or the tabletops from the area where people generally eat on is one of the major sites from where the microbes find their way into the food. So the tabletops in all food serving areas like canteens, restaurants and other food serving shops must be properly maintained to avoid the accumulation of high number of such bacteria. Poor personal hygiene of the workers or the food handler, unsanitized towels for cleaning, cross contamination from other contaminated equipments, contaminated eating utensils kept on the table all contribute to the buildup of pathogenic microbes on the tabletops (10, 40- 44). Tabletops made of wood are more prone to accumulation of nutrients spilled from the food items on the table and is often difficult to clean. Avoidance of vigorous cleaning with proper disinfectants might increase the accumulation of biofilm formation resulting in continuous spread of infection. The spreading is not only aided by hands but also with the clothes used for cleaning the tabletops as well (45-46).

In current study we found *Esherichia coli, Klebsiella pneumonia, Klebsiella oxytoca, Corynebacterium xerosis, Staphylococcus aures, Salmonella* spp., *Proteus mirabilis, Enterobacter aerogenes, Pseudomonas aeruginosa* and *Alcaligenes fecalis*. They all can cause disease in human. *Staphyloccus aureus* can produce enterotoxin and cause food borne intoxication. Other staphylococcal food borne disease can cause abdominal cramp, nausea, vomiting and sometimes diarrhea (47,48). Though *Klebisella pneumoniae* is not generally recognized as foodborne pathogen, but in a study it was showed to be capable to cause nosocomial infection being foodborne (49,50). *Klebsiella oxytoca* can cause gastroenteritis (51). *Proteus mirabilis* can come from poultry origin and can being a foodborne pathogen it can cause disease in human. It can produce urease which aids in the development of urinary tract infection (52). *Pseudomonas aeruginosa* can increase cellular permeability and eventually cause cell death (53). *Corynebacterium xerosis* can cause septicemia, pleuropneumonia and arthritis in immune-compromised person (54). *Escherichia coli* is the most common pathogen causing severe gastro-enteric disease worldwide (55).

Drug resistance has become a very common and alarming scenario which has made the treatment and complete eradication of the pathogenic bacteria very difficult. Resistance properties are shared among the bacterial population and several factors aid in such dissemination of resistant traits like adaptation with the antibiotic, misuse of antibiotics, international travelling/migration. Furthermore, bacteria can resist

the effects of antibiotics by adapting new mechanisms like efflux pump to move out the antibiotics from the cell, changes in their metabolic pathways, changes in receptors, acquisition of resistant gene containing plasmid etc (56-61).

In this study, most resistant pathogenic isolates were found from the hospital; canteens. As the hospital environment is a source of pathogenic bacteria due to the over activity from the patients. The health care workers and the patients often use the hospital canteens. The workers in the canteen serve food not only in the canteen but also to the words and cabins for the patients. Thus they bring the pathogenic microbes and disseminate throughout all the areas of the hospital including the canteen area. If proper hand washing, use of appropriate sanitizing and disinfecting solutions is not strictly maintained, the incidence disseminating the foodborne infection will not be eliminated. Second most drug resistant pathogens were found from canteens of the academic institutions. A huge number of students come in the canteens. Many general people also come here for cheaper rate of the food in such canteens. As the environment is overcrowded and vigorous washing of tabletops is not possible and as a result many pathogenic microbes are disseminated and with the organic substances attached on the tabletops aid in the proliferation and biofilm formation of the adjacent microbes. Fast food shops and local restaurant showed better results than hospital canteen and canteen of academic institutions. As fast food shops generally can maintain hygienic condition as they are not overcrowded and most people visiting fast food shops or restaurant are generally in good health. Proper hygienic condition should be strictly maintained to overcome the incidents of foodborne disease.

5. Conclusion

Foodborne illness is very common especially in overcrowded and developing countries where large number of people lack the proper knowledge of sanitation. Foodborne diseases are caused by pathogenic bacteria transmitted by food. These bacteria can get into the food from different sources. One such source is contaminated tabletops from where the bacteria can ready come in close contact with food directly or by means of our hands which carry bacteria from tabletop into the food while touching the food directly with bare hands. Moreover, the bacteria on the surfaces also come from different sources like contaminated food, unsanitized hands from the workers, contaminated water, tabletop washing clothes etc. Strict regulation for the proper personal hygiene maintenance in food processing and serving area, use of appropriate disinfectants to clean the tabletops and washing clothes, regular changing of the washing clothes, overall maintenance of cleanliness in food handling environment, punishment for not following the sanitation program in the food serving areas should be compulsory.

Conflict of interest

Authors declare to have no conflict of interest.

Acknowledgment

Authors are thankful to the Stamford University of Bangladesh for the support.

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