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Microbiological status of some street iftar items collected from chalk bazar in Dhaka city, Bangladesh

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Abstract

In Dhaka, the capital of Bangladesh and one of the most densely populated cities of the world, different categories of street foods are widely consumed by all classes of people, especially for iftar during the holy month of Ramadan. The objective of this research was to assess the microbiological quality of street iftar food items collected from a street in Chalk Bazar locality of Dhaka along with the antibiogram profile of the bacterial isolates. A total of 74 samples belong to ten different categories of street food items and 8 different types of street vended juices were collected aseptically. The bacteria were isolated by using different culture media. The antibiotic susceptibility of the bacterial isolates was determined by the disc diffusion method. In case of street food total viable bacteria (on average of 6 $\log_{10}$ CFU/g). On the other hand, an extended number of total viable bacteria were encountered in all juices samples which also on an average of 6 $\log_{10}$ CFU/mL. Fungi, *Pseudomonas* spp. and *Staphylococcus* spp. were found in the majority of the samples irrespective of the categories. Few samples were contaminated with *Escherichia coli* and *Klebsiella* spp. Most of the cultivated bacterial strains exhibited resistance against commonly used antibiotics, while several isolates were noted to be multi-drug resistant. The present study revealed a huge array of microbial load which indicates a high risk to public health. Presence of antibiotic-resistant bacteria heightened the risk by many folds and urges the need for frequent surveillance.

1. Introduction

Foodborne outbreaks encompass a wide range of illnesses from bacterial, viral, fungal, and different chemical contamination of food (Khare *et al*., 2018). Different pathogens are responsible for a broad spectrum of infections and intoxications such as enteric complications, fever, colorectal ulcer along with hemorrhage, abdomen cramping infection in the bloodstream, meningitis, kidney failure, paralysis, and miscarriage. These infections vigorously occurred worldwide due to the use of non-edible food colour, impurified oil, and unhygienic water for preparing these foods (Khan *et al.,* 2014).

Different types of street foods (ready to eat) and beverages are prepared, and sold by vendors and hawkers, especially in urban population's worldwide (Campos *et al*., 2015). Changing lifestyles, women's participation in the outside jobs, and family structures are encouraging people to consume ready-to-eat food in contrast to homemade food. In Bangladesh, lots of street foods are very much popular among the Bangladeshi community, especially during the month of Ramadan. The commonly consumed iftar items are Chola, Peaju, Beguni, Jilapi, Khejur, and different types of fresh juice which are also found throughout the year in different street areas of Dhaka and other cities of Bangladesh. The proper microbiological and chemical quality of such food needs to maintain strictly because people break their fast with these food items. It has been observed previously that food becomes contaminated during processing, handling, storage, and transporting (Sarker *et al*., 2013; Manguiat and Fang, 2013; Senjuti *et al*., 2014). Moreover, the quality of fruit juices could be affected by the contaminated ingredients used in juice preparation (Lucky *et al*., 2017). Contaminated water and filthy handling are some of the major factors which cause foodborne intoxication and infections (Noor *et al*., 2016; Nur *et al*., 2017). Around the world, especially in developing countries, foodborne diseases, outbreaks, and severe health risks have been reported which are linked with consuming street foods (Sultana *et al*., 2014). In Bangladesh, for the attraction of the consumers, most of

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the street food vendors display iftar items openly in an improper storage condition, and without the appropriate protective packs (Islam *et al*., 2014; Khairuzzaman *et al*., 2014). A huge range of microbial contaminations was reported from street food in densely populated countries because of unhygienic circumstances (Das *et al.*, 2012).

Previously, our research group has conducted various microbiological analyses on different food samples and fruit juices which boost our interest to conduct current research (Lucky *et al*., 2017). Moreover, considering the consumer demand and fascination on the street iftar items, the current study aimed to point out the occurrence of pathogenic microorganisms in street foods, specifically the iftar items, and also focused on multi-drug resistant bacteria that might be spreading over the population through contaminated ready-to-eat foods.

2. Materials and methods

2.1 Study area, sampling, and sample processing

Total ten different categories (n = 50) of iftar food items commonly denoted by their local name (Chola, Peaju, Beguni, Chicken chop, Alur chop, Beefkabab, Halim, Doi bora, Jilapi, and Khejur), and eight categories of street vended juice samples (n = 24) (Sugarcane juice, Papaya juice, Orange juice, Lemon juice, Yogurt, Cashewnut milk, Mango juice, and Mixed fruit juice) were purchased from local vendors of Chalk Bazar area of Dhaka city from May 2019 to June 2019 during the holy month of Ramadan. The iftar items and liquid fresh juice samples were collected in zip-lock bags, and in sterile bottles, respectively, and were transported immediately to the laboratory using the standard protocol (Akter *et al.*, 2019). Iftar items were chopped into small pieces, and 20 g of each solid sample was blended with 180 mL of normal saline. In the case of juice samples, 1 mL of each sample was transferred with a sterile pipette to the tube containing 9 mL of normal saline. All the homogenized samples were diluted up to 10^{-4} by following the standard methods of ten-fold dilutions (Nur, Gosh, and Mrityunjoy *et al*., 2020; Islam *et al.,* 2020).

2.2 Microbiological analysis

An aliquot of 0.1 mL from the dilution 10^{-3} of each sample was spread onto nutrient agar (NA) plate for enumerating the total viable bacteria (TVB) and on Sabouraud Dextrose agar (SDA) plate for the estimation of fungal load (Nur, Gosh and Mrityunjoy, 2020). For the isolation of *Escherichia coli* and *Klebsiella* spp., 0.1 mL of suspension from the dilution 10^{-2} were spread on MacConkey agar. For the assessment of *Staphylococcus aureus, Pseudomonas* spp., *Salmonella* spp., *Shigella* spp. and *Vibrio* spp., 0.1 mL of each sample was spread onto Mannitol Salt Agar, and Cetrimide agar Xylose Lysine Deoxycholate agar and Thiosulfate Citrate Bile Salt Sucrose agar plates, respectively. Plates were incubated for 24-48 hours for bacterial and fungal enumerations at 37°C and 25°C, respectively. All the experiments were triplicate, and each data point represents the mean ± SD count (Nur, Hossain and Mrityunjoy, 2020).

2.3 Antibiotic susceptibility test of the isolates

Antibiotic susceptibility of the bacterial isolates was examined by the disc diffusion assay on Mueller-Hinton agar (MHA) against the commonly used antibiotics following the standard protocol (Nur, Gosh and Mrityunjoy, 2020). Some common antibiotic discs such as Penicillin G (10 µg), Gentamicin (10 µg), Oxacillin (1 µg) Amoxicillin (30 µg), Imipenem (30 µg), Erythromycin (15 µg), Tetracycline (30 µg), Ciprofloxacin (5 µg), Azithromycin (15 µg), Nalidixic acid (30 µg) and Ampicillin (10 µg) were aseptically placed over the surface of Mueller-Hinton agar plates which was previously lawn with the bacterial suspensions with standard turbidity (compared to that of the McFarland standard of 0.5) (Nur, Hossain and Mrityunjoy, 2020).

3. Results

Accelerated quantities of contaminating microorganisms were recovered in the street iftar food samples. All the samples harboured total viable bacteria in a range of 6.12±0.17 $\log_{10}$ CFU/g to 6.49±0.12 $\log_{10}$ CFU/g, while fungi were present in a range of 5.38±0.18 $\log_{10}$CFU/g to 6.69±0.32 $\log_{10}$ CFU/g in the majority of the samples (Table 1). All the street iftar food items were predominantly contaminated with *Pseudomonas* spp. *Staphylococcus* spp. were not encountered in four iftar food samples. A half proportion of the samples were found to be contaminated each with *E. coli* and *Klebsiella* spp. *Salmonella* spp., contamination was found only in Peaju and Alur chop samples (Table 1). Nevertheless, *Vibrio* spp. was absent in all the tested samples. Microbial contamination was found in all the juice samples (Table 2). The highest and the lowest load of total viable bacteria were found in a range of 6.42±0.29 $\log_{10}$ CFU/mL to 6.39±0.23 $\log_{10}$ CFU/mL, while all the samples contained viable bacteria, three samples were devoid of fungal growth. *Staphylococcus* spp. was encountered predominately in all the samples. *Klebsiella* spp. and *Pseudomonas* spp. were found in the majority of the samples, while a few samples exhibited the growth of *E. coli*. Only papaya juice samples had contamination with *Salmonella* spp. All the samples

Table 1. Microbial counts (log_{10} CFU/g) of street-vended Iftar food items.

Sample	Bacterial and Fungal load (log_{10} CFU/g ±SD)							
	TVB	Fungi	*E. coli*	*Klebsiella* spp.	*Pseudomonas* spp.	*Staphylococcus* spp.	*Vibrio* spp.	*Salmonella* spp.
Chola	6.35±0.13	NG	NG	4.59±0.22	5.52±0.18	4.75±0.12	NG	NG
Peaju	6.12±0.12	NG	NG	NG	5.64±0.17	NG	NG	4.5±0.26
Beguni	6.4±0.06	NG	NG	4.49±0.39	5.55±0.35	5.45±0.29	NG	NG
Chicken chop	6.17±0.11	6.3±0.26	4.79±0.13	NG	5.41±0.20	NG	NG	NG
Alur chop	6.36±0.24	5.35±0.15	4.72±0.16	NG	5.57±0.20	4.58±0.22	NG	4.42±0.10
Beef kabab	6.34±0.16	6.33±0.14	5.43±0.19	NG	5.57±0.17	NG	NG	NG
Halim	6.49±0.17	6.26±0.57	4.59±0.33	NG	5.47±0.40	NG	NG	NG
Doi bora	6.37±0.09	6.43±0.24	5.47±0.25	5.13±0.03	5.55±0.29	6.47±0.25	NG	NG
Jilapi	6.37±0.09	6.69±0.32	NG	5.4±0.20	5.47±0.32	5.45±0.27	NG	NG
Khuejur	6.16±0.16	5.38±0.18	NG	5.32±0.17	5.65±0.15	5.75±0.19	NG	NG

NG = No growth. Each data point represents mean ± SD of triplicates (n = 50)

Table 2. Microbial counts (log_{10} CFU/g) of street-vended juice samples.

Sample	Bacterial and Fungal load (log_{10} CFU/g ±SD)							
	TVB	Fungi	*E. coli*	*Klebsiella* spp.	*Pseudomonas* spp.	*Staphylococcus* spp.	*Vibrio* spp.	*Salmonella* spp.
Sugarcane juice	6.36±0.19	5.53±0.19	3.74±0.29	3.64±0.22	4.29 ±0.18	4.43±0.24	NG	NG
Papaya juice	6.39±0.23	NG	3.65±0.28	4.19± 0.18	3.67 ±0.25	4.21±0.25	NG	4.23±0.15
Orange juice	6.29±0.16	NG	NG	NG	NG	4.37±0.29	NG	NG
Lemon juice	6.42±0.29	NG	NG	NG	3.5 ±0.26	4.23±0.15	NG	NG
Yogurt	6.33±0.20	NG	NG	NG	NG	3.49±0.28	NG	NG
Cashewnut milk	6.26±0.18	5.33±0.14	NG	4.21±0.25	4.18±0.10	3.37± 0.29	NG	NG
Mango Juice	6.23±0.19	5.25±0.24	4.39±0.27	4.3±0.26	3.5±0.26	4.36±0.26	NG	NG
Mixed-fruit juice	6.36±0.29	5.69±0.32	NG	4.35±0.29	4.25±0.15	4.28±0.20	NG	NG

NG = No growth. Each data point represents mean ± SD of triplicates (n = 24)

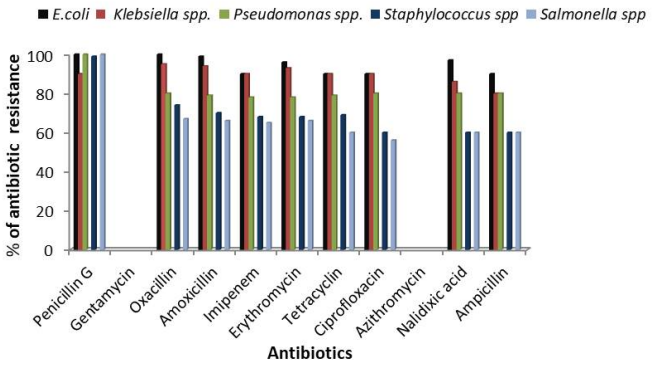

Figure 1. Resistance pattern of the isolates against commonly used antibiotics

were free from the growth of *Vibrio* spp. (Table 2). A total of five isolates such as *Klebsiella* spp., *Staphylococcus* spp., *Pseudomonas* spp., *Salmonella* spp. and *E. coli* from the iftar food and juice samples were subjected to antibiotic susceptibility assay. The results of this assay revealed that all the isolates were resistant to multiple drugs (Figure 1). Only Gentamicin and Azithromycin were found to inhibit the growth of all the tested isolates successfully. On the other hand, resistance against Penicillin G was noticed in almost all the tested bacterial isolates. *E. coli, Klebsiella* spp. and *Pseudomonas* spp. showed a relatively higher rate of resistance against Oxacillin, Amoxicillin, Imipenem, Erythromycin, Tetracycline, Ciprofloxacin, Nalidixic acid, and Ampicillin (Figure 1).

4. Discussion

The contamination of street foods with pathogenic microorganisms has been recorded and several outbreaks of diseases have been found due to the consumption of contaminated street foods (Sarker *et al*., 2013). In developing countries, *Bacillus cereus, Clostridium perfringens, Staphylococcus aureus,* and *Salmonella* spp. are frequently found in street foods (Islam *et al.,* 2020; Rahman *et al.,* 2011). In the present study, the viable bacterial load is more than 6 log_{10} CFU/g in the street iftar food and juice samples exceeded the standard acceptable microbiological limit (<5 log_{10} CFU/g or mL). The legislative bodies should strictly follow the recommended microbial limit for the ready-to-eat street food items. The numbers of *E. coli* should not exceed more than 10^2 CFU/g of the food items (FSANZ, 2001). Street food items could be unacceptable if the presence

of *Salmonella* spp., *Shigella* spp., *Bacillus* spp., *Clostridium perfringens*, *Staphylococcus* spp., *Listeria monocytogenes,* and *Vibrio parahaemolyticus* exceed the limit ($<10^4$ CFU/g) (FSANZ, 2001). The presence of specific bacterial isolates in the current study crossed the acceptable limit as well. The findings of the current study were in agreement with our earlier studies that recorded huge contamination of *Staphylococci, Bacillus* spp., fungi, total coliform, fecal coliforms, *Klebsiella, Enterobacter,* and *Escherichia coli* in street foods and fruit juices (Mamun *et al*., 2013; Noor *et al*., 2013; Akter *et al.*, 2019). In our country, the casual and non-professional attitude of street food sellers increases the possibilities of microbial propagations from the environment. In addition, the current study also revealed the alarming presence of multidrug-resistant bacteria in the street iftar items. Previously multi-drug resistance *Staphylococcus* spp*., Salmonella* spp*.*, *Klebsiella* spp*., Shigella* spp. and enteropathogenic *Escherichia coli* were found in street food samples (Khalif *et al*., 2018).

5. Conclusion

Our present study revealed the considerable presence of drug-resistant microorganisms in the street iftar items which portray a huge risk to the health of the consumers. Unhygienic processing and lack of awareness among the public and vendors are responsible for microbial contamination in street foods which may result in foodborne disease outbreaks. The findings of the current study urge the need to form and implementing the food safety laws as well as encouraging public awareness programs by the proper regulatory bodies, and standard guidelines must be followed during preparation, storage, and vending the foods to ensure the health security of the consumer.

Conflict of interest

The authors declare no conflict of interest.

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