



Original Research Article

Evaluation of bacterial contamination of the serving plates used in various canteens of Medical Institute

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ABSTRACT

Globally there is increasing incidence of food borne illness. Various cases of food borne illness occur due to improper food handling and its consumption. Food handling includes utensils used for plating and serving play a significant role in disease transmission. The purpose of this Study was Evaluation of bacterial contamination of the serving plates used in various canteens of Medical Institute. This Prospective Analytical study was conducted in the department of Microbiology, attached to a Tertiary Care Hospitals after obtaining ethical clearance over a time in two months.

Fifty four out of 90 samples were culture positive from various sites of the serving plates by canteens. Out of 54 isolates, Gram negative bacilli (n=30) were more common than Gram positive cocci (n=24). Gram positive cocci most resistant to Ampicillin and Cefoxitin and Gram negative most resistant to Cotrimoxazole. Present study highlights the need to provide guidelines for cleanliness to prevent the food-borne illness in various canteens attached to medial institutes.

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1. Introduction

Food-borne illness is one of the major problems in developed and developing countries due to consumption of contaminated food or through failure of hygiene.

The unhygienic methods through which the food is obtained, prepared, served and consumed may play an important role in food contamination and transmission of micro-organisms like bacteria, viruses, helminthes and fungi etc. causing food-borne diseases;¹ such as cholera, salmonellosis, shigellosis, typhoid and other gastroenteritis diseases.²

It is important to note that, most microorganisms survive for more than 30 minutes on the hands and with regular hand hygiene practices it can be controlled,³ but many bacterial pathogens especially on non-living objects can survive for days to weeks, causing an exogenous source of infection in various places like canteens .

When contamination of food by a pathogen occurs in canteens, restaurants, fast-food services and cafeterias because of failure to observe proper sanitation, improper handling of foods, cross-contamination and long interval between preparation and consumption, a large number of people over a wide area will be affected.⁴ So, effective cleaning is of utmost importance because not only it removes gross contamination but also remove any residual flora that could support the survival and growth of microorganisms.⁵ As a result of inefficient and inadequate cleaning practices microorganisms may persists on utensils and work surfaces and grow in numbers and can cause food-borne infection.⁶

Various studies shows that the non living surfaces such as, biometric system, keyboards and utensils serve as a potential source of infection^{7,8} So this study emphasizes on the need for maintenance of high level of hygiene on surface of fomites like utensils or serving plates in various places like students & patients canteens.

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2. Materials and Methods

This Prospective Analytical study was conducted in the Department of Microbiology, attached to a Tertiary Care Hospital in Central India Over a time period of two months after obtaining Ethical Clearance. A Total of 90 samples were taken from various sites of the serving plates used by Patients' canteen (30 samples), students' canteens (Girls hostel (30 samples) & Boys hostels' canteen (30 samples)) of Tertiary care hospital (Medical institute) will included in study and comprises of the study units.

2.1. Collection of samples

Samples will be collected using a sterile cotton swab moistened with Sterile Distilled Water from various sites of the serving plates used by canteen of a Medical institute.

All the specimens will collected and transported immediately to the Microbiology laboratory for further processing. After the collection of sample, all samples will be inoculated on Blood agar and MacConkey agar (Hi Media Pvt. Ltd, Mumbai, India) & incubated at 37 °C for 18-24 hours & prepare direct smear from cotton swab and Gram staining for primary identification of isolates.

After 24 hours of incubation, the colonies will examined under magnifying lens and identified using the standard microbiological procedures like colony morphology, Gram staining and biochemical reactions as described in Practical Microbiology of Mackie & McCartney 14th volume.⁹Antibiotics sensitivity pattern of the identified organism was done according to CLSI guidelines.

3. Result & Observation

A Total of 90 (serving plates) samples were taken from various sites of the serving plates by different canteens of a Tertiary Care Hospital, Over a time period of 2 months.

Study population were taken from 3 Groups that are:

Group I: (Patients' canteen), Group II: (Girls hostels' canteen) and Group III: (Boys hostels' canteen). From each serving plates ,three samples were collected that are: Right and Left corners of plates, Front centre of plates and back centre of plates.

Out of 90 samples, 54 (60%) samples were culture positive. The distribution of culture positive samples from various sites of the serving plates by medical institutes' canteens is shown in. Table 1

Maximum no. of culture positive samples were from Right and Left corners of plate(26) followed by Back center of plate (19) than Front center of plate (09). Total isolated organisms were 54. Out of 54 isolates, Gram negative bacilli (n=30) were more common than Gram positive cocci (n=24). Number and percentage of isolated bacteria from various sites of the serving plates by Medical institutes' canteens are shown in. Table 2

The interpretation of results were based on the Standards for antimicrobial susceptibility Testing established by the Clinical and Laboratory Standards Institute (CLSI, 2016). Antibiotic resistance pattern of the all isolates are shown in. Table 3

4. Discussion

This prospective analytical study was conducted in Department of Microbiology in a Medical College attached to a Tertiary care hospital over a period of two months. The purpose of this study was to Evaluation of bacterial contamination of the serving plates used in various canteens of Medical Institute.

Food-borne illnesses are major cause of concern in developing as well as developed countries. In 1999-Most of the annual 1.5 billion episodes of diarrheal cases are food-borne in origin, and more than 3 million resultant deaths per year indicate the magnitude of this problem.

Unhygienic utensils and serving plates used in various canteens of medicals institutes like hostels' canteens and patients' canteen may play an important role in the pathogenesis of food-borne diseases.

This study aims to determine the presence of microbial growth in the serving plates, to isolate the pathogenic microorganisms and to determine their Antibiogram. Then provide guidelines for cleanliness mainly on hand washing to prevent the food-borne illness in various canteens attached to medical institutes.

This study isolated and identified the following bacteria from various sites of the serving plates by canteens: Staphylococcus aureus (26.67%), Escherichia coli(10%), Pseudomonas aeruginosa (7.77%), Klebsiella pneumoniae (5.55%), Shigella spp (4.44%), Salmonella typhi (4.44%) and Citrobacter spp (1.11%). In the present study, Staphylococcus aureus is found to be more prevalent. Majority of bacteria isolates were from Right and Left corners of plate (CP) and Second majority of bacterial contamination are Back center of plate (BCP) then front. Among Gram positive bacteria, Staphylococcus spp showed highest resistance to Ampicilin (58.33%) and less resistance to Erythromycin (8.33%) antibiotics. Among Gram negative bacteria Escherichia coli showed highest resistance to Chloramphenicol (33.33%) and least resistance to Cefoxitin (0.00%) antibiotics. Pseudomonas spp. showed highest resistance to Co-trimoxazole (71.42%) and less resistance to other antibiotics, Klebsiella pneumonia showed highest resistance to Ampicillin(80%) and less resistance to other antibiotics whereas Shigella spp. and Salmonella typhi showed the 25% resistance to following antibiotics i.e., Gentamicin, Cotrimoxazole, Ciprofloxacin, Cefoxitine however Citrobacter spp showed resistance to Chloramphenicol (100%) and Ampicilin (100%) (Table 3). The antibiotic susceptibility patterns showed that all bacterial isolates were resistant to at least one antibiotic. The

Table 1: Culture positive samples & isolated bacteria from various sites of the serving plates by Medical institutes' canteens

Sample site (Surface areas)	No. of samples collected	Culture positive samples		
		GPC	GNB	Total
Right and Left corners of plate(CP)	30	12	14	26
Front center of plate(FCP)	30	04	05	09
Back center of plate(BCP)	30	08	11	19
Total	90			54

CP = Right and Left corners of plate, FCP= Front center of plate, BCP= Back center of plate

Table 2: Number and percentage of isolated bacteria from various sites of the serving plates by Medical institutes' canteens

Isolated Organisms	No. of isolated bacteria	Percentage (%)
Gram-positive		
Staphylococcus aureus	24	44.44%
Subtotal	24	
Gram-negative		
Citrobacter spp	01	1.85%
Pseudomonas aeruginosa	07	12.97%
Escherichia coli	09	16.67%
Klebsiella pneumonia	05	9.27%
Salmonella typhi	04	7.4%
Shigella spp.	04	7.4%
Subtotal	30	
Total isolate	54	

Table 3: Antibiotic resistance patterns of isolated bacteria from various sites of the serving plates by Medical institutes' canteens

Bacterial Isolates	AMP%	E%	CD%	GEN%	COT%	CIP%	CX%	C%	
Gram positive									
Staphylococcus aureus	24	14(58%)	02(8%)	16(66%)	02(8%)	01(4%)	02(8%)	13(54%)	03(12%)
Gram negative									
Citrobacter spp	01	01(100%)	-	-	00(00%)	00(00%)	01(100%)	00(00%)	01(100%)
Pseudomonas aeruginosa	07	03(42%)	-	-	01(14%)	05(71%)	01(14%)	02(28%)	02(28%)
Escherichia coli	09	02(22%)	-	-	02(22%)	01(11%)	02(22%)	0(00%)	03(33%)
Klebsiella pneumoniae	05	04(80%)	-	-	0(00%)	02(40%)	02(40%)	02(40%)	01(20%)
Shigella spp.	04	0(00%)	-	-	01(25%)	01(25%)	01(25%)	01(25%)	0(00%)
Salmonella typhi	04	0(00%)	-	-	01(25%)	01(25%)	01(25%)	01(25%)	0(00%)

AMP= Ampicilline ; E=Erythromycin ; CD=Clindamycin; GEN=Gentamicin; COT=Cotrimoxazole; CIP=Ciprofloxacin; CX=Cefoxitine; C=Chloramphenicol

resistance of bacteria to commonly used antibiotics is an increasing problem worldwide and especially in developing countries

Similar study done by Nowrouzi¹⁰ et al, in 2004, results showed that about 31/5% of washed dishes was bacterial contamination and most of them were of heterotrophic bacteria and 4% were contaminated with Escherichia coli and the results are consistent with the present study in terms of contamination with heterotrophic bacteria.

Other study done by Al Buyeh et al¹¹ (2014), shows, cooking dishes was the highest contamination with a variety of heterotrophic bacteria (40%) while contamination with Escherichia coli was 8% study of Rodriguez M, et al.¹² Similar study done by Noro et al (2014)¹⁰ 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. Contrast study shows, the contamination rate of cooking dishes with coliform was 57% and Escherichia coli was 17% with study done by Soltan Dallal et al.¹³ The human hand is a major source of contamination because it may serve as a reservoir for microorganisms. The pathogen isolated in this present study are similar to micro organisms reported by Okonko et al., in 2008. Even wash the plates with unclean undrinkable water either with a very mild and cheap detergent or doesn't care to use the detergent at all leading to non-compliance with health principles during the process. The plates kept after cleaning were having food particle leftovers as well as stored in open giving way to organisms and contamination. Spoons and plates also had high levels of contamination

which may be due to methods of washing; insufficient and inappropriate washing methods such bulk washing, lack of disinfection and use of undrinkable water may also be a contributing factor shows in study by Gholammostafaei et al 2014.¹⁴ In present study, Isolation of *Staphylococcus aureus* and *Salmonella* spp was good practical impact.

Similar study done by Ibekwe et al in 2008 reported in their, It is an evidence of poor sanitary conditions and lack of inadequate portable water¹⁵ The presence of *Staphylococcus aureus* poses a threat to human health because it can lead to food poisoning or food intoxication when the food is not properly preserved or refrigerated which is more severe and persist when the organism is destroyed (www.foodsafety.gov.2016). Isolation of *Staphylococcus aureus* is an indication of poor sanitary conditions and use of dirty towels¹⁵ The organism is pathogenic and survives for longer period in water than the coliforms. *Salmonella* in the cafeteria is worrisome as it is a major cause of food borne illness (salmonellosis) and is responsible for majority of cases of illness.

5. Conclusion

The presence of these isolates suggests poor sanitary hygiene, improper food handling and general neglect of food safety procedures which should be followed in a canteen if broken may pose a health hazard to consumers.

Present study highlights the need of sensitization & training sessions regarding hand hygiene practices as well as assessment & management about adequate sanitation practices, for all canteens in Medical Institutes. Proper sanitary practices during cleaning the serving plates as well as while proper precautions like covering them with on storing them for future use. Food handlers must maintain high personal hygiene including washing of their hands, apron and hand towel. Issuing guidelines on food safety and cafeteria hygiene should be put in place with periodic supervisions to ensure adherence to the guidelines. Personal and environment hygiene should also be emphasized. Hand washing techniques and the use of alcohol base hand sanitizers or use of soap and water should also be adopted. All these measures if adopted can reduce microbial contamination to safe levels.

6. Source of Funding

None.

7. Conflict of Interest

None.

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