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

AK Mohiuddin
Faculty of Pharmacy,
World University of Bangladesh
Dhanmondi, Dhaka, Bangladesh
trymohi@gmail.com

ABSTRACT

Food adulteration and contamination are as old as the civilization itself. It is the consequence of the development of civilization, over utilization of nature, industrialization and in a price for the progression. It is highly prominent in Urban areas of Bangladesh. It is the consequence of commercialism of business people who are doing this knowingly to maximize profit. Higher degree of awareness shown by the people with higher educational background. Government regulatory agencies are less confident regarding food standard testing, as reported in the study. Educated people show higher degree of awareness of how the quality of food should be maintained. Regulatory authority is found to be in confidant in testing the food standard which also reflects their negligence. Safe food means, in general, there will be no danger from harmful elements that are deliberately added to food products in the country. The economic development of this country rarely reveals the basic literacy and consciousness of mass people. Necessary steps are to be taken to protect the environment for our own existence.

Keywords: Adulteration; Carcinogen; Chemical Intoxication; Food Poisoning; Health Hazard; Liver and Kidney Dysfunction

INTRODUCTION

Contamination is the presence of an unwanted substance where it should not be or at concentrations above recommended. Pollution is contamination that causes 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 misdeed in the food sector has revealed alarming scenario leading to massive public outcry. Although there is no official statistics regarding food borne illness, it is realized to be a major problem in urban areas of Bangladesh. Contaminated food, filthy and grimy environment of urban cities result in health hazard which may even cause deaths. The healthcare providers/policy makers' 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.

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 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 to 24 hours 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

How to cite this article: Mohiuddin AK; The Mysterious Domination of Food/Drinking Water Contaminants and Adulterants in Bangladesh; PharmaTutor; 2019; 7(1); 42-58; http://dx.doi.org/10.29161/PT.v7.i1.2019.42

- 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

Table 1. Food Safety Laws and Regulations and Food Standards in Bangladesh

Agricultural Products Market Act, 1950 (revised in 1985)
Fish Protection & 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

Laboratories for Food Analysis

- Public Health Laboratory (IPH)
- BSTI (Ministry of Industries)
- Food testing Laboratory (Ministry of Food & 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 & Food Science, University of Dhaka

RESULTS AND DISCUSSIONS

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 article is confined 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

Food and Supply Water Contamination Dhaka city, among huge amount of solid wastes every day from industrial discharge, fossil fuels, fertilizers, sewage sludge, municipality wastes and they are the major sources of heavy metals exposed to crops, vegetables and other food items from soils, causing serious health hazards to human beings (Hashem et.al., 2017; Mahmud, 2015 and Ashiqur, 2016). A significant deportation of heavy metals like arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, molybdenum and vanadium took place from soils to locally grown vegetables (spinach, tomato and cauliflower) grown in industrially polluted soils

of Konabari at Gazipur and Keraniganj in Dhaka (Rafiqul et.al., 2013). Due to absence of effluent treatment plants (ETP), the factory wastes are unloaded to farmlands, and conclusively contaminate the farm produce. In our country we have allowed things like food contamination and pollution to run riot. Till now, neither health ministry or the ministry of science and technology nor the ministry of industries, has conducted any examination of the pesticide- residue levels or toxic chemicals in the foodstuff being marketed (Asadullah, 2011). 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)**.

Table 2. Detection of Foodborne Pathogens in Food And Household Water Samples Collected at Point of Use From Four Slums Of Dhaka City, Bangladesh, December 2015 To May 2016

Presence of organisms in food/water	**Overall n = 56**	
Organisms present in Food	**n (%)**	**95% CI**
Yeast and mould (>100 CFU/mg)	48.0 (85.7)	0.74–0.93
Coliforms (>100 CFU/mg)	41.0 (73.2)	0.59–0.84
B. cereus (>100 CFU/mg)	27 .0 (48.2)	0.35–0.62
E. coli (>100 CFU/mg)	17.0 (30.4)	0.19–0.44
Staphylococcus (>100 CFU/mg)	8.0 (14.3)	0.08–0.27
V. cholera	2.0 (3.5)	0.01–0.14
Organisms present in Water	**Overall n = 16 n (%)**	**95% CI**
Total coliforms	16.0 (100)	–
Faecal coliforms	16.0 (100)	–
Total aerobic bacterial count	16.0 (100)	–
Yeast	16.0 (100)	–
Mould	16.0 (100)	–
Staphylococcus	16.0 (100)	–
E. coli	10.0 (62.5)	0.35–0.86
Faecal streptococci	9.0 (56.3)	0.29–0.79
Pseudomonas	7.0 (43.8)	0.21–0.71

Total coliforms and fecal coliforms count (CFU/g). (Ishita et.al, 2018)

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 metals in Elephant road, Dhaka University, Jatrabari, and Demra area and toxic Pentachloro- Phenol (PCP) and existing pathogenic bacterial load in the WASA supplied drinking water sample from different areas of Dhaka city were found to be unacceptable for human consumption (Table 3).

Table 3: Lead, Cadmium, Chromium and Arsenic content in first 14 water samples

Sample No.	Sampling Area	Pb content (mg/L)	Cd content (mg/L)	Cr content (mg/L)	As content (µg/L)	Total Bacterial Count c.f.u./100mL
1	Dhaka University	0.52	0.05	BDL	0.78	4.0 × 105
2	Bangshal	BDL	0.03	BDL	0.43	2.1 × 104
3	DMCH	BDL	0.04	BDL	0.25	1.0 × 104
4	Basabo	BDL	BDL	BDL	5.12	4.2 × 106
5	Komlapur	BDL	BDL	BDL	0.21	-

6	Badda	BDL	0.04	BDL	1.29	1.0 × 105
7	Sobujbagh	BDL	0.04	BDL	0.42	5.2 × 106
8	Shagun Bagichaa	BDL	0.06	BDL	BDL	5.0 × 103
9	Demra	0.46	0.07	BDL	0.44	-
10	Jatrabari	0.51	0.07	BDL	0.15	1.5 × 104
11	Mohammadpur	BDL	0.07	BDL	0.53	5.0 × 103
12	Panthapath	BDL	0.07	BDL	0.29	3.0 × 104
13	Elephant Road	0.53	0.08	BDL	0.10	2.5 × 104
14	Shampur	BDL	0.08	BDL	0.56	3.5 × 104

(Murshed et.al, 2013)

Arsenic Issue of Drinking Water

Twenty million people in Bangladesh are still drinking water contaminated with arsenic, a potentially deadly toxin discovered in supply two decades ago (Eresh, 2017). The Bangladesh government is failed to take initiatives to naturally occurring arsenic in drinking water across large areas of rural Bangladesh, as reported by Human Rights Watch. Approximately 20 years after initially coming to international attention, an estimated 20 million people in Bangladesh – mostly rural poor – still drink contaminated water over the national standard (Richard, 2017). Bangladesh's health system largely neglects the consequence of arsenic exposure on public health. An estimated 43,000 people die every year from arsenic-related contagion in Bangladesh, according to another study (Hasin, 2016). The government identifies people with arsenic-related contagion primarily via skin abrasion, although the vast majority of those with arsenic-related illnesses don't develop them. Those exposed are causative agent of cancer, CVD, and lung disease as a result, but many receive no health care at all (Human Rights Watch, 2016).

Food Adulterants

Important food hazards include microbial contamination, pesticide remainder, misused additives, chemical impurities, including biological toxins and adulteration. Although microbiological contamination and chemical hazards are taken into account, it is realized that food adulteration and fraud should not be overlooked considering their consequence in public health (FAO/WHO Expert Consultation, 1986). Food adulteration includes various forms of practices, such as mixing, altering, camouflaging the quality of food by mis-labelling, putting up decomposed or expired food, and adding toxic substances (Park, 2005). About the proportion of adulterated food items in the market varied between 70% to 90%. Around 80% food items in the market were found adulterated in an incidental survey by public health laboratory of Dhaka City Corporation in 2004 (Staff Correspondent, 2011 and Mirza et.al., 2014). International Centre for Diarrheal Disease & Research, Bangladesh (ICDDR, B), estimated 150 food items in the country. More than 50% of the food samples they tested were adulterated reported by the Institute of Public Health (IPH). Textile dyes, which are highly noxious to health, are being openly used as food coloring agent (OP-Ed, 2018). 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, calcium carbide is used that becomes a spray Acetile-gas to generate heat.

Table 4. Adulterants Used in Different Food Items of Vegetable Origin as Reported in Lay Press Reports

Food category and food item	Adulterant
Edible oil	**Argemone oil, mineral oil and rancid oil given commonly****
Soybean oil Mustard oil	Palm oil, chemical*, color*, burnt Mobil† from rail locomotives, burnt oil from 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 fertilizer 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, fertilizer urea, substandard inedible dalda, rotten egg
Biscuit‡	Ammonium bicarbonate, sodium cyclamate, fertilizer 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
Sugar	Soda used instead of sugar in food
Honey	Sugar syrup
Others	
Pickle	Inedible ingredients
Jorda (smokeless tobacco)	Wood dust, chemical
Mineral water and	Tap-water, arsenic contaminated, contaminated with bacteria, no

drinking-water‡	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	

(Sharifa et.al, 2014)

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 degrees Celsius and the melting point is 54 degrees Celsius Dalda. So, there is no reason that Dalda can be engrossed by the body (Aasha, 2004). Most sweetened condensed deserts sold in the market actually comprises palm oil which is used as an alternative for cow's milk and therefore most sweetened condensed milks out there do not contain milk at all (Qyshalini, 2017). Fish is considered to be an essential protein for people of all ages. Many fish sellers spray formalin in fish in an assorted manner, it makes the fish or fruits stiff and keeps them looking fresh for longer **(Table 5).** Undoubtedly human health is now under the domination 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 more than enough, 80% of the imported formalin is directly related to 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 (Zubair, 2018).

Table 5: Underlying Reasons Behind Adulteration Issue in Fish Supply Chain of Bangladesh

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 organization.
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.

(Modified from Fatema et.al, 2016)

Ironically even food color is being adulterated. Cheap food color is finding its way into many types of food. This includes the jilapi, beguni, alu'r chop, piaju. Ice cream, chewing gum, candy, chips, and even biryani may contain huge amounts of low-quality food color. Cooking oil that is so widespread too deep fry items should only be used once but many food vendors and eateries recycle burnt oil. Once the oil is used for cooking, it becomes oxidized. The more the oil is used, more pre-oxide will be created which is really disastrous for the body. It's getting more toxic 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 wholesaler and another is supplier – suspected to be involved in the trade and marketing of fake eggs (Ashif, 2017). Doubt also pointed in rice also. The term 'plastic rice' was focused by the online media around 2010, when China outlined its use for adulteration of a premium rice called Wuchang, which is known for its aroma (The New Indian Express, 2017).

Table 6. Effect of Formalin Treated Food Consumption on Health.

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

(Fatema et.al, 2016)

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 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 around 100% of sweetmeats, 25% of biscuits, more than 50% of breads and 60% of ice creams **(Table 7)** were extensively adulterated (Rahman et al., 2005).

Table 7. Adulterants Used in Different Food Items of Animal Origin as Reported in Lay Press Reports.

Food category and food item	
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	

(Sharifa et.al, 2014)

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. An estimated three 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 (Nath, 2014). The long-term effects are also very severe especially the incidence of renal failure, liver damage and cancer which are alarmingly increase in Bangladesh. The accumulation of heavy metals, such as lead, chromium and arsenic accumulate in the body may causes kidney and liver failure and develop anomaly among children. Non-selective and aberrant 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 slags in broiler meat and liver from different farms and local markets for the presence of slags of ciprofloxacin, enrofloxacin, oxytetracycline, doxycycline and amoxicilin 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 (Emran, 2016). Most Edible Oil are adulterated and most of the soybean oils, mustard oil and ghee sold to consumers are substandard.

Table 8: Toxic Elements in Noxious Addition of Food/Additives with Possible Outcomes

Contaminants	**Food/Additives**	**Possible Outcome**
Coloring agents chrome, tartzine 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 & 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

(Mirza et.al, 2014; Zubair et.al, 2013; Mohammad S, 2018; Arifur et.al, 2015; Nishat, 2017; Abu, 2013; Nehreen et.al, 2016; Newsdesk, 2018, Shafkat, 2013; Staff Correspondent, 2011; Sharifa et.al, 2014, Rajib, 2015; Editorial, 2014; Mahboob, 2015)

Milk in rural areas is usually devalued with dirty water, which may cause hepatitis. People have now come to know about a newer milk adulteration technique where sorbitol, and detergent used as thickening. ICDDR, B recent studies shows nearly 75% samples from primary-level producers were contaminated with coliform and more than 50% with fecal coliform bacteria. At the collection points, samples were found contaminated with a high number of coliform bacteria and fecal contamination of more than 90% while more or less 40 % of the samples had a high E coli count. (Newsdesk, 2018). Vegetable and fruit samples collected from surrounding Dhaka (Savar, Dhamrai and Tongi) show the presence of textile dyes may cause diarrhea, food poisoning and other GI problems in the short-term, but in the long-term toxic materials will accumulate in the body with serious health implications (Asadullah, 2010).

Energy drinks Vs Carbonated drinks

The government has decided to prohibit the production, marketing and import of energy drinks under the guise of carbonated beverages with immediate effect (Business, Staff Reporter 2018). 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 about the production of energy drinks in the name of carbonated beverages should be discontinued, as the ingredients of the two are significantly different. There is no standard fixed 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 (Staff Correspondent, 2015). In 2012, a test conducted by Department of Narcotics Control on energy drinks from several local and foreign merchants had found unrestrained amount of beer, alcohol, artificial caffeine and sildenafil citrate (Generic of Viagra) as ingredients (Ashif, November 2017). The production and marketing of energy drinks under a license for carbonated beverage is deception, illegal under several laws including the BSTI Act and the Food Safety Act. Initially, the government will forbid companies 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 revise the import policy in order to boycott the foreign energy drinks with harmful ingredients (Ashif, September 2017).

Safety Issues of Bottled Water

So-called mineral water supplied to household and offices in jars are not tested at all. Mostly, 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 (Joynul, 2018). 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 familiar places Gabtoli, Mirpur, Mohakhali, Mohammadpur, Dhanmondi, Airport, Uttara, Banani, Gulshan, Rampura, Malibagh, Bshabo, Motijheel, Jatrabari, Keraniganj, Sadarghat, Chaawk Bazar, New market, Elephant Road, Karwan Bazar, Farmgate and on the city's outskirts at Aminbazar, Savar and Ashulia. The level of 'coliform bacteria' in the samples collected from Gulshan, Banani, Bashabo, Chaw Bazar, Elephant Road areas areas was found significantly high in the research (Sarwar et.al, 2018 and Zubair, 2018). Meanwhile, a mobile court busted six fake mineral water plants in Bosila area, near Dhaka's Mohammadpur and convicted six staffers to different terms of jail. The team also seized 2000 jars of water and destroyed those later (Online Report, 2018).

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. 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 oils, lentils, juices, sauses, spices. Formalin and carbide used in milk, meat, fish and fruit (Ahamed May, 2018). The shopkeepers and the merchants many of them with a pious fade 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. 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 (Editorial, 2017).

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 corrupt businessmen is busy in manufacturing low-grade 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 unprocessed palm oil and animal fat to produce Laccha vermicelli while harmful 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 sugar, flour, water and oil. Mostly, the vermicelli is dried in unhealthy condition in the rooftop of the factories (Ahamed, June 2018). An anonymous, a seasonal vermicelli maker said a section of merchant in the city bought the inferior vermicelli and sell them tagging labels of famous companies. BSTI officials left a comment as Bangla vermicelli is used to make by seasonal factory for a certain time, it is not compulsory to take license from BSTI, but the factory should take certificate issued by the Sanitary Inspector (Mizanur, 2016; News Correspondent, 04 July 2016; Solaiman, 2017; Ahamed, 2018). With Eid-ul-Azha in front, 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 (Editorial, July 24, 2018). Consciously causing such harm to public health so as to raise the price of cows is a crime, and must be dealt with swiftly. The use of steroids, antibiotics, growth hormone and other chemicals is forbidden by the Animal Feed Act 2010. Perpetrators may be faced with a year in prison, a Tk 50,000 fine, or both. A large number of farmers are engaged in cow fattening just before 3 or 4 months of Eid-Ul-Azha (Muslim festival), when they sell the animals with lucrative price. Visiting different villages in Ataikula, Santhia, Bera upazilas of Pabna, and Baghabari, Shahjadpur areas in Sirajganj, these journalists found that almost every domiciliary was using steroids, antibiotics and other chemicals for months in overt 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 Manikganj, Faridpur, Barisal, Nilphamari, Chuadanga and some other districts. Meat consumption from these animals poses severe health risks for humans, stated by the proficient (Pinaki et.al, 2014). The changes to the cattle to be slaughtered 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 chemicals were not harmful, there is reason to believe these chemicals may cause cancer, kidney disease, and infertility in women (Tribune Editorial September, 2016).

Penalty Imposed on Famous Eateries

Isn't it surprising that like many occasional drives against various crimes, the fight against unhealthy food, too, has assumed the character of an occasional activity? While this should have been a continuous and uninterrupted activity round the year across the country, scattered and infrequent moves here and there, leave no everlasting impingement on the sellers and producers of unauthentic food items of all varieties. Gazette reports say that the drive against food adulteration is a recent disport. The Bangladesh Food Safety Authority (BFSA), the state watchdog to regulate the sector is reportedly checking the capital's food markets under the supervision of an executive magistrate. One has reasons to question the logic 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 penalizing a few sweetmeat shops, restaurants and if at all, some kitchen market sellers. The fact that such drives, scattered and impassive, failed to bring any control 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 popular food chain/shops should impart an idea to general people that paying high price is not always an indicator of good quality. Even a few of them were condemn more than once or twice for the same reason but below standard food serves never ended (Table 9). For a better view references regards are attached in this table with date published.

Table 9. Eateries/Chain Shops Raid List for Adulteration/Substandard Food Serving

Eateries/Super Shops	Possible Reasons/Issues	Reference	Date Published
Khushbu Biriyani, Gulshan	Textile dyes for coloring Biriyani	Daily Sun & Daily Bangladesh	29.05,18 & 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 Café, 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.	DhakaTribune	28.06.16
Bonoful Sweets, Chittagong	Harmful ammonia for making biscuits crispy.	DhakaTribune	28.06.16
Sizzle, Chittagong	Applying color in making cakes which is unfit for human consumption	DhakaTribune	28.06.16
Flavor Sweet and Bakers and Fulkoli Food Products, Chittagong	Date-expired food colour in manufacturing cake and sweetmeat.	DhakaTribune	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	Selling stale and adulterated foods	The Daily Star	17.09.18

Rajshahi City			
Maloncho Restaurant at the New Elephant Road	Poor Hygiene	DhakaTribune	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' & 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 Chhayanir and Thai Chinese Restaurant and New Star Kebab	Preserving and selling unhygienic food items	The Independent & Daily Prothom Alo	19.06.17 & 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 & 11.05.16
Agora in Prabartok, 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
Platinum Suites, King's Confectionary, Kobe Restaurant, Pizza Inn	Selling expired, stale and rotten foods.	Bdnews24.com	02.06.18
Disney Dine Restaurant Kabab Jangson Limited Nababi Bhoj Solution Lounge, Shamoli	Selling adulterated food items in unhygienic conditions	DhakaTribune	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

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 accused convicts-at times by way of colossal monetary penalties-is not permanent solution of

dealing with the complication. A properly organized mechanism with efficient manpower and regular audit round the year can only bring things to some form of order. In this context, it is urgent that the BSFA and allied 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 result in overall quality and standard improvement of food of all varieties. To monitor the situation, inspection and sudden raids are welcome, but it must not be overlooking that inspection is just one of the many ways to rein in food adulteration.

Recommendations

While contamination of food may be due to disregard, planned adulteration by noxious chmical agents for long shelf-life of products and increasing the volume in size and weight-among the many twisted methods-is so uncontrolled that it is almost impossible to find anyone who does not confront an undesired moment of food-related ailment at least once a year. Consideration of the incidence thus calls for a whole package of initiative actions. In advanced countries this involves a preventive and automated environment of manufacturing, supervision, storing and packaging foods to prevent infection and contamination in the entire chain. However, in situations predominating in this country, it is not merely about maintaining a clean chain but putting in strong preventions so that dirty pool in the business could be gridlocked. Sources of harmful stuffs must be blocked, if necessary, 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. Community pharmacists and allied health professionals should be familiar of the local occupations, companies, and factories and to be cognizant of the initial outcomes of disease. Again, they should become acquainted with the local community and to acclimate 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.

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 crucial role in environmental health is related principally to being alert to the circumstances predominating in the community and of working with others to sufficiently control any of the attendant hazards. Government 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.

Abbreviations: BDL (Below Detection Limit); BSTI (Bangladesh Standards and Testing Institution); BCSIR (Bangladesh Council of Scientific and Industrial Research); ICDDR,B (International Centre for Diarrheal Disease Research, Bangladesh); ETP (Effluent Treatment Plants); IPH (Institute of Public Health); DDT (Dichloro-Diphenyl-Trichloroethane); BFSA (The Bangladesh Food Safety Authority); BARC (Bangladesh Agricultural Research Council).

Conflict of interest: None

REFERENCES

1. Abu NMAA. Food Safety and Public Health Issues of Bangladesh. European Food and Feed Law Review 31-40. URL: https://www.k4health.org/sites/default/files/food_safety_and_public_health_issues_in_bangladesh-_a_regulatory.pdf
2. Aasha M.A., Avik S.R. and others. Eating Away Our Health Cover Story Star Weekend Magazine Volume 4 Issue 20 November 5, 2004 URL: http://archive.thedailystar.net/magazine/2004/11/01/cover.htm
3. Ahamed U. Food adulteration rampant Consumers urge continuous drive against the menace Daily Sun 30 May, 2018 URL: https://www.daily-sun.com/printversion/details/312186/2018/05/30/Food-adulteration-rampant-
4. Ahamed U. Substandard vermicelli floods city markets The Daily Sun 4th June, 2018 URL: https://www.daily-sun.com/post/313478/Substandard-vermicelli-floods-city-markets
5. Arifur MR, Zakir MS. at al. (2015); Food Adulteration: A Serious Public Health Concern in Bangladesh. Bangladesh Pharmaceutical Journal ; 18(1): 1-7
6. Ahamed U. Food adulteration rampant Consumers urge continuous drive against the menace Daily Sun 30 May, 2018 URL: https://www.daily-sun.com/printversion/details/312186/2018/05/30/Food-adulteration-rampant-
7. Asadullah M.K. Slow poisoning continues unabated The Daily Star August 14, 2010 URL: https://www.thedailystar.net/news-detail-150627
8. Asadullah M.K. Bitter Truth Rampant adulteration still a havoc The Daily Star July 09, 2011 URL: https://www.thedailystar.net/news-detail-193429
9. Ashiqur R., Jahan SA., Khairul B. at al.(2016); A Comparative Study of Heavy Metal Concentration in Different Layers of Tannery Vicinity Soil and Near Agricultural Soil ; American Journal of Analytical Chemistry; 7(12) ; 880-88
10. Ashif S.I. Govt: There's no such thing as fake eggs in market DhakaTribune July 31st, 2017 URL: https://www.dhakatribune.com/bangladesh/2017/07/31/government-no-fake-eggs-market
11. Ashif S.I. (September) Energy drinks cannot be sold as carbonated drinks DhakaTribune September 13th, 2017 URL: https://www.dhakatribune.com/feature/food/2017/09/13/govt-wont-allow-production-energy-drinks-now
12. Ashif S.I. (November) The dangers lurking in your energy drinks. DhakaTribune, November 11th, 2017
13. Business. Staff Reporter. Manufactures seek help to dispel doubts about beverages. The Independent 5 October, 2018.
14. Editorial. Food Adulteration. The Independent 25 May, 2017. URL: http://www.theindependentbd.com/arcprint/details/96152/2017-05-25
15. Editorial. LOOK FOR THE FLIES- THE FUTURE AHEAD! Bangladesh J Medicine 2014; 25: 40-41 URL: https://www.banglajol.info/index.php/BJMED/article/download/25086/16929
16. Editorial July, 2018. Monitor cattle fattening Proper planning can make the difference this time. The daily Star July 24, 2018.
17. Emran H. Antibiotics-fed poultry pose threat to public health NEWAGE Bangladesh Nov 26,2016 URL: http://www.newagebd.net/article/3565/antibiotics-fed-poultry-pose-threat-to-public-health
18. Eresh O.J. World Water Day Taking responsibility for our future. The daily Star March 22, 2017.
19. Fatema TZ. Moslah MU. Economic Reasons behind Adulteration Issues in Fish Supply Chain in Bangladesh Journal of Business Studies, Vol. XXXVII, No. 1, April 2016
20. FAO/WHO. Assuring food safety and quality: guidelines for strengthening national food control systems. Rome: Food and Agriculture Organization; 2003. p. 28. (FAO food and nutrition paper no. 76).
21. Hashem MA, Nur MS and others. Heavy metal assessment of polluted soil around Hatirjheel Lake of Dhaka city, Bangladesh Bangladesh J. Sci. Ind. Res. 52(1), 61-66, 2017
22. Hasin J. Arsenic in Bangladesh: how to protect 20 million from the world's largest poisoning.
23. Human Rights Watch Nepotism and Neglect The Failing Response to Arsenic in the Drinking Water of Bangladesh's Rural Poor April 6, 2016 URL: https://www.hrw.org/report/2016/04/06/nepotism-and-

neglect/failing-response-arsenic-drinking-water-bangladeshs-rural
24. The New Indian Express. Plastic rice! Are you serious? 10th June 2017 URL: http://www.newindianexpress.com/cities/chennai/2017/jun/10/plastic-rice-are-you-serious-1614929.html
25. Tribune Editorial. Put a stop to unethical cow-fattening practices. DhakaTribune September 3rd, 2016. Support The Guardian 18 October, 2016
26. Joynul M.A. What Are We Drinking: Water or Poison? Daily Sun 12th January, 2018 URL: http://www.daily-sun.com/post/281517/2018/01/12/What-Are-We-Drinking:-Water-Or-Poison
27. Käferstein F. K. Food safety: a commonly underestimated public health issue 1997. Retrieved from URL: http://apps.who.int//iris/handle/10665/54778
28. Ishita M, Nurun NN., Mustafa M., Manoj R. at al. (2018) ; Children living in the slums of Bangladesh face risks from unsafe food and water and stunted growth is common Acta Pædiatrica 107(7); 1230–1239
29. Mahboob MS (2015); Food Adulteration : The Bangladesh Paradox. Law Journal Bangladesh, [Vol. 2, Jan - Jun]
30. Mahmudul IM. Toxicity of Heavy Metals In Soils And Crops And Its Phyto-Remediation Dissertation For Phd Department Of Soil, Water And Environment university Of Dhaka, Dhaka -1000 May, 2015 URL: http://repository.library.du.ac.bd/xmlui/bitstream/handle/123456789/952/Mahmudul%20Islam.pdf?sequence=1
31. Mitali P., Anwara B. Organic Solid Waste Management and the Urban Poor in Dhaka City Int J Waste Resour 2018, 8:1 DOI: 10.4172/2252-5211.1000320 ISSN: 2252-5211
32. Mirza FIC (2014); Evaluating Position of Bangladesh to Combat 'Adulterated Food' Crisis in Light of Human Rights IOSR Journal Of Humanities And Social Science (IOSR-JHSS); 19(3); 45-54
33. Mizanur FMR. Sub-standard vermicelli manufactured ahead of Eid. DhakaTribune, June 22nd, 2016
34. Mohammad S. Heavy Metal' in Imported Fish: Samples sent for retest. The Daily Star March 18, 2018 URL: https://www.thedailystar.net/backpage/heavy-metal-imported-fish-samples-sent-retest-1549705
35. Murshed S., Ali M.H. a; Analysis of WASA Supplied Drinking Water Around Dhaka City from Laboratory Analysis Perspective ; International Journal of Chemical and Physical Sciences IJCPS Vol. 2, No. 6, Nov-Dec 2013
36. Nath D.K. 2014. Food or poison? bdnews24.com, May 9, 2014.URL: http://opinion.bdnews24.com/2014/05/09/food-or-poison.
37. Nehreen M., Isreq MHR. and others. Food Adulteration and Bio-Magnification of Environmental Contaminants: A Comprehensive Risk Framework for Bangladesh. Front. Environ. Sci., 18 May 2016 | https://doi.org/10.3389/fenvs.2016.00034
38. News Correspondent, Bogra. Substandard vermicelli floods Bogra markets. The Independent 4 July, 2016
39. Nishat TS. Food adulteration: A serious health risk for Bangladesh. risingbd.com February 09, 2017.
40. NewsDesk. Over 75% pasteurised milk unsafe for direct consumption in Bangladesh: ICDDR, B study. bdnews24.com May 16, 2018. URL: https://bdnews24.com/health/2018/05/16/over-75-pasteurised-milk-unsafe-for-direct-consumption-in-bangladesh-icddrb-study
41. Online Report 6 fake mineral water plants busted in Dhaka, 6 jailed The Daily Star, May 12, 2018 URL: https://www.thedailystar.net/city/6-fake-mineral-water-plants-busted-dhaka-mohammadpur-mobile-court-rab-bsti-6-jailed-1575328
42. OP-ED. Public Health Issues in Bangladesh The Independent 6 April, 2018 URL: http://www.theindependentbd.com/printversion/details/144723
43. Park K. Park's textbook of preventive and social medicine. 18th ed. Jabalpur: Banarsidas Bhanot; 2005. p. 481.
44. Pinaki R., Ahmed KT. Cow fattening out of control Cow fattening out of control Traders cut long process short with help of harmful drugs
45. Pollution Abatement Strategies for Rivers and Wetlands in and Around Dhaka City February 2010 Parliamentary Standing Committee on Ministry of Environment & Forests URL: http://ext.bd.undp.org/CCED/bgdp/BGDP%20Materials/Review%20Documents/Pollution%20abatement%20strategies%20for%20river%20and%20wetland.pdf

46. Qyshalini N. A doctor reveals that condensed milk contains more sugar than actual milk! Web Goodtimes December 30, 2017 URL: http://en.goodtimes.my/2017/12/30/doctor-reveals-condensed-milk-contains-sugar-actual-milk/
47. Rahman, S.M., Hoque M.A., and Talukder M.R.A. 2005. Food security in Bangladesh: utilization, nutrition and food adulteration (paper presented at the National Workshop on Food security, Dhaka, Bangladesh, 19–20 October 2005), pp. 45-46.
48. Rafiqul M. I., Jahiruddin M. and others. Consumption of Unsafe Foods: Evidence from Heavy Metal, Mineral and Trace Element Contamination Department of Soil Science Bangladesh Agricultural University, Mymensingh 2013 URL: http://fpmu.gov.bd/agridrupal/sites/default/files/ToR%2016%20Final%20Report.pdf
49. Rajib KR. Cover Unsafe Food Unhealthy Life. Daily Sun 3 July, 2015. URL: http://www.daily-sun.com/magazine/details/55558/Unsafe-Food-Unhealthy-Life/2015-07-03
50. Richard P. The politics of arsenic-free water. DhakaTribune March 15th, 2017
51. Sadiqur R., Rashad A. Pollution all around A cross-section of people share their opinions with New Age Staff Correspondents NEWAGE Bangladesh Oct 26,2018 URL: http://www.newagebd.net/article/54185/pollution-all-around
52. Sarwar MSK. How safe is bottled water for drinking? The Financial Express January 07, 2018 URL: https://thefinancialexpress.com.bd/views/how-safe-is-bottled-water-for-drinking-1515258813
53. Shafkat R. Letters To The Editor Urea in puffed rice. The Daily Star August 27, 2013 URL: https://www.thedailystar.net/news/urea-in-puffed-rice
54. Sharifa N, Tahmeed A. (2014); Food Adulteration and Consumer Awareness in Dhaka City, 1995-2011. J Health Popul Nutr.; 32(3); 452–464
55. Staff Correspondent. Food adulteration rings alarm bell STAR-RDRS roundtable told most food items adulterated, pose lethal risks to public health. The Daily Star August 11, 2011 URL: https://www.thedailystar.net/news-detail-198096
56. Staff Correspondent. No standard fixed for energy drinks Amu tells JS. The Daily Star March 07, 2015.
57. Solaiman S. Adulterated vermicelli floods markets. The Daily Sun 8 June, 2017
58. The Bangladesh Today Improving Dhaka's environment September 22, 2018
URL: https://thebangladeshtoday.com/2018/09/22/improving-dhakas-environment/
59. UN Secretary General 'Water-Related Diseases Responsible For 80 Per Cent Of All Illnesses, Deaths In Developing World', says secretary-general in environment day message Meetings Coverages and Press Release 16 May 2003
URL: https://www.un.org/press/en/2003/sgsm8707.doc.htm
60. Zubair K.L., Mohiuddin AK., Bake MA. Food Contaminants: Bangladesh Perspective January 2013 Reference Id: PHARMATUTOR-ART-1570
URL: https://www.pharmatutor.org/articles/food-contaminants-bangladesh-perspective
61. Zubair K.H. Time to end food adulteration The Daily Star January 19, 2018 URL: https://www.thedailystar.net/letters/time-end-food-adulteration-1521907