



The Mysterious Domination of Food/Drinking Water Contaminants and Adulterants in Bangladesh

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Abstract: Food adulteration and contamination is nothing new in this age. It is the consequence of modern civilization, people moving from places with altered social value and ethics, industrialization and rapid progression of economic activities. It is highly prominent in urban areas of many developed or underdeveloped countries and so is with in Dhaka city. Commercialism and business mind drive people toward such unethical activities knowingly or unknowingly. Most of the cases it is done by uneducated or illiterate people, having least idea about what evil they are doing to mankind. People who are health conscious mostly avoid these but many of them have to go with this because of the busy life schedule or carelessness. By definition, safe food or drink means pollutants or adulterants presence within the limit of the standard such as pathogenic micro-organisms, natural toxins and potentially harmful chemicals that may cause health hazards beyond a certain limit, either deliberately added or naturally present in them. Again, the economic development of the country doesn't reveal basic literacy and awareness of general people. Necessary steps should be taken by the authority and mass people should change their mind set up and have to avoid those who creates harm. Brief review of chemical induced food and drinking contamination, their consequences and control. Health care providers/policy makers have a major role play to concerned field. Both general people and the old system are responsible for this unlivable condition of Bangladesh. Population is not the sole for this instance. A sense of poor rules and regulation is always found everywhere. Negligence is becoming a wide spread disease contaminating illiterate to well educated, all kind of people. Many articles and documents found in concerned area of research but the scope of this research is on its focus point chemical induced food adulteration in Bangladesh. Still, the most important aspect of contamination and adulteration is covered but fact is less

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amount of recent data obtained in few areas. The language of this study is too simple to understand by people with simple scientific literacy. Pharmacists, doctors, nurses, hospital authorities, public representatives, policy makers and regulatory authorities along with general people have to acquire much from this article. Any article or research is based on the think doing good for mankind, at least

going ahead from the present situation, overcoming problems and measures. Bangladesh has recently passed from the list of LDC country with massive economic development. The article should create a guideline for the future policy makers of both government and other sectors to review the alarming situation of chemical induced food and water contaminants\adulterants in Bangladesh.

INTRODUCTION

Contamination is the presence of an unwanted substance where it should not be or at concentrations above recommended. Pollution is contamination that results in adverse biological effects to resident communities. Food contaminants and adulterants gave a new dimension in city life, together rest of the country. Rural people are less exposed to adulteration than urban people because of busy life, arrangement of food/spice item are mostly obtained from nearby grocery stores, chain shops and nearby open markets. Recent media reports on the malpractice in the food sector has revealed horrifying scenario leading to massive public outcry. Although, there is no official statistics on food borne illness, it is perceived to be a major problem in urban areas of Bangladesh. Contaminated food, filthy and unhygienic environment of urban cities result in health hazard which may even cause deaths. The healthcare providers/policy maker's role in environmental health is related primarily to being alert to the conditions prevailing in the community and of working with others to adequately control any of the attendant hazards.

Food safety laws and regulations and food standards in Bangladesh:

- Agricultural Products Market Act, 1950 (revised in 1985)
- Fish Protection and Conservation Act, 1950 (latest amendment in 1995)
- The Food Grain Supply (Prevention of Prejudicial Activity) Ordinance, 1956
- The Bangladesh Pure Food Ordinance, 1959 (Bangladesh Ordinance No. LXVIII of 1959)
- Agricultural Pest Ordinance 1962
- Agricultural Produce Markets Regulation Act, 1964 (revised in 1985)
- The Cantonments Pure Food Act 1966
- Destructive Insects and Pests Rules, 1966 (Plant Quarantine) amended up to 1989
- The Bangladesh Pure Food Rules 1967
- The Special Powers Act, 1974
- The Animals Slaughter (Restriction) and Meat Control (Amendment) Ordinance, 1983
- Marine Fisheries Ordinance, 1983 and Marine Fisheries Rules, 1983

- Fish and Fish Products (Inspection and Quality Control) Ordinance, 1983
- The Pesticide Ordinance, 1971 and The Pesticide Rules, 1985
- Bangladesh Standards and Testing Institution Ordinance, 1985 (XXXVII of 1985)
- The Radiation Protection Act, 1987
- The Iodine Deficiency Disorder Prevention Act, 1989
- The Essential Commodity Act, 1990
- National Food Policy 1996
- National Agriculture Policy 1996
- Fish and Fish Products (Inspection and Quality Control) Rules, 1997
- National Food and Nutrition Policy 1997
- National Fisheries Policy 1998
- National Policy for Safe Water and Sanitation 1998
- National Health Policy 2000
- Bangladesh Standards and Testing Institution (Amendment) Act, 2003
- The Bangladesh Pure Food (Amendment) Act, 2005
- Product Labeling Policy 2006
- National Livestock Policy 2007
- Fish Feed and Animal Feed Act 2010
- Export and Import Policy 2009-2012
- The Bangladesh Food Safety Act 2013
- BSTI Ordinance and many others

MATERIALS AND METHODS

Comprehensive literature search followed by consulting healthcare professionals, Hospital, clinic associates, newspaper journalists, NGO workers about adulteration and food contamination. A few high officials were asked help for necessary books, journal, newsletters. A few local magazine and newspapers also observed to get the necessary concern. Projections were based on various types of adulteration in food served/sold to general people, contaminated drinking water supply from a variety of sources.

Gross outcomes of chemical contamination: Food remains a significant vehicle of disease organisms. Foodborne disease, more commonly but often incorrectly called "food poisoning," is grossly underreported. In most instances the illness produced by contaminated food is

Table 1: Detection of foodborne pathogens in food and household water samples collected at point of use from four Slums of Dhaka city, Bangladesh, December 2015-May 2016^[1]

Presence of organisms in food/water	Overall n = 56	
	n (%)	CI (95%)
Organisms present in food		
Yeast and mould (>100 CFU mg ⁻¹)	48.0 (85.7)	0.74-0.93
Coliforms (>100 CFU mg ⁻¹)	41.0 (73.2)	0.59-0.84
<i>B. cereus</i> (>100 CF mg ⁻¹)	27.0 (48.2)	0.35-0.62
<i>E. coli</i> (>100 CFU mg ⁻¹)	17.0 (30.4)	0.19-0.44
Staphylococcus (>100 CFU mg ⁻¹)	8.0 (14.3)	0.08-0.27
<i>V. cholera</i>	2.0 (3.5)	0.01-0.14
Organisms present in water		
	n = 16 n (%)	
Total coliforms	16.0 (100)	-
Fecal coliforms	16.0 (100)	-
Total aerobic bacterial count	16.0 (100)	-
Yeast	16.0 (100)	-
Mould	16.0 (100)	-
Staphylococcus	16.0 (100)	-
<i>E. coli</i>	10.0 (62.5)	0.35-0.86
Fecal streptococci	9.0 (56.3)	0.29-0.79
<i>Pseudomonas</i>	7.0 (43.8)	0.21-0.71
Total coliforms and fecal coliforms count (CFU g ⁻¹)		

mild and of short duration but more severe outbreaks (such as hepatitis a, most commonly seen in public restaurants) can occur. Epidemics of food-borne disease are dramatic and sudden and most people become sick within 6-24 h after consuming the contaminated foodstuffs. The epidemic pattern of food-borne disease presents differently from the gastrointestinal symptoms (e.g., nausea, vomiting and diarrhea) induced by intestinal enteroviruses. The safety laws and regulations of Bangladesh are as given in Table 1. WHO published-chemical exposure to toxic level is suspected to be involved in causing:

- Carcinoma
- Cardiovascular disease
- Kidney, liver dysfunction hormonal imbalance
- Premature birth
- Suppression of immune system
- Impaired development of nervous system
- Mental health problems and
- Learning disabilities/cognitive dysfunction

Laboratories for food analysis:

- Public Health Laboratory (IPH)
- BSTI (Ministry of Industries)
- Food testing laboratory (Ministry of Food and Disaster management)
- Food testing laboratory (Dhaka City Corporation)
- Institute of Food Radiation Biology, Bangladesh Atomic Energy Commission
- Institute of Food Science Technology, BCSIR
- Institute of Nutrition and Food Science, University of Dhaka

RESULTS AND DISCUSSION

Food adulteration is the most notorious enemy of mankind. Civilization has its own drawback that even causing destruction of itself. Very few people raised voice on this but crippled by the facts of commercialism. The scope of this study is limited to chemical food contaminants and adulterants. A few discussions based on real life experience and recent studies or reports from various journals and news articles are summarized here.

Food and supply water contamination: Dhaka city, among huge amount of solid wastes per day from industrial discharge, fertilizers, fossil fuels, sewage sludge and municipality wastes and they are the major sources of heavy metals in soils and subsequent uptake by crops, vegetables and other food items causing serious health hazards to human beings^[2-4]. A significant transfer of arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, molybdenum and vanadium like heavy metals took place from soils to vegetables (spinach, tomato and cauliflower) grown in industrially polluted soils of Konabari at Gazipur and Keraniganj in Dhaka^[5]. In the absence of Effluent Treatment Plants (ETP), the factory wastes are drained out at will into the farmlands and ultimately contaminate the farm produce. In our country we have allowed things like pollution and food contamination to run riot. Till now, no agency, either under the health ministry or the ministry of science and technology or the ministry of industries has conducted any examination of the pesticide-residue levels or toxic chemicals in the foodstuff being marketed^[6]. Apart from these, the slum areas are both populated and are in greatest risk of notorious pathogen found both in food sample and supplied water (Table 2). According to Dhaka Water Supply and Sewerage Authority (DWASA), it can currently supply 75% of water demand, out of which 85% is from groundwater sources (Deep Tube wells). The presence of toxic metal lead in Elephant road, Dhaka University, Jatrabari and Demra area and toxic Penta Chloro Phenol (PCP) and existing pathogenic bacterial load in the WASA supplied drinking water from different areas of Dhaka city were found to be unsuitable for human consumption (Table 3).

Arsenic issue of drinking water: About 20 million people in Bangladesh are still drinking water contaminated with arsenic, two decades after the potentially deadly toxin was discovered in the supply^[7]. The Bangladesh government is failing to adequately respond to naturally occurring arsenic in drinking water across large areas of rural Bangladesh.

Table 2: Lead, cadmium, chromium and arsenic content in first 14 water samples^[8]

Sampling area	Pb content (mg L ⁻¹)	Cd content (mg L ⁻¹)	Cr content (mg L ⁻¹)	As content (µg L ⁻¹)	Total bacterial count cfu/100 mL
Dhaka University	0.52	0.05	BDL	0.78	4.0×10 ⁵
Bangshal	BDL	0.03	BDL	0.43	2.1×10 ⁴
DMCH	BDL	0.04	BDL	0.25	1.0×10 ⁴
Basabo	BDL	BDL	BDL	5.12	4.2×10 ⁶
Komlapur	BDL	BDL	BDL	0.21	-
Badda	BDL	0.04	BDL	1.29	1.0×10 ⁵
Sobujbagh	BDL	0.04	BDL	0.42	5.2×10 ⁶
Shagun Bagichaa	BDL	0.06	BDL	BDL	5.0×10 ³
Demra	0.46	0.07	BDL	0.44	-
Jatrabari	0.51	0.07	BDL	0.15	1.5×10 ⁴
Mohammadpur	BDL	0.07	BDL	0.53	5.0×10 ³
Panthapath	BDL	0.07	BDL	0.29	3.0×10 ⁴
Elephant Road	0.53	0.08	BDL	0.10	2.5×10 ⁴
Shampur	BDL	0.08	BDL	0.56	3.5×10 ⁴

Table 3: Adulterants used in different food items of vegetable origin as reported in lay press reports^[9]

Food category and food item	Adulterant
Edible oil	Argemone oil, mineral oil and rancid oil given commonly**
Soybean oil	Palm oil, chemical*, color*, burnt Mobil† from rail locomotives, burnt oil from
Mustard oil	electric transformer chemicals
Food grain and grain products	
Lentils, mugdal, chola, mosurdal, dabli, mashkolai, buter dal (lentil types)	Toxic coloring agents*, imported low-quality inedible lentils mixed with textile dye* and have fungal growth; less expensive Mashkolai dal powdered with champa color* and sold as mugdal
Rice	Urea added to make it whiter
Dhekichata chal (husked rice), ata (course flour)	Red toxic color* mixed with rice and ata to sell as husked rice, red atta
Muri (puffed rice)	Urea fertiliser to make it whiter and puffier
Wheat, corn	Animal feed packaged as human food
Semai (vermicelli)	Dalda made with rotten potato, cow intestine, low-quality palm oil
Vegetables and tubers	
Vegetables	Organophosphorus compounds and other pesticides
Tomato	Calcium carbide for artificial ripening
Potol (pointed gourd), peas	Textile dye*
Eggplant	Pesticide*
Green peas	Chemically colored* Dabli
Potato	Red toxic color*
Spices	
Mixed spices (powder)	Brick dust, saw dust, chaler kura (dust from outer layer of rice)
Turmeric powder	Brick dust, buter dal, kheshari dal (lentils), artificial powder, color
Chili powder	Powder with color
Coriander powder	Chaler kura (dust from outer layer of rice), toxic color*
Zeera (cumin) powder	Brick dust, toxic color*, powder
Pepper	Papaya seed
Salt	No iodine
Bakery products	
Cake‡	Textile dye, chemicals*, inedible date expired ata/maida, fertiliser urea, substandard inedible dalda, rotten egg
Biscuit‡	Ammonium bicarbonate, sodium cyclamate, fertiliser urea, toxic coloring agents*, palm oil, burnt oil, outdated inedible ata/maida
Bread‡	Rotten egg, outdated ata/maida
Fruit and fruit products	(Lead arsenite, Calcium carbide, Ethephon, Formalin, Injection of dye in general)
Mango, banana, pineapple	Calcium carbide for artificial ripening
Cherry	Koromcha (Carissa carandas, Christ's thorn) with chemical color
Orange and lychee juice	Water, flavor, textile dye*, sweet pumpkin and color
Imported juices	Substandard, date expired with new sticker
Snacks	
Noodles‡	Dhekichata chal, lal atta (coarse wheat flour), red potato
Chanachur	Fried in burnt mobil†, no potato, imported powder and color
Peyaju, beguni	Toxic dye*
Chocolate, sugar and honey	
Chocolate	Powder, sugar, color*, chemical

Table 3: Continue

Food category and food item	Adulterant
Sugar	Soda used instead of sugar in food
Honey	Sugar syrup
Others	
Pickle	Inedible ingredients
Jorda (smokeless tobacco)	Wood dust, chemical
Mineral water and drinking-water‡	Tap-water, arsenic contaminated, contaminated with bacteria, no mineral

*Chemical nature/composition not mentioned/specified; **Argemone oil leads to Epidemic dropsy, loss of vision, heart diseases, tumor, mineral oil cause liver damage and carcinogenic; rancid oil leads destroys vitamin A and E; †Polychlorinated Biphenyl (PCB) used as coolant in automobiles and transformers; ‡Prepared in unhygienic condition

Human Rights Watch said in a report. Approximately 20 years after initially coming to international attention, an estimated 20 million people in Bangladesh—mostly rural poor—still drink water contaminated over the national standard^[10]. Bangladesh’s health system largely ignores the impact of exposure to arsenic on people’s health. An estimated 43,000 people die each year from arsenic-related illness in Bangladesh, according to one study^[11]. The government identifies people with arsenic-related illnesses primarily via skin lesions, although, the vast majority of those with arsenic-related illnesses don’t develop them. Those exposed are at significant risk of cancer, cardiovascular disease and lung disease as a result but many receive no health care at all^[12].

Food adulterants: Important food hazards include microbial hazards, pesticide residues, misuse of additives, chemical contaminants, including biological toxins and adulteration. Although, microbiological contamination and chemical hazards have received most attention, it is recognized that food adulteration and food fraud should not be neglected considering their role in public health^[13]. Food adulteration includes various forms of practices such as mixing, substituting, concealing the quality of food by mis-labelling, putting up decomposed or expired food and adding toxic substances^[14]. About the proportion of adulterated food items in the market varied between 70-90%. About >76% food items in the market were found adulterated in a random survey by public health laboratory of Dhaka City Corporation in 2004^[14, 15]. According to, the International Centre for Diarrheal Disease and Research, Bangladesh (ICDDR, B), there is approximately 150 food items in the country. A study by the Institute of Public Health (IPH) revealed that >50% of the food samples they tested were adulterated. Textile dyes which are highly injurious to health are being randomly used to color many types of food. Textile dyes which are highly injurious to health are being randomly used to color many types of food. Clay powder is mixed with the mixture of turmeric powder and cold toxic yellow dye to make it yellow. Water and salt are well mixed with these species to increase the weight. Mangoes,

watermelon, litchi, watermelon, pineapple, papaya and bananas are artificially ripened using a carcinogenic chemical called ethylene oxide (Table 4). In bananas, another chemical called calcium carbide is used that becomes a spray Acetyl-gas to generate heat. Dalda (hydrogenated vegetable oil/fat popular in South Asia) used in cooking is an example of a worst case false. “Our stomach temperature is 37°C and the melting point is 54°C Dalda. So, there is no way that Dalda can be absorbed by the body. Most sweetened condensed milk products sold in the market actually contains palm oil which is used in substitute for cow’s milk and therefore, most sweetened condensed milks out there do not contain milk at all^[17]. Fish is considered to be an essential protein for people of all ages. Many fish sellers spray fish with formalin in an indiscriminate manner, it makes the fish or fruits stiff and keeps them looking fresh for longer (Table 5). Undoubtedly human health is now under the possession of formalin in our country about 400 tons formalin is being imported which are goes to human stomach, creates deadly mistreats on long term exposure (Table 6), even though for laboratory or research purposes 100 tons of Formalin is quite enough, 80% of the imported formalin being added to food only for business purposes. Three-fourths of the marketed vegetables, fruits and fish contain pesticides and formalin residues. The consumption of such foods might lead to serious diseases^[18].

Ironically even food color is being adulterated. Substandard food color is finding its way into many types of food. This includes the reddish jelapi and the saffron beguni, peaju or alur chop. Candy, chips, ice cream, chewing gum and even biryani may contain large amounts of poor-quality food color. Cooking oil that is so, commonly used to deep fry items should only be used once but many food vendors and restaurants recycle burnt oil. Once the oil is used for cooking, it becomes oxidised. The more the oil is used, the more pre-oxide is created which is really harmful for the body. This gets more poisonous with continued usage. In 2017, police seized around 3,000 eggs suspected to be artificial during a raid in Patiya upazila, Chittagong. They also arrested two men—an egg shop owner and an egg supplier—suspected to

Table 4: Underlying reasons behind adulteration issue in fish supply chain of Bangladesh^[19]

Reasons	Details
A cheap method to prevent post harvest loss	To prevent this post-harvest loss one of the cheap methods is to use formalin and other toxic chemical which helps to keep this fish fresh for a long time
Lack of technical knowledge	Lack of proper technical knowledge contributes in use of waste material in fish culture, improper handling after post-harvest and use of formalin and other toxic elements
Lack of ice box, unavailability of ice, high price of ice, lack of cold store to keep unsold fish	Ice/Icebox is expensive. Main problem in the market of Bangladesh is there is lack of cold storage in the market place As a result, there is no proper way to preserve unsold fish
Lack of awareness	Most of the traders do not aware of the danger of using these harmful chemicals. On the other hand, customers are also not properly aware of this issue
Lack of government initiative	Co-ordination between authorities is a major issue, does not appear to be any cohesive view regarding procedures and penalties for the same offence by officials from same organisation
Lack of policy framework	Food laws and regulations are mostly outdated and fragmented. Even the new Safe Food Act 2013 is not free from this as it is basically modeled on the Pure Food Ordinance of 1959
Inadequate penalties	Considering the extent of harmfulness of food adulteration, penalties mentioned in law is insufficient. For an example, the penalty for food adulteration is maximum term of six months of imprisonment or up to a maximum fine of BDT 1000 which is equivalent to EUR 10.77. Considering the gravity of the offences this punishment is not hard enough

Table 5: Effect of formalin treated food consumption on health^[19]

Exposure routes	Effect on human
Carcinogenicity	Formalin has the potential effect to cause cancer, repeated and prolonged exposure increases the risk of cancers of the lung, nasopharynx, oropharynx and nasal passage
Reproductive health	It has a harmful effect on reproduction system by inducing oxidative stress
Skin (dermal)	Prolonged and repeated contact with formalin could cause numbness (lack of feeling) and a hardening or tanning of the skin
Eye contact	Formalin solution splashed in the eye can cause injuries from transient discomfort to severe such as loss of vision

Table 6: Adulterants used in different food items of animal origin as reported in lay press reports^[9]

Food category and food item	Lay press reports
Hen egg**	White eggs of farm hens colored red with textile dye* to sell as local hen eggs. Tortoise eggs sold as hen eggs
Fish	Inject formalin through the gills or dip fishes in water treated with chemicals such as chloro-fluoro carbon (CFC); DDT† powder to prevent rotting; add red color* to give fresh look; sell rotten fish
Dry fish	DDT†
Mutton	Buffalo, sheep and beef meat sold as mutton
Beef	Buffalo meat sold as beef
Halim‡	Left over bones, intestine
Sweetmeats and dairy products	
Butter	Cow's intestine, dalda mixed with color*, powder*
Ghee, dalda (hydrogenated vegetable oil) ‡	Banaspati, toxic chemical*, potato smash, cow's fat, intestine
Sweetened curd‡	Textile dye*
Sweetmeats‡	Textile dye named 'thousand power color' and toxic chemicals*; rotten eggs; dalda made with cow's intestine, saccharin, soybean oil and vegetable oil instead of milk fat; paste of ground rice and sulphuric acid mixed with milk to make posset
Jilapi (coil-like juicy sweet)	Fried with Mobil¶
Halua	Rotten carrot and lau (bottle gourd), chemical*
Ice-cream‡	Unsold foul-smelling ice-cream refined and re-packaged, almost no milk, palm oil for soap manufacturing, textile dye*, low-quality milk powder, sodium cyclamate
Imported milk powder	Adulterated, low-quality, date expired without BSTI approval
Fast food and restaurant food†	
Jelly, sauce	Toxic coloring agents*, chemicals*, spirit
Chicken**	Dead chicken; cooked and raw meat refrigerated together
Shrimp	Sold rotten
Fish	Fried and raw fish refrigerated together

*Chemical nature/composition not mentioned/specified; ** BLRI also showed that broiler meat and egg showed presence of antibiotic residue of Ciprofloxacin, Sulfonamide, Oxytetracycline and Enrofloxacin in high level; †Dichloro-diphenyl trichloroethane; ‡Prepared in unhygienic condition; ¶Polychlorinated Biphenyl (PCB) used as coolant in automobiles and transformers

be involved in the trade and marketing of fake eggs^[20]. Doubt also pointed in rice also. The term 'plastic rice' was coined by the online media around 2010 when China reported its use for adulteration of a premium rice

called Wuchang which is known for its aroma^[21]. The Institute of Public Health (IPH) in Dhaka and the World Health Organization (WHO) in their joint study on food adulteration in 1994 tested 52 street vendors and

Table 7: Toxic elements in noxious addition of food/additives with possible outcomes^[16, 9, 22-31]

Contaminants	Food/additives	Possible outcome
Coloring agents chrome, tartazine and erythrosine	Spices, sauces, juices, lentils and oils	Cancer in kidney, liver, skin, prostate and lungs
Rye flour (ibid)	Barley, bread and wheat flour	Convulsion and miscarriage
Hormone (ibid)	Cauliflower	Infertility of women
Coal tar and industrial Dyes	Sweets, Sauce, Pastry cream, powders spices	Carcinogenic
Burnt oil	Crispy snack	Food poisoning, reflux, heartburn
Agenomato or monosodium glutamate (ibid)	Chinese restaurant food items	Nervous system disorder and depression
Flour	Chalk Powder	GI problems
Soap	Ghee/Butter	GI problems
Calcium Carbide/Ethylene dioxide	Ripening of fruits	Cancer in kidney, liver, skin prostate and lung
Urea (ibid)	For whiten rice and puffed rice	Damage of kidney and nervous system, respiratory problem
Brick Dust	Chili powder	Respiratory problem
Sulfuric acid and palm oil	Condensed milk	Cardiac function problem
Saw dust, used and exhausted tea leaves	Loose tea	Respiratory problem
Sodium cyclamate	Sweetmeat	Cancer, fetal abnormality
Metanil yellow Aniline dyes	Turmeric powder	Carcinogenic
Melamine	Milk Products	Kidney malfunction
Oleomargarine or lard	Butter	Asthma and weakened kidney function
Yellow and Sudan Red colors (ibid)	Chili powder	Tumors in liver and bladder and finally for cancer
	DDT	Dried fish (Shutki) Cancer especially breast cancer, liver cancer and pancreatic cancer, reproductive damage (Weaken semen, early menopause, exposure of teratogen and birth defects) and some neurological damage reported
Bottle and Jar water	Bottle and Jar water	Bottle and Jar water
	Formalin	Preservation of fish, meat, fruit and milk Throat cancer, blood cancer, childhood asthma and skin-diseases
Poisonous coloring agents like auramine, rhodamine b, malachite green, yellow G, Allura red and Sudan red	Applied on food items for coloring, brightness and freshness	Damage liver and kidney and cause stomach cancer, asthma and bladder cancer

found that all of their food samples were contaminated with different types of pathogenic microorganisms. They also conducted another study in 2003 in Dhaka city and found that 96% of sweetmeats, 24% of biscuits, 54% of breads and 59% of ice creams (Table 7) were extensively adulterated^[32].

Consumption of adulterated food items may cause asthma, sore throat, larynx constriction, bronchitis, skin infections, allergic reactions, diarrhea, hematuria, circulatory failure, numbness, dizziness, kidney failure, stomach cancer, liver cancer, nervous disorders and many other diseases (Table 8). After consumption of adulterated food items, thousands of people are becoming sick. Children are the worst victims. About 3 million people suffered from diarrhea during 2005-2009 and about 15% of children died in 2011 as reported by the Directorate General of Health Services^[33]. The long-term effects are also very severe especially the incidence of renal failure, liver damage and cancer which are increasing alarmingly in Bangladesh. Heavy metals such as lead, chromium and arsenic accumulate in the body that might cause kidney and liver damage and develop abnormality among children. Indiscriminate and irrational use of antibiotics in poultry without following withdrawal period may result in unexpected residues in animal food and could cause serious health hazards to

consumers. Research reports on antibiotic residues in broiler meat and liver from different farms and local markets for the presence of residues of ciprofloxacin, enrofloxacin, oxytetracycline, doxycycline and amoxicillin antibiotics revealed significant level of exposure of antibiotic residues. There's a greater chance of declining immunological responses and can detrimentally affect intestinal microbiota in susceptible individual. According to Prof. Muniruddin Ahmed (Clinical Pharmacy and Pharmacology, Dhaka University) Cooking cannot destroy antibiotic residues which made them resistant to antibiotic treatment^[34].

Milk in rural areas is usually adulterated with dirty water which can cause hepatitis. People have now come to know about a new milk adulteration technique that uses a thickening agent, sorbitol and detergent. ICDDR, B recent studies shows nearly 75% samples from primary-level producers were contaminated with coliform and >50% with fecal coliform bacteria. At the collection points, samples were found contaminated with a high number of coliform bacteria and fecal contamination of >90% while >40 % of the samples had a high *E. coli* count^[22]. Vegetable and fruit samples collected from around Savar, Dhamrai and Tongi show the presence of textile dyes which in the short-term will cause diarrhea, food poisoning and gastrointestinal problems but in the

Table 8: Eateries/chain shops raid list for adulteration/substandard food serving

Eateries/Super shops	Possible reasons/Issues	References	Date published
Khushbu Biriyani, Gulshan	Textile dyes for coloring Biriyani	Daily Sun and Daily Bangladesh	29.05.18 and 28.05.18
'Kosturi Restaurant, Gulshan	unhygienic environment inside the restaurant.	UNB News	28.05.18
Swapno's Banani	Date-expired food	Daily Sun	29.05.18
KFC, American Burger, Dawat-e Mejban, United Catering, Dynamic Food Court, Dhanmondi	Rotten and unhealthy foods	Daily Sun	29.05.18
Meenabazar's Shantinagar	Soda water without the BSTI approval and other issues	Daily Sun	29.05.18
Agora and Nandan Super shop	Selling different local and foreign products having no BSTI approval.	Daily Sun	29.05.18
Boomers Cafe, Baily Road	keeping food in unhygienic environment	Daily Sun	29.05.18
SBARRO Cafe	keeping sauce without a BSTI approval.	Daily Sun	29.05.18
Kutumbari Restaurant, Chittagong	Preserving date-expired fish and meat.	Dhaka Tribune	28.06.16
Bonoful Sweets, Chittagong	Harmful ammonia for making biscuits crispy	Dhaka Tribune	28.06.16
Sizzle, Chittagong	Applying color in making cakes which is unfit for human consumption	Dhaka Tribune	28.06.16
Flavor Sweet and Bakers and Fulkoli Food Products, Chittagong	Date-expired food colour in manufacturing cake and sweetmeat.	Dhaka Tribune	28.06.16
Fakhruddin Biryani, Baily Road	Using expired and rotten ingredients for making Kebab and Halim	The News Today	06.02.18
'Mr Bakers, Turag Area	Preserving date-expired and stale cake and making biscuits and toasts without BSTI license	The Daily Sun	16.06.17
Arabians Sweets and Bakery	For not writing manufacturing and expiry dates on their packets	The Daily Sun	16.06.17
'Pusty Dairy and Bakery, Malibagh	For not taking BSTI license for producing curd	The Daily Sun	16.06.17
'Lucky Vermicelli Factory' at Matuail in Jatrabari	Making vermicelli in an unhygienic environment	The Daily Sun	16.06.17
Yammi Yammi' and 'Ujjal Food Products' at Pallabi, Mirpur	Making food items in an unhygienic manner	The Daily Sun	16.06.17
New Food Hotel and Restaurant, Shibganj Sweets, Tuhin Food Hotel, New Bidyut Hotel, Tripti Hotel and Cafe RAJ Hotel, Memory Biriani House, Amir Ali Fish Shop in Rajshahi City	Selling stale and adulterated foods	The Daily Star	17.09.18
Maloncho Restaurant at the New Elephant Road	Poor Hygiene	Dhaka Tribune	25.07.15
Food Corner, Kings Fast Food, Penji Fast Food, Kepray Fast Food, Capital Fast Food, Al Amin Food, Saikat Fast Food, Welcome Fast Food and Al Jaber Fast of Newmarket, Dhaka	Selling unhygienic food.	United News of Bangladesh UNB Beta	20.05.18
KFC' and Boomers Baily Road	Serving expired and chemical-mixed food items	DhakaTribune	25.07.15
Pizza Hut, Baily Road	Using chemicals in two of its popular sauces without the authority's approval	DhakaTribune	25.07.15
Chandrima Restaurant and Mini Chinese, Kasturi Chhayani and Thai Chinese Restaurant and New Star Kebab	Preserving and selling unhygienic food items	The Independent and Daily Prothom Alo	19.06.17 and 18.06.17
Dawar-E-Mejban, Dhanmondi	Using harmful chemicals to color foods.	NEWAGE	25.05.18
Ma-Moni Hotel and Restaurant, Suprema Restaurant, Kosturi Restaurant, Rangpur City	Preserving foodstuffs in unhygienic and dirty environment	BSS News and Bangladesh Post	26.09.18
Agora, Shwapno and Meena Bazar Chittagong	For selling rotten meat and fish	Bdnews24.com	11.06.16
Meena Bazar, Agora, Swapna Dhaka	For selling low-grade packed products.	Bdnews24.com	09.04.12
Agora, Meena Bazar and fast food chain Coopers, Shantinagar	For keeping expired and stale food items (rotten fish, meat and expired food items)	The Daily Star and The Independent	15.05.16 and 11.05.16
Agora in Prabantok, The Grocer and Khulshi Mart in Khulshi, Meena Bazar in Sholoshahar and Shwapno in Gol Pahar Chittagong	Selling products at hiked up prices and also selling rotten and stale items	The Daily Star	11.06.16

Table 8: Continue

Eateries/Super shops	Possible reasons/Issues	References	Date published
Platinum Suites, King's Confectionary, Kobe Restaurant, Pizza Inn	Selling expired, stale and rotten foods	Bdnews 24 com	02.06.18
Disney Dine Restaurant Kabab Jangson Limited Nababi Bhoj Solution Lounge, Shamoli	Selling adulterated food items in unhygienic conditions	Dhaka Tribune	18.05.18
Mir Al-Amin Hotel and Sharif Hotel	Producing food items in an unhygienic condition during Ramadan	Daily Sun	19.06.17
Alauddin Sweetmeat, Royal Restaurant Lalbagh, Star Hotel and Kabab, Voot Restaurant, Ambala Sweetmeat, Iftari Bazar and Dominous Pizza in Dhanmondi	Using illegal food colorings, poisonous chemicals and used cooking oil in Ramadan	The Daily Star	29.05.12

long-term toxic materials will accumulate in the body with serious health implications^[35]. In Bangladesh, people allowed things like pollution and food contamination to run riot. Till now, no agency, either under the health ministry or the ministry of science and technology or the ministry of industries has conducted any examination of the pesticide-residue levels or toxic chemicals in the foodstuff being marketed. These merchants and traders are the enemy not only of the nation and their own children but of the entire mankind. The Holy Prophet (PBUH) has disowned those who indulge in this immoral business. He said "The adulterator is not one of us"^[36].

Energy drinks vs. carbonated drinks: The government has decided to ban the production, marketing and import of energy drinks under the guise of carbonated beverages with immediate effect^[37]. The Bangladesh Standard and Testing Institution (BSTI) at a council meeting on also resolved to take legal action against the companies that have been advertising their products as energy drinks after having them listed as carbonated beverages with BSTI. The move came after the Bangladesh Food Safety Authority (BFSA) wrote to BSTI to say the production of energy drinks in the name of carbonated beverages should not be allowed as the ingredients of the two are significantly different. There is no government fixed standard for energy drinks in the country, Industries Minister told parliament once. Authority received complaints about the use of various highly addictive substances, including caffeine and opium in energy drinks^[38]. In 2012, a Department of Narcotics Control test conducted on energy drinks from several local and foreign companies had found excessive amount of artificial caffeine, Viagra (sildenafil citrate), beer and alcohol as ingredients^[39]. The manufacture and advertising of energy drinks under a license for carbonated beverage is fraud, punishable under several laws including the BSTI Act and the Food Safety Act. Initially, the government will write to the companies to instruct them to discontinue their production and marketing of energy drinks. Punitive

actions will follow if they do not comply, said the official. The government will also amend the import policy in order to blacklist the foreign energy drinks with harmful ingredients^[40].

Safety issues of bottled water: So-called mineral water supplied to houses and offices in jars are not tested. In most cases, the water is filled in the jars right away from the tap and sometimes in the empty bottles of some of the well-known mineral bottle brands^[41]. The Bangladesh Agricultural Research Council (BARC) has of late made a sensational revelation regarding the quality of water different companies supply for drinking in and around Dhaka. According to the findings of the government study, 'coliform bacteria' (pathogens from feces of humans and animals) has been found in 97% of so-called filtered water supplied in jars to households, shops and offices in the capital city of Bangladesh. A team of BARC researchers determined the 'horrifying' data while studying the level of minerals in jars and bottled water marketed in Dhaka city. The researchers sampled 250 jars from across the city's Farmgate, Karwan Bazar, Elephant Road, New Market, Chawk Bazar, Sadarghat, Keraniganj, Jatrabari, Motijheel, Basabo, Malibagh, Rampura, Mohakhali, Gulshan, Banani, Uttara, Airport, Dhanmondi, Mohammadpur, Mirpur, Gabtoli and on the city's outskirts at Aminbazar, Savar and Ashulia. The level of coliform bacteria' in the samples collected from Elephant Road, Chawk Bazar, Basabo, Gulshan and Banani areas was found significantly high in the research^[18, 42]. A few months ago, a mobile court busted six fake mineral water plants in Bosila area of Dhaka's Mohammadpur and sentenced six staffers to different terms of jail. The team also seized 2000 jars of water and destroyed those later^[43].

Food adulteration during Ramadan: The crime of those selling adulterated and unhygienic food items is very serious and strict action needs to be taken as per law against such guilty persons. According to media reports some 600 field-level sanitary inspectors are working across the country to ensure food safety for all during the

holy month of Ramadan. This is welcome news but if previous records are anything to go by people should not get their hopes up too high. Even more unfortunate is the fact that this nefarious practice increases exponentially during the month of Ramadan. It was found that coloring agents are used in spices, sauces, juices, lentils and oils. Formalin and carbide used in fish, fruit, meat and milk^[44]. The shopkeepers and the merchants many of them with a pious face try to earn a large amount of profit by this unethical practice and so, they play with the life and health of the people. They mix dangerous things in the daily eatables.

Sub-standard vermicelli (shemai) and cow fattening ahead of Eid: Adulterated vermicelli flooded different markets in the capital ahead of Eid-ul-Fitr, one of the biggest religious festivals of the Muslims, posing a serious threat to public health. A section of unscrupulous businessmen is busy in manufacturing sub-standard vermicelli in the port city ahead of Eid-ul-Fitr as the food item has a high demand in the day. According to local sources, some of the factories are using unrefined palm oil and animal fat to produce Laccha vermicelli while hazardous chemicals and toxic color were also used to make the food items. Bangla vermicelli is produced using flour and water and Laccha is produced with oil, flour sugar and water. Most cases, the vermicelli was being dried in unhygienic condition in the rooftop of the factories^[45]. Seeking anonymity, a seasonal vermicelli maker said a section of businessmen in the city bought the adulterated vermicelli and sell them tagging labels of renowned companies. BSTI personnel left a comment as Bangla vermicelli is used to make by seasonal factory for a certain time, it is not mandatory to take license from BSTI, however, the factory should take health and hygienic certificate issued by the Sanitary Inspector^[46,47]. With Eid-ul-Azha around the corner, the Poribesh Bachao Andolon (Poba) has recently urged the government to monitor how cattle is being reared and fattened in the farms in the country^[48]. Knowingly causing such damage to public health in order to hike up the price of cows is a crime and must be dealt with swiftly. The use of antibiotics, growth hormones, harmful chemicals and steroids is prohibited by the Animal Feed Act 2010. Violators may be faced with a year in prison, a Tk 50,000 fine or both. A large number of farmers involved in bull fattening just before 3 or 4 months of Eid-ul-Azha (Muslim festival) when they sell the animals with profitable price. Visiting different villages in Bera, Santhia and Ataikula upazilas of Pabna and Shahjampur and Baghabari areas in Sirajganj, these correspondents found that almost every household was using steroids, antibiotics and other chemicals for months in blatant violation of law. Everyone from cattle farm owners to

landless farmers wanted to take full advantage of this. These cattle-fattening drugs are also widely used in Chuadanga, Jhenidah, Nilphamari, Barisal, Faridpur, Manikganj and some other districts. Consumption of meat of these animals poses serious health risks for humans, according to experts^[49]. The changes to the cow caused by these injections are not merely cosmetic-severe health damage is done to humans by the consumption of this meat. While most traders would still claim that the fattening supplements were not harmful, there is reason to believe these chemicals may cause cancer, kidney disease and infertility in women^[50].

Penalty imposed on famous eateries: Isn't it surprising that like many occasional drives against various crimes, the fight against unsafe food, too has assumed the character of a seasonal activity? While this should have been a continuous and unrelenting activity round the year across the country, sporadic and infrequent moves here and there, leave no permanent impact on the sellers and producers of spurious food items of all varieties. Newspaper reports say that the drive against food adulteration is currently on in the capital, launched last week. The Bangladesh Food Safety Authority (BFSA), the state watchdog to regulate the sector is reportedly monitoring the capital's food markets under the supervision of an executive magistrate. One has reasons to question the rationale behind the drive in the capital alone that too with just one magistrate. The effectiveness of the drive is bound to cause nothing more than a ripple with mobile courts punishing a few sweetmeat shops, restaurants and if at all, some kitchen market sellers. The fact that such drives, sporadic and half-hearted, failed to bring any discipline in the country's food market cannot be disputed. However, famous eateries/food chains are not devoid of these cases of adulteration and substandard food staffs. Penalty imposed on these famous shops/food chain should at least give an idea to general people that paying high price is not always an indicator of good quality. Even a few of them were penalise more than once or twice for the same reason but substandard food serves never ended (Table 9). For a better view references regards are attached in this table with date published.

Government officials monitoring food markets in capital Dhaka fined businesses millions of BDT only after finding that their food items contained ingredients harmful to human health. Inadequate monitoring of food markets may have exposed people's health to serious hazards from consumption of substandard and adulterated foods. In the absence of corrective measures, punishing the offenders-at times by way of hefty monetary penalties-is not an appropriate method of dealing with the problem. A properly institutionalized mechanism with sufficient manpower and regular monitoring round the year can only

bring things to some semblance of order. In this regard, it is important that the BSFA and other agencies such as the BSTI and the city corporations which also run such drives maintain a well-coordinated plan of action. It is also important that punitive actions should be backed by actions to improve the quality and standard of food of all varieties. To monitor the situation, inspection and sudden raids are welcome but it must not be forgotten that inspection is just one of the many ways to rein in food adulteration.

CONCLUSION

With constant change to the physical, biological, cultural, social and economic environment, both healthcare providers and citizens should cultivate an informed awareness of these changes and health providers should adapt their methods of health education, disease prevention and disease control to the changes in each community. This is especially true food daily consumed which require concerted community action for their control but providers may play a much more fundamental and personal role in controlling food-borne diseases; often, the first indication of an outbreak of food-borne disease is time-limited, with an unusually large number of people seeking relief from health hazards. The necessary role in environmental health is related primarily to being alert to the conditions prevailing in the community and of working with others to adequately control any of the attendant hazards. Government related authorities, NGOs and other private organizations (e.g., Pharmaceutical companies) should take initiatives further to ameliorate food and drinking water situation which is worst among all other previous times. General people should be aware of these facts of mischiefs and take necessary steps on their own. A year-round campaign regarding these issues in public places, electronic media and even in rural areas can bring a change as brought by diarrhea. Vitamin A campaigns back in 70's and 80's.

RECOMMENDATIONS

While contamination of food may be due to negligence, deliberate adulteration by toxic chemicals or radioactive materials for long shelf life of products and increasing the volume in size and weight-among the many crooked methods-is so rampant that it is difficult to find anyone who does not encounter an unpleasant moment of food-related illness at least once a year. Taking care of the situation, thus, calls for a whole package of initiatives. In advanced countries this involves producing, handling, storing and preparing foods in such a way as to prevent infection and contamination in the entire chain. However, in situations prevailing in this country, it is not merely

about maintaining a clean chain but putting in strong deterrents, so that, criminality in the business could be stopped. Sources of harmful stuffs must be plugged, if necessary by way of ban on imports or local production. Strong advocacy on the detrimental effects of consumption should be routinely done. At the same time, training on safe and scientific methods of preservation of food products should also be a high priority in an attempt to curb adulteration. Adulteration and contaminant control are a never ending, on the other hand a continuous process. It will increase with time as the civilization go ahead. Pharmacists should be aware of the local occupations, companies and factories and to be cognizant of the initial symptoms of disease. Again, pharmacists should become acquainted with the local community and to adapt the principles of health and medical care to the particular situations encountered. The pharmacist's continuing education requirements should include watching the local pattern of society and its diseases and changing the emphasis toward evolving disease patterns and their control. Government and regulatory authorities are to play strong role in controlling food contaminants and adulteration.

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