

# Food safety in Bangladesh: A microbiological perspective

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**Bangladesh has long been facing problems associated with microbiological contamination of varieties foods due to the lack of awareness on hygiene followed by the defective legislative action. Manifestation of microbial prevalence in different foods bring about vital information on food safety as well as may envisage on the further intoxication caused by the prevailing microorganisms. Although a few extent of food inspection is apparently in some of the governmental regulatory bodies; however, the mass population is still suffering from a number of food borne illness. Present review partially focused on the microbiological regulation of the foods in Bangladesh and discussed the possible remedies for the maintenance of food safety.**

**Key words:** Food safety; Food borne microorganisms; Food borne illness

## FOODBORNE MICROORGANISMS AND FOODBORNE ILLNESS

Foodborne illness is also widely known as "foodborne disease," "foodborne infection," or "food poisoning" (1). While most of the foodborne illnesses are acute, sometimes they may lead to more serious complications including haemorrhagic colitis, bloodstream infection, meningitis, joint infection, kidney failure, paralysis, miscarriage, and other complications (2-6). Indeed, the elemental prerequisite for leading a sound life depends on the sufficient reserve of quality food and water that are well controlled by various legislative bodies (1, 7-10). However, pathogenic microorganisms together with fungal species, parasites, viruses, toxins, trace elements have been frequently reported to gain access into varieties of foods triggering the foodborne illnesses or infections (8, 11-22). As reported by a number of researches, foods are usually contaminated with microorganisms during the stages of harvesting, processing, storage, shipping, food preparation, kitchen utensils including the cutting boards or other surfaces, cross-contamination, etc. (18, 22-25).

The control of food contamination by microorganisms, or in other words, the practice of food protection largely depends on the types and modes of food hazards, the genetic makeup of the food contaminating bacteria or fungi, knowledge on toxins associated with food deterioration, and finally the urge

of practical implementation of food protection means both by the governmental or non-governmental organizations (NGOs) along with adequate research facilities on food microbiology (Figure 1).

Foodborne complications are of global public health concerns. While in the poor countries where hygiene maintenance is the principal reason of dissemination of diseases, surprisingly in the developed countries like United States, the impact of food borne diseases may also result in significant morbidity and mortality (1). However, certain regulatory bodies like the Center for Science in the Public Interest (CSPI), Centers for Disease Control and Prevention (CDC), FoodNet, etc., working with the food safety are actively engaged to control and monitor the food associated problems in the developed countries, whereas in the developing countries like in Bangladesh, such regulation is not that prominent to ensure the local health safety (Figure 2).

## FOOD SAFETY AND FOODBORNE ILLNESS: GLOBAL PERSPECTIVE

In order to ensure a healthy and safe dissemination of food around the world, in 1962, the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) jointly created the Codex Alimentarius Commission (CAC). Since then the Codex system has developed an array of general and commodity-specific standards, guidelines, codes of practice and other suggestions to enhance the global food safety. Indeed the food borne illness as well as the food safety is a mounting issue over the communities (26). According to the CAC, an international food standard setting authority developed

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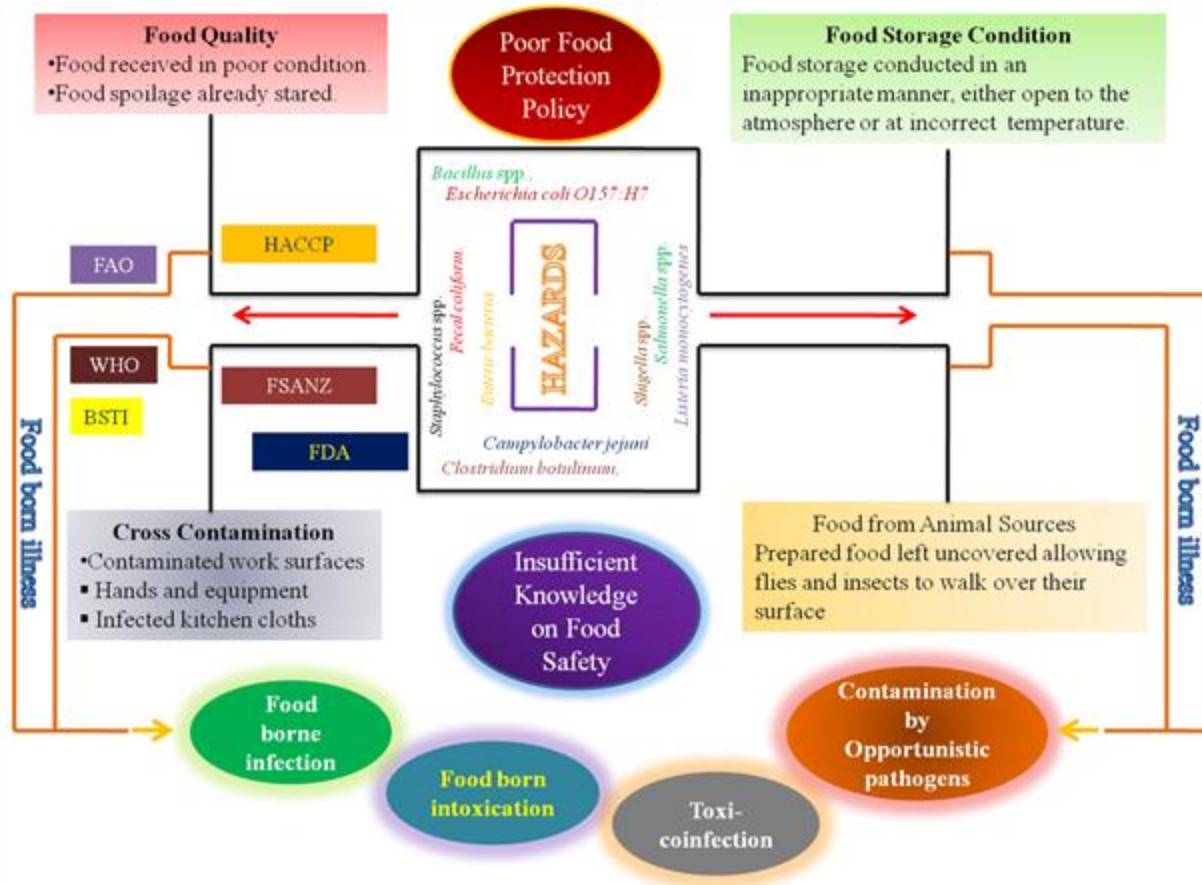


FIG. 2. Common aspects of the onset food borne disease outbreaks in Bangladesh. The schema emphasized on the lack of regulatory bodies in food protection as well as the impact of insufficient practice of unhygienic maintenance of food in triggering the food borne diseases: infection, intoxication, toxico-infection, and opportunistic infection of food items consumed.

cantaloupe was found to affect 148 people in 28 states, of which 30 people died (30). According to CDC (1) estimation, each year approximately 16% US people get sick from foodborne complications, 3,000 face death. The largest outbreaks of 2013 have been reported to be associated with *Salmonella* Heidelberg-contaminated chicken produced by California-based Foster Farms (30). Apart from USA, the other parts of the world have also revealed sufficient foodborne disease outbreaks (12, 23). To combat foodborne microorganism mediated disease outbreaks, the necessary risk assessment approach is now being applied to the microbiological safety of foods by several regulatory bodies as stated earlier (29). As stated earlier, such coordination or guidelines of risk management within food hazards in Bangladesh is also demanding.

#### MICROBIOLOGICAL STATE OF COMMON FOODS IN BANGLADESH

Among the disease conquered countries around the

globe, Bangladeshi people are more likely to be prone to microbial attack due to the relatively dense population with extremely unhygienic sanitary facilities (11, 31, 32). Several researches revealed that the propagation of waterborne microorganisms into the environment causing cholera and diarrhoea is very frequent in this country (32-34). A recent estimation has revealed that approximately 30 million people in Bangladesh suffer from foodborne illnesses each year (8, 35). Besides, the National Taskforce on Food Adulteration (NTFS) made by the GoB found that adulterated foodstuffs each year causes various food borne enteric illnesses, malnutrition and other diseases leading to morbidity and mortality especially to the children (26, 36). Indeed, microbiologically contaminated water used for food processing as well as generated from the defective water distribution system is often responsible in conveying the enteric diseases within communities (25, 34). Water can harbor varieties of microorganisms including pathogenic strains of *Escherichia coli*, *Salmonella* spp., *Vibrio cholerae*, *Shigella* spp., *Cryptosporidium parvum*, *Giardia lamblia*, *Cyclospora cayetanensis*, *Toxiplasma gondii* and

and the Norwalk and hepatitis A viruses. Minute amounts of contamination with some of these organisms can result in food borne illness leading to the dreadful impact on the mass public health (Figure 2).

A range of foods including the street vended food items or even foods supplied within the hospitals has been reported to be contaminated with an array of microorganisms including the faecal ones especially by the infected food handlers with deprived hygienic condition (37). In most of the cases, microbial studies have been carried out employing the selective and differential cultural media, the confirmative biochemical identification methods, and to some aspects, molecular studies have been conducted to demonstrate the virulent genes (13, 38-40). The fungal contamination aspects with the existence of mycotoxins have also been investigated to some extent.

### **FOOD SAFETY REGULATION IN BANGLADESH: CURRENT CONCEPTS**

Food safety is an imperative issue in Bangladesh as there has been a long history of the countries to be victimized due to severe adulteration in foods resulting in fatality (13, 41, 42). Several laws and constitutions including the Bangladesh Pure Food Ordinance, 1959, Bangladesh Pure Food Rules, 1967, the Food Grain Supply (Prevention of Prejudicial activity) Ordinance, 1956, the Radiation Protection Act, 1987, the Iodine Deficiency Disorders (IDD) Prevention Act, 1989, the Essential Commodity Act, 1990, and Fish and Fish product (Inspection and Quality Control) Rules, 1997 exist in Bangladesh for items (42).

Within the framework of the Bangladesh Standards and Testing Institution Ordinance, 1985, the institution of Bangladesh Standards and Testing Institution (BSTI) has been established for standardization, testing and quality control, certifying the quality of commodities and materials, grading and marking of different goods. This is to be mentioned that the Ordinance has been amended as The Bangladesh Standards and Tasting Institution (Amendment) act, 2003 (42). Besides, more than dozen of laws deal with the food safety affairs excluding the common law provisions (26). The laws are principally implemented by several ministries and their subordinate bodies like the Parliament, Ministry of Agriculture (MOA), Ministry of Local Government, Rural Development and Co-operatives (MOLGRD), Ministry of Industry (MOI), Ministry of Fisheries and Livestock (MOFL), Ministry of Commerce (MOC), Ministry of Establishment (MOE) and Ministry of Home Affairs (MOHA) (26).

Despite the existence of several food controlling bodies, an official statistics published by the Ministry of Health and Family Welfare (MOHFW)

Government of Bangladesh (GoB) unraveled the case of adulteration of approximately half of the food samples tested by the laboratory of the Institute of Public Health (IPH) within the time frame of 2001 to 2009 (26). According to the report of the Directorate General of Health Services (DGHS), the enormity of the diarrhoeal diseases is caused principally by the unsafe foodstuffs. The report revealed around 18,000,000 people to suffer from diarrhoea from 2003 to 2009 (26). Unhygienic state of food as well as malnutrition largely account for this situation. Use of formalin, dichloro diphenyl trichloroethane (DDT) and toxic colors, or other forms adulteration within the food items may also trigger the enteric diseases, sleeping disorders, heart diseases and neurological diseases among the consumers (26, 27). General ignorance posed by the food industries towards the existing food regulations, regulatory failures, unexpected rise of food price, lack of consumer information, and educational and cultural state of the food handlers and the processors may trim down the required standards of food safety (26, 43, 44). Moreover, the lack of coordination among the GoB agencies dealing with food safety may also result in the failure of the whole food safety arrangement in Bangladesh (26). Therefore, an effectual food safety regulatory structure is crucial to ensure the consistent supply of safe food items to the consumers. The accomplishment of the hazard analysis and critical control point (CCP) approach is fundamental to ensure a sound food safety management which in turn would define the control measures to reduce the foodborne microorganisms to an acceptable level (Figures 1 and 2) (45).

### **CONTROL OF FOOD SPOILAGE MICROORGANISMS: RECOMMENDATIONS**

Irrational increase in populations with the concurring food demand is a major problem in Bangladesh. The situation has been worsen with the use of polluted waters for food processing, lack of knowledge on the dietary intake of essential and toxic elements, and finally the scarcity in knowledge on hygiene. An efficient food safety regulatory framework is therefore of the essence to ensure the supply of safe foods to the consumers in a country (Figures 1 and 2). Currently, in Bangladesh the steadfast estimation of the public health blow due to the microbiological contamination of food is not available principally due to the lack of a regular monitoring system. Therefore, in perspective of Bangladesh, public health management and the mass awareness on hygiene are the principal concerns for eradicating foodborne diseases. Regulatory bodies and the Governmental health sectors should take necessary steps to furnish important information towards the general people about the sanitary condition of the food production and processing which in

turn would minimize the risk of undergoing microbial infections. Establishment of the “Hazard Analysis: Critical Control Points” (HACCP) regulations should be endorsed at each step of food processing from the primary production, processing, manufacture, and distribution to the point of consumption.

Other measures for controlling the food quality as well as consumer safety should focus on the improvement of the surveillance of foodborne diseases, the judicious information on foodborne disease outbreaks as well as the food contamination events, setting and following the standards for the required quality of foods, development of the risk assessment measures for new food items, routine microbiological examination to ensure the safety of diverse food items, and finally building effectual communication on food-related risks are recommended. Lunching the facilities in the research laboratories for conducting sophisticated experiments relating molecular methods used to detect and identify foodborne pathogens are recommended (46).

From the view point of consumers, in order to avoid the foodborne illness, careful selection of foods for consumption is of prime importance. All raw foods must be appropriately checked for bacterial or fungal contamination specifically in premises where hygiene and sanitation are not sufficient enough to ensure the removal of food spoilage microorganisms. Undercooked food items must be avoided and it should be kept in consideration that even the cooked food that has been allowed to stand for several hours at ambient temperature can act as microbial media supporting microbial growth and hence should be thoroughly reheated before eating. Avoidance of taking street food is recommended since consumption of food and beverages obtained from street food vendors has frequently been associated with an increased risk of illness. In areas where the municipal supply water is at risk in microbiological perspective or the supply points are located at relatively unhygienic environments should be strictly avoided for drinking water. Off-season fruits and vegetables should be avoided since preservative chemicals are usually employed to maintain their apparent shelf life. Indeed, the general consciousness on health and hygiene would be the most valuable measure to keep safe from food borne infections and intoxications.

### CONCLUSION

The necessity of identifying the possible areas for development within the regulatory affairs engaged in food protection in Bangladesh is of significant demand. Existing food microbiologists in Bangladesh, researchers interested to chalk out the problems associated with contaminated foods, and finally the

general people are expected to heighten their consciousness on food safety. Indeed, the preliminary microbiological and biochemical researches followed by advanced genetic investigations on food contaminating agents should be expanded both in governmental and non-governmental sectors to ensure the food safety, consumer safety and for the control of the steadiness of the mass population health.

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