

# Occurrence of pathogenic microorganisms in dessert items collected from Dhaka city

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**Due to delicious taste and readily availability, desserts are one of the most popular foods in Dhaka city. High amount of carbohydrate and protein in dessert items make them more susceptible to proliferation of microbial growth. Present study depicted a complete microbiological profile of some popular desserts such as, sweet, pastry, ice cream, pudding, falooda, yogurt and custard available in different food shop at Dhaka city, Bangladesh. All the samples were found to be contaminated with heterotrophic bacteria as well as fungi within the range of  $10^3$  to  $10^6$  cfu/g. In case of specific microflora, the growth of *Staphylococcus* spp., *Klebsiella* spp. and *Pseudomonas* spp. were observed in most of the samples indicates the poor quality of these products. Bioburdens of *E. coli* in sweet, pudding and yogurt were found in the range of  $1.2 \times 10^2$  to  $2.7 \times 10^3$  cfu/g. *Salmonella* spp., *Shigella* spp. and *Vibrio* spp. could not be isolated from any of the samples. Current study indicates that hygienic conditions should be maintained during preparation, packaging and retailing of dessert items in order to reduce the load of contamination in ready to eat foods which will ensure good health of consumers.**

**Keywords:** Dessert, Microbiological analysis, Consumer safety

## INTRODUCTION

Desserts are one of the most common ready to eat food worldwide, most of them are milk based and others are made by mixing starch, sugar, salt, citric acid, gelatin and flavoring agents (1, 2). In Bangladesh, desserts like falooda, pudding and custard are available in different restaurants. Moreover, some items like cakes, ice creams are sold commercially. They are popular because they supply protein and energy instantly (3). Along with high nutritional value, contaminated desserts may cause serious food borne illness to consumers (4-7).

Many studies revealed that contaminated milk and milk based products are responsible for outbreaks of food borne disease (8-12). Milk based food like desserts can serve as an ideal growth medium for bacteria. Growth of pathogenic bacteria in these foods will be detrimental to health of children and immunocompromised persons when they consume such products in sufficient amount. Faulty pasteurized milk and contaminated raw materials are possible ways by which pathogens can get entry to final product (13).

In case of pastry or cake raw eggs are major source of contamination of pathogenic bacteria like *Salmonella* spp. (14-15). Some studies claim that outbreak of salmonellosis is associated with slightly cooked desserts using raw egg (14-16). Similarly, others pathogenic microbes can be get entry from different ingredients like custard powder, cream or sauces, nuts etc. (17). Higher moisture content, neutral pH and rich amount of nutrient make dessert excellent growth medium for many kinds of microorganisms (18). However, the microbial loads of food products

are influenced by a number of factors such as the storage condition, raw materials used, processing environment, sanitary conditions, unhygienic handling packaging and storage (19).

Yeast and mold are the most common contaminants along with pathogenic bacteria like *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus*, *Campylobacter jejuni*, *Salmonella* species, *Listeria monocytogenes* and some other pathogens (20). Presence of coliforms and *S. aureus* in desserts may be due to defective pasteurization, contaminated water or poor sanitary practices of handlers (1-2). *L. monocytogenes*, is another most common food borne illness causing microorganisms, may be associated with the consumption of pasteurized milk, cheese made from unpasteurized milk and other dairy based products (21-22).

Nearly 30 million foodborne illnesses are encountered every year in Bangladesh (32). To ensure public health safety, safe foods should be ensured for all consumers (17, 23). The aim of this research was to investigate the presence of microorganisms in common desserts available in Dhaka city.

## MATERIALS AND METHODS

**Study area, sampling and sample processing.** Total sixteen desserts of different categories (sweet, pastry, ice cream, pudding, falooda, yogurt and custard) from two different locations (Baily Road and Mouchak) of Dhaka city were randomly collected following standard protocol (24). All the samples were quickly transported to the laboratory. Prior to microbiological assay, 10 g of each sample was homogenized with 90 ml of normal saline in 9:1 ratio and serially diluted to  $10^{-5}$  (4-7, 25).

**Microbiological analysis of each sample.** A volume of 0.1 ml from each sample suspension was spread onto nutrient agar (NA) and incubated at 37°C for 24 h for enumerating total viable bacteria (TVB). Sabouraud dextrose agar (SDA) (HiMedia Laboratories, Mumbai, India) was inoculated in the similar manner followed by incubation at 25°C for 48 h for the isolation of fungi (25).

**Isolation of pathogenic microorganisms.** For the isolation of coliform

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bacteria (*Escherichia coli*, *Klebsiella* spp.), 0.1 ml of the each sample suspension was spread over MacConkey (HiMedia Laboratories, Mumbai, India) agar and incubated at 37°C for 24 h (4-7, 25).

0.1 ml of each sample suspension was spread on Mannitol salt agar (MSA) (Oxoid Ltd., Basingstoke, Hampshire, England) for the estimation of *Staphylococcus aureus* and the plates were incubated at 37°C for 24 h. For the estimation of starch hydrolyzing bacteria (*Bacillus* spp.), 0.1 ml of each sample suspension was spread onto Starch agar (SA) (HiMedia Laboratories, Mumbai, India) and incubated at 37°C for 24 h. For the enumeration of *Pseudomonas* spp., 0.1 ml of each sample suspension was spread onto *Pseudomonas* agar (HiMedia Laboratories, Mumbai, India) and plates were incubated at 37°C for 24 h. All the isolates were confirmed by biochemical examinations (Table 2).

**Enrichment of *Salmonella* spp., *Shigella* spp. and *Vibrio* spp.** Enrichment was performed for *Salmonella* spp. and *Shigella* spp. in Selenite Cystine Broth (SCB). 1.0 ml of homogenized sample suspension was transferred to SCB followed by incubation at 37°C for 4 h and serial dilutions were made upto 10<sup>-3</sup>. From 10<sup>-3</sup> dilution, 0.1 ml was spread onto *Salmonella Shigella* (SS) agar (HiMedia Laboratories, Mumbai, India) followed by the incubation at 37°C for 24 h. In case of *Vibrio* spp., 1.0 ml of the homogenized sample suspension was transferred to alkaline peptone water (APW) and after incubated at 37°C for 4 h, samples were serially diluted to 10<sup>-3</sup>. Then, 0.1 ml of sample was spread onto Thiosulfate Citrate Bile Salts Sucrose (TCBS) agar (HiMedia Laboratories, Mumbai, India) followed by the incubation at 37°C for 24 h (4-7, 25).

## RESULTS

Different studies on food products claim that processed foods are one of the most important portions of energy intake but contaminated food are serious threat to public health (26-28). So before declaring food as safe to consume, food should be compared with different food standard guidelines. In case of ready to eat foods, the maximum permissible limits for Total Plate Count (TPC) is <10<sup>5</sup> cfu/g, yeast and mold is <10<sup>4</sup> cfu/g, coliform bacteria <200/g and *E. coli* should be absent (29-31).

Previously published many study on food samples claim that ready to eat foods of Bangladesh were

contaminated with different microorganisms, among them *E. coli* was predominantly present in most of the cases (35). Present study found that, all the samples were contaminated with heterotrophic bacteria within the range of 10<sup>4</sup> to 10<sup>6</sup> cfu/g (Table 1). Comparing this result with food standard, three out of 16 samples exceed the microbial limit and only results from six samples were found to be satisfactory (below 10<sup>5</sup> cfu/g). On the other hand, fungal load was within the range of 10<sup>2</sup> to 10<sup>4</sup> cfu/g which is under the recommended limit of fungus. Huge bacterial growth in desserts is a matter of concern as consumption of these food may lead to disease in many occasion.

In case of specific micro flora, the growth of *Staphylococcus* spp. was most predominated but *E. coli*, *Klebsiella* spp., *Bacillus* spp., and *Pseudomonas* spp. were also observed in many dessert samples. *Staphylococcus* spp. growth was found in ten samples with higher load up to 10<sup>3</sup> cfu/g. Unhygienic handling can be the possible cause of this contamination (1-3). Out of sixteen samples, five desserts mainly pudding and sweet were found to be contaminated with *E. coli* which is so alarming as it indicated the presence of others water borne pathogens. Six samples were found to be contaminated with *Klebsiella* spp. Use of contaminated water during preparation and washing are possible ways of transmission of these pathogens (33). *Pseudomonas* spp. is found in almost everywhere in the environment, but their presence in food is not acceptable (34). Six dessert samples were contaminated with *Pseudomonas* spp. (up to 10<sup>2</sup> cfu/g). Spore forming bacteria like *Bacillus* spp. were

Table 1: Microbiological profile of some popular desserts

Collection site	Sample name	TVB	Total Fungi	<i>E. coli</i>	<i>Klebsiella</i> spp.	<i>Bacillus</i> spp.	<i>Pseudomonas</i> spp.	<i>Staphylococcus</i> spp.
Baily Road	Sweet	1.7×10 <sup>6</sup>	2.7×10 <sup>3</sup>	3.7×10 <sup>3</sup>	0	0	0	2.8×10 <sup>3</sup>
	Normal Pastry	1.2×10 <sup>4</sup>	1.7×10 <sup>2</sup>	0	1.1×10 <sup>2</sup>	0	1.1×10 <sup>2</sup>	1.6×10 <sup>3</sup>
	Chocolate Pastry	2.3×10 <sup>4</sup>	2.0×10 <sup>2</sup>	0	0	0	1.8×10 <sup>2</sup>	0
	Ice cream	2.0×10 <sup>4</sup>	1.5×10 <sup>2</sup>	0	0	0	0	2.0×10 <sup>2</sup>
	Pudding	3.0×10 <sup>5</sup>	1.2×10 <sup>2</sup>	1.2×10 <sup>2</sup>	0	0	0	3.1×10 <sup>2</sup>
	Falooda	2.1×10 <sup>5</sup>	2.2×10 <sup>2</sup>	0	1.3×10 <sup>2</sup>	1.1×10 <sup>2</sup>	2.1×10 <sup>2</sup>	0
	Yoghurt	4.5×10 <sup>6</sup>	2.3×10 <sup>3</sup>	0	1.2×10 <sup>2</sup>	0	0	0
	Custard	4.1×10 <sup>5</sup>	1.9×10 <sup>2</sup>	0	2.1×10 <sup>2</sup>	0	0	2.8×10 <sup>2</sup>
Mouchak	Sweet	2.0×10 <sup>5</sup>	2.7×10 <sup>2</sup>	1.2×10 <sup>3</sup>	0	0	0	2.8×10 <sup>3</sup>
	Normal Pastry	1.8×10 <sup>3</sup>	1.7×10 <sup>2</sup>	0	0	0	1.2×10 <sup>2</sup>	1.0×10 <sup>2</sup>
	Chocolate Pastry	2.1×10 <sup>4</sup>	2.0×10 <sup>2</sup>	0	0	0	1.4×10 <sup>2</sup>	0
	Ice cream	2.4×10 <sup>4</sup>	1.5×10 <sup>3</sup>	0	0	0	0	2.0×10 <sup>2</sup>
	Pudding	3.1×10 <sup>5</sup>	1.2×10 <sup>2</sup>	1.2×10 <sup>2</sup>	0	0	0	1.9×10 <sup>2</sup>
	Falooda	3.2×10 <sup>5</sup>	2.2×10 <sup>2</sup>	0	1.3×10 <sup>2</sup>	1.1×10 <sup>2</sup>	1.7×10 <sup>2</sup>	0
	Yoghurt	2.9×10 <sup>6</sup>	2.1×10 <sup>4</sup>	1.2×10 <sup>2</sup>	0	0	0	0
	Custard	3.0×10 <sup>5</sup>	2.0×10 <sup>2</sup>	0	1.1×10 <sup>2</sup>	1.3×10 <sup>2</sup>	0	2.2×10 <sup>2</sup>

\**Salmonella* spp., *Shigella* spp. and *Vibrio* spp. were totally absent.

**Microbial limit.** Total plate count (TPC) or Total Viable Bacteria (TVB) is <10<sup>5</sup> cfu/g, yeast and mold are <10<sup>4</sup> cfu/g, coliform bacteria <200/g, and *E. coli* should be absent.

Tables 2: Confirmative biochemical tests for the isolates

Assumed Organism	TSI			H <sub>2</sub> S reaction	Indole test	MR test	VP test	Citrate test	Motility	Oxidase test
	slant	butt	gas							
<i>E. coli</i>	Y	Y	+	-	+	+	-	-	+	-
<i>Klebsiella</i> spp.	Y	Y	-	-	-	-	-	-	-	+
<i>Pseudomonas</i> spp.	R	R	-	-	-	-	-	+	-	-
<i>Staphylococcus</i> spp.	Y	R	+	+	-	+	-	+	+	-

TSI = Triple Sugar Iron Test; Y = Yellow (Acid); R = Red (Alkaline); MR = Methyl Red; VP = Voges-Proskauer

also encountered in three samples with the load of  $10^2$  cfu/g.

Huge amount of microbes in ready to eat food is not acceptable as they are consumed without any further processing and current condition may be due to lack of knowledge about hygienic in consumers, use of contaminated equipment and dirty processing area. In present study, commercially available foods (sweet, pastry, ice cream) containing less microbial load than handmade food (sweet, pudding, falooda, yogurt and custard), indicates the unhygienic handling or poor environmental conditions.

### CONCLUSION

Cross-contamination of foods is one of the major concerns in the food industry, and if microorganisms are not completely removed from food-contact surfaces, they may form biofilms and also increase the bio-transfer potential. This study demonstrates the presence of some pathogens including *Staphylococcus* spp. and *E. coli* in dessert items. Therefore, from the public health point of view, these foods offer serious threat for the consumers. Presence of contaminating microorganisms indicates the poor hygienic conditions during the manufacturing, storage and sales process of these traditional foods. Manufacturing procedures within the scope of the HACCP, appropriate hygienic measures to avoid processing and post processing cross contamination and the use of properly pasteurized milk are critical for controlling these pathogens in dessert items.

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