

# A Summary of Recent Studies Published by DIU Researchers

## 6 CLEAN WATER AND SANITATION



**Daffodil**  
*International*  
**University**



The researchers of Daffodil International University (Faculty, Students, Alumni) have conducted a number of research projects related to SDG 6 (Clean Water & Sanitation) and results of the projects have also been published as research papers in various international reputed peer reviewed and Scopus indexed journals. The summary of the research publications related to SDG 6 are given below:

## **1. Groundwater Contamination and Health Risk Evaluation of Naturally Occurring Potential Toxic Metals of Hatiya Island, Bangladesh**

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## **ABSTRACT**

Groundwater meets the majority portion of drinking water needs, particularly in the rural area of Bangladesh. Groundwater has been continuously contaminated by potentially harmful metals as a result of natural processes as well as some anthropogenic activity, creating a variety of health impacts. The current research aimed to evaluate the naturally occurring level of metal contamination and the human health risk associated with deep groundwater in the Hatiya Island. Because of the arsenic, iron, and salinity problem in shallow groundwater, the inhabitants of the Hatiya Island use deep groundwater. During the field investigation, no shallow tubewells were observed; therefore, only deep groundwater samples were collected. The total sample size collected throughout the Hatiya island was 17. Five metals (Zn, Fe, Mg, Mn, and Cu) were analyzed using an Atomic Absorption Spectrophotometer (AAS). The concentrations of studied potential risky metals were ranked as follows: Mg > Zn > Fe > Mn > Cu. The detected values of all metals except Fe were found within the drinking water limits of WHO (2017), BIS (2012), and BDWS (1997), where only 29.41% of the Fe sample exceeded the standard drinking limits. According to the metal evaluation index (MEI) and degree of contamination (Cd), the groundwater of the study area is free from contamination but the metal pollution index (MPI) and nemerow pollution index (NI) exhibited little pollution in the middle of the western part of the study area. The hazard quotient (HQ) values revealed no oral and dermal health risk for individual metals (Cu, Zn, Fe, Mn). On the other hand, the hazard index (HI) values exhibited no risk for combined metals as none of the values exceeded the safety limit value of 1. According to the HQ and HI results, the deep groundwater on Hatiya Island is non-carcinogenic and risk-free for children and adults. However, children were more susceptible to oral health risks than adults. In contrast, adults were more vulnerable to dermal health risks than children.

## **KEYWORDS**

[drinking water](#)  
[pollution indices](#)  
[toxic elements](#)  
[Hatiya Island](#)

## 2. Assessment of Ecosystem Services, Plant Diversity Pattern, and Water Quality of an Urban Water Body in Dhaka, Bangladesh

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- Part of the [Advances in Science, Technology & Innovation](#) book series (ASTI)

### Abstract

The balance between open space and built environment is one of the key constituents of a sustainable city. The purpose of this research is to assess the ecosystem services, plant diversity pattern, and water quality of an urban green zone with a lake so that the adverse impact of encroaching these spaces can be scientifically proved. Dhanmondi Lake is one of the earliest examples of manmade water bodies in Dhaka City. A total of five provisioning services (fish, fruit, medicine, flower, and fuel), ten regulating services (photosynthesis, CO<sub>2</sub> sequestration, O<sub>2</sub> production, pollination, seed dispersal, air quality regulation, airflow, noise control, etc.), eighteen cultural services under four categories (relaxation, recreation and spiritual, social relation, economic, and academic) have been identified in the study area. Dhanmondi lake provides a huge range of habitat for fish (06), birds (18), and plant (34) species. The value of plant diversity in Dhanmondi lake is ranging from  $D = 0.72-0.93$  (out of 0–1). It indicates the rich plant diversity pattern. The quality of the lake water is quite decent. The slight deterioration in pH (7.3–8.5), DO (3.1–4.1 mg/l) and alkalinity (252–344 mg/l) is caused due to the anthropogenic activities around the lake. A brief Total Economic Value Framework has been produced to study the valuation of these Ecosystem Services. This study has the strength to re-

evaluate the importance and impact of the open spaces in an urban area. Also, it provides scientific evidence for new open space development for a sustainable smart city.

## **Keywords**

- Ecosystem services
- Plant diversity
- Water quality
- Dhanmondi lake

## **3. Household drinking water E. coli contamination and its associated risk with childhood diarrhea in Bangladesh**

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- DOI: [10.1007/s11356-021-18460-9](https://doi.org/10.1007/s11356-021-18460-9)

## **Abstract**

Faecal contamination (by *Escherichia coli* [*E. coli*]) of household drinking water can have adverse effects on child health, particularly increasing the episodes of childhood diarrhea; however, the evidence is scanty in Bangladesh. This study utilised data from the most recent nationally representative 2019 Multiple Indicator Cluster Survey to investigate the relationship between *E. coli* concentration in household drinking water and diarrheal episodes among children aged under-5 years in Bangladesh. Childhood diarrhea was identified by asking the children's mothers or caregivers if they had a diarrheal episode in the 2 weeks preceding the survey. *E. coli* colonies were counted as colony-forming units (CFUs) per 100 ml of water and classified into three risk groups (low: < 1 CFU/100 ml; moderate: 1-10 CFU/100 ml; and high: > 10 CFU/100 ml). The design-adjusted logistic regression was used to estimate the association between drinking water *E. coli* risk groups and childhood diarrhea, adjusting for potential confounders. We observed a significant association between household drinking water *E. coli* contamination and diarrheal episodes among under-5 children. Compared to the children from households with a low risk of *E. coli* contamination in drinking water, children from households with a moderate risk of *E. coli* contamination were 1.68 times more likely to have diarrhea, which was 2.28 times among children from households with a high risk of *E. coli* contamination. Findings of the study have significant policy implications and urge to ensure safe water supplies, improve water management practices and modify hygiene behaviours to reduce episodes of childhood diarrhea.

**Keywords:** Diarrhea; Drinking water contamination; *E. coli*; Under-5 children.

## **4. Groundwater quality and human health risk assessment in selected coastal and floodplain areas of Bangladesh**

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[Journal of Contaminant Hydrology, Volume 249](#)

## **Abstract**

Groundwater aquifers are a common source of drinking water in Bangladesh. However, [groundwater contamination](#) is a major public health concern across



the country. This research aims to examine the groundwater quality and health concerns using a random sampling process. Multivariate statistical and health risk analyses of elements were performed to determine the source of contaminants and their effects on human health. A total of 24 parameters were analyzed, where  $\text{Na}^+$ ,  $\text{NH}_4^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{F}^-$ ,  $\text{NO}_3^-$ , Mn, Fe, Se, U, and As concentrations were found to be high in different sampling points compared to the Department of Environment of Bangladesh (DoE), and the World Health Organization (WHO) groundwater quality standards. Principal Component Analysis (PCA) and Cluster Analysis (CA) identified the dominant and potential sources of contaminants in the groundwater aquifer, including geogenic, [salinity](#) intrusion, industrial, and agricultural. The results of the degree of contamination level ( $C_d$ ) and the heavy metal pollution index ( $HPI$ ) showed that 28% and 12% of the sampling points had high levels of heavy metal contamination, indicating a high risk for human health issues. Cr concentrations were found to have a higher carcinogenic (cancer) risk than As and Cd concentrations. Hazard quotient ( $HQ$ ) and hazard index ( $HI$ ) scores expressed the hazardous status and possible chronic effects in the context of individual sampling points. For both child and adults, 44% and 36% of the sampling points had a high  $HI$  score, indicating the possibility of long-term health risks for local populations.

## 5. Detection of Rotavirus Strains in Freshwater Clams in Japan

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[Food and Environmental Virology](#), 14(1)

## **Abstract**

Bivalve molluscan shellfish like clams and oysters, etc., are capable to bioaccumulate surrounding contaminants from waters into their digestive systems and posing serious threats of food poisoning. Detection of rotaviruses (RVs) in shellfish is of particular importance because RVs are prone to genome reassortment resulting in the emergence of new RV variants that may compromise vaccine safety. Herein, we have detected the wild-type RVs and Rotarix/RotaTeq vaccine strains in freshwater clams collected on the riverside, Kawasaki city, from July 2019 to January 2020 and correlated the detected genotypes with that of gastroenteritis cases of nearby clinics to understand the transmission of RVs in the environment. The wild-type RVs were detected in 62 (64.6%) out of 96 freshwater clams in every study month: July, September, November, and January that are considered as off-season for RV infections. The most frequent genotypes were G2 (42.9%), G8 (28.6%), G3 (14.3%), G1 (7.1%), and G10 (7.1%), which remained comparable with genotypic distribution found in the clinical samples over the last few years indicating that these RVs may accumulate in clams since a long time. However, G10 genotype was detected in clam but not in clinical samples suggesting the presence of asymptomatic infection or RVs could be carried out from a long distance. Importantly, vaccine strains, RotaTeq (1%) but not Rotarix (0%), were also detected in a clam. Attention must be paid to monitoring the potential transmission of wild-type and vaccine RV strains in the environment to prevent

the emergence of new variants generated from genome reassortment with vaccine strains.

**Keywords:** Clams; Clinical samples; Environmental samples; Rotavirus; Vaccine strains.