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FIELD STUDY AND CLINICAL CORRELATION OF WATER BORNE DISEASES IN DAKSHIN DINAJPUR, WEST BENGAL

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Abstract:

This study investigated the prevalence and impact of waterborne diseases (WBDs) in and adjoining areas of Balurghat, Dakshin Dinajpur, West Bengal, India. A survey of 180 respondents across 10 study sites in urban and rural areas was conducted using observational studies, household surveys, and hospital record reviews. The most common WBDs identified were diarrhoea, dysentery, typhoid, hepatitis, malaria, dengue, and skin infections. Diarrhoea was found to be the most prevalent disease. Analysis of hospital admission data from 2020-2024 revealed concerning trends, with significant increases in cases of diarrhoea (8,179 total admissions) and dengue (1,339 total admissions). Other diseases like typhoid, malaria, and tuberculosis also showed fluctuating but persistent presence. The study highlights the ongoing public health challenge posed by WBDs in the region, particularly in rural areas with limited access to clean water and sanitation. These findings underscore the need for improved water management, sanitation infrastructure, and public health interventions to address the burden of waterborne illnesses in Balurghat and similar regions.

Keywords: *Diarrhoea, Malaria, Typhoid, Water Borne Diseases, Water Contamination.*

1. Introduction

Waterborne diseases are illnesses caused due to consumption of contaminated water, either directly or through food made with it. Water contamination can happen when food or water for consumption is contaminated by an infected person or through surface contamination, which results in infection. Waterborne diseases are one of society's most persistent and economically disastrous biological threats. Lack of safe water results in untold suffering, diseases, infant mortality, stunted growth and economic loss. The significance of water for sustaining terrestrial life and its pivotal role in human endeavours, economic development, social well-being, and fundamental necessities such as nutrition and healthcare cannot be overstated. Nevertheless, ongoing industrial expansion and developmental activities pose a threat to the integrity of water resources through the introduction of various biological and non-biological pollutants. Waterborne pathogens have emerged as a critical global health

concern, with their presence detected across a spectrum of aquatic environments, encompassing freshwater ecosystems like rivers and lakes, as well as marine habitats and domestic water supplies (1).

Waterborne diarrhoea remains a prominent cause of mortality and sickness among children in developing nations, with 90% of diarrhoea fatalities occurring in children under five. Rural residents in developing countries use discharge near or around neighbouring shrubs and jungles for defecation, which results in faecal pollution of water in rural African and other developing-country locations (2). Common waterborne diseases include bacteria-caused diseases such as cholera, typhoid, and diarrhoea, protozoa such as amoebiasis, and viral diseases such as retroviruses, hepatitis A, hepatitis E, and polio infections. When measures are delayed, these pathogens may cause adverse effects on human health, such as disability, illness, disorders, or death (3). Transmission of these pathogens occurs while using infected water for drinking, food preparation, and washing clothes. Diseases like cholera, diarrhoea, dysentery, hepatitis A, hepatitis E, typhoid, and polio are all connected to contaminated water and inadequate sanitation (4). These maladies stem from a diverse array of infectious agents, including bacteria, viruses, protozoa, and parasites, primarily transmitted through the consumption of or contact with contaminated water, potentially leading to various health complications, notably gastrointestinal disorders. Cholera, hepatitis, shigellosis, typhoid, and acute diarrhoeal disease (ADD) are all prevalent waterborne illnesses in India. Between 2014 and 2018, these illnesses were responsible for about 11,728 deaths, with 10,738 of those deaths occurring after 2017(5).

Environmental dynamics contribute an additional layer of complexity to addressing WBDs. Pathogen behaviour can be markedly influenced by factors such as water quality, temperature fluctuations, and interactions with other microorganisms (6). The accurate replication of these dynamic environmental conditions within laboratory settings represents a critical challenge in bridging the gap between controlled research environments and real-world field conditions.

The aims and objectives of the research are to observe the incidence of water borne diseases in and around Balurghat town, to throw some light on prevention and spread of water borne diseases and to create awareness on health, access to safe water and sanitization in both municipality and rural areas of Balurghat.

In Balurghat region of Dakshin Dinajpur, West Bengal, waterborne illnesses pose a significant threat to public health, profoundly affecting the well-being of its inhabitants. The area encompasses a mix of urban and rural populations, with varying levels of access to clean water and proper sanitation. Consequently, diseases transmitted through water have emerged as a primary cause of sickness and death, especially among susceptible groups like children, seniors, and those in impoverished conditions. In Balurghat, prevalent illnesses include dysentery, typhoid fever, diarrhoea, and hepatitis A. Without prompt and effective treatment, these conditions can lead to severe dehydration, malnutrition, and potentially fatal outcomes.

Dakshin Dinajpur, located in West Bengal, has historically faced significant challenges related to waterborne diseases due to a combination of geographic and infrastructural factors. The region's abundance of rivers, ponds, and marshes, while vital for agriculture, has also contributed to the spread of diseases like cholera, dysentery, and typhoid, especially during the monsoon season..The consequences of waterborne diseases in Balurghat are extensive. Beyond the immediate health implications, these illnesses place a substantial strain on local healthcare systems, resulting in increased medical costs, work and school absenteeism, and diminished quality of life.

Children are particularly vulnerable to dehydration and malnutrition caused by diarrheal diseases, which can impede their growth and development.

2. Methodology

For survey of water borne diseases in Balurghat, Dakshin Dinajpur some rural areas like Dangi, Badbangi, Bannapara, Ajodhya, Amritokhondo, Bongi, Noksha, Amtoli, Chakram, Belin, Thakurpir, Danga and Khadimpur, Khidirpursosan of Balurghat municipality were selected as study area.

2.1 Description of study area

2.1.1 Khidirpur: As per the Census 2011 data, the village code for Khidirpur is 311150. This village is situated in the Balurghat subdivision of the Dakshin Dinajpur district in West Bengal, India. It lies 5.4 kilometers from Balurghat, which serves as both the district and sub-district headquarters for Khidirpur. The village spans a total area of 243.84 hectares.

2.1.2 Dangi: According to Census 2011 information the location Dangi village is located in Balurghat subdivision of Dakshin Dinajpur district in West Bengal, India. It is situated 6.3km away from Balurghat, which is both district & sub-district headquarter of Dangi village. The total geographical area of village is 195.08 hectares.

2.1.3. Badbangi: Based on the Census 2011 records, Badbangi village is identified by the code 311167. This village is part of the Balurghat subdivision within the Dakshin Dinajpur district of West Bengal, India. It is located 4.2 kilometers from Balurghat, which functions as the district and sub-district headquarters for Badbangi. The village covers a geographical area of 189.2 hectares.

2.1.4. Bannapara: According to Census 2011 information the location code or village code of Bannapara village is 311169. Bannapara village is located in Balurghat subdivision of Dakshin Dinajpur district in West Bengal, India. It is situated 3.7km away from Balurghat, which is both district & sub-district headquarter of Bannapara village. As per 2009 stats, Vatpara is the gram panchayat of Bannaparavillage.The total geographical area of village is 45.82 hectares.

2.1.5. Ajodhya: According to Census 2011 information the location code or village code of Ajodhya village is 311190. Ajodhya village is located in Balurghat subdivision of Dakshin Dinajpur district in West Bengal, India. It is situated 2.1km away from Balurghat, which is both district & sub-district headquarter of Ajodhya village. As per 2009 stats, Amritakhand is the Gram panchayat of Ajodhya village. The total geographical area of village is 208.91 hectares.

2.1.6. Noksha: According to Census 2011 information the location code or village code of Noksha village is 311170. Noksha village is located in Balurghat subdivision of Dakshin Dinajpur district in West Bengal, India. It is situated 7.4km away from Balurghat,which is both district & sub-district headquarter of Noksha village. The total geographical area of village is 287.91 hectares**.**

2.1.7. Chakram: According to Census 2011 information the location code or village code of Chakram village is 311182. Chakram village is located in Balurghat subdivision of Dakshin Dinajpur district in West Bengal, India. It is situated 9.2km away from Balurghat, which is both district & sub-district headquarter of Chakram village. The total geographical area of village is 120.26 hectares.

2.1.8. Belain: According to Census 2011 information the location code or village code of Belain village is 311162. Belain village is located in Balurghat subdivision of Dakshin Dinajpur district in West Bengal, India. It is situated

5.6km away from Balurghat, which is both district & sub-district headquarter of Belainvillage.The total geographical area of village is 117.09 hectares.

2.1.9. Danga: According to Census 2011 information the location code or village code of Danga village is 311196. Danga village is located in Balurghat subdivision of Dakshin Dinajpur district in West Bengal, India. It is situated 3.3km away from Balurghat, which is both district & sub-district headquarter of Danga village.The total geographical area of village is 218.05 hectares.

2.1.10. Jangalpur: According to Census 2011 information the location code or village code of Jangalpur village is 311201. Jangalpur village is located in Balurghat subdivision of Dakshin Dinajpur district in West Bengal, India. It is situated 5.9km away from Balurghat, which is both district & sub-district headquarter of Jangalpur village. The total geographical area of village is 77.8 hectares.

2.2. Survey methods

This study was designed to assess the diseases borne from water in human beings due to consumption of contamination or polluted water. Some specific areas were selected for survey.

2.2.1 Observational studies

Purpose: To assess the impact of water quality on disease transmission.

Method: a. Water usage behaviours and sanitary practices in households or communities was observed.

b. Factors like handwashing, water storage, or treatment methods and their relation to disease occurrence was explained for general awareness.

c. This was done through direct observation and in-depth interviews.

2.2.2 household surveys

Purpose: To assess water usage, quality, and disease incidence at the community level.

Method:

a. Household members were interviewed about their water sources, treatment methods, and sanitation practices.

b. Collected data on reported illnesses (e.g., diarrhoea, cholera) within the household.

c. This was done through semi structured questionnaires and face-to-face interviews.

2.2.3. Hospital records review

Purpose: To gather retrospective data on waterborne disease cases.

Method:

a. Reviewed health facility records (e.g., hospitals, clinics) for reported cases of WBD.

b. Correlated the incidence of diseases, water source, and water quality in the region.

c. This helped in understanding the disease burden and identifying high-risk areas.

2.2.4. Questionnaires for survey

A pre-made questionnaire was used to assess people's living conditions. The questionnaire contained questions about their lifestyle, and about one hundred eighty peoples were interviewed. The survey questions were in Bengali for ease of understanding of the respondents.

3. Results

The overall details of collected data from 180 respondents of 10 study sites have been tabulated below. In the Municipality area of Balurghat (Khadimpur and Khidirpur study sites) prevalence of diarrhoea, dysentery, typhoid and hepatitis was observed, whereas, in the Gram panchayet areas (Danga, Badbangi, Chakram, Dangi, Jangalpur,

Ajodhya, Noksha, Bannapara), diarrhea, dysentery, skin infection, malaria, dengue, typhoid, hepatitis were observed (Table 1). Diarrhoea was found to be the most prevalent disease. Analysis of hospital admission data from 2020-2024 revealed concerning trends, with significant increases in cases of diarrhoea (8,179 total admissions) and dengue (1,339 total admissions).

Table 1: Summary of information collected

Sl. No.	Names of study side	Number of people Interviewed	Prevalence of Disease	Remarks
1	Khidirpur	37	Diarrhoea	Unhygienic
2	Dangi	10	Typhoid	Poor water supply, drainage system
3	Badbangi	12	Diarrhoea	Contaminated water source
4	Bannapara	2	Dengue	Poor sanitation, Unhygienic
5	Ajodhya	19	Diarrhoea	Unhygienic
6	Naksha	16	Dengue	Poor Drainage system
7	Chakram	20	Typhoid	Unhygienic
8	Belain	14	Diarrhoea	Contaminated water source
9	Danga	38	Tuberculosis	Contaminated water source
10	Jangolpur	12	Dengue	Poor Drainage system, Unhygienic

Following is the graphical presentation of the observation in the study (Fig.) area as well as the incidence wise clinical data (2020-2024) observed in the Government hospital, Balurghat, Dakshin Dinajpur, West Bengal (Fig.2).

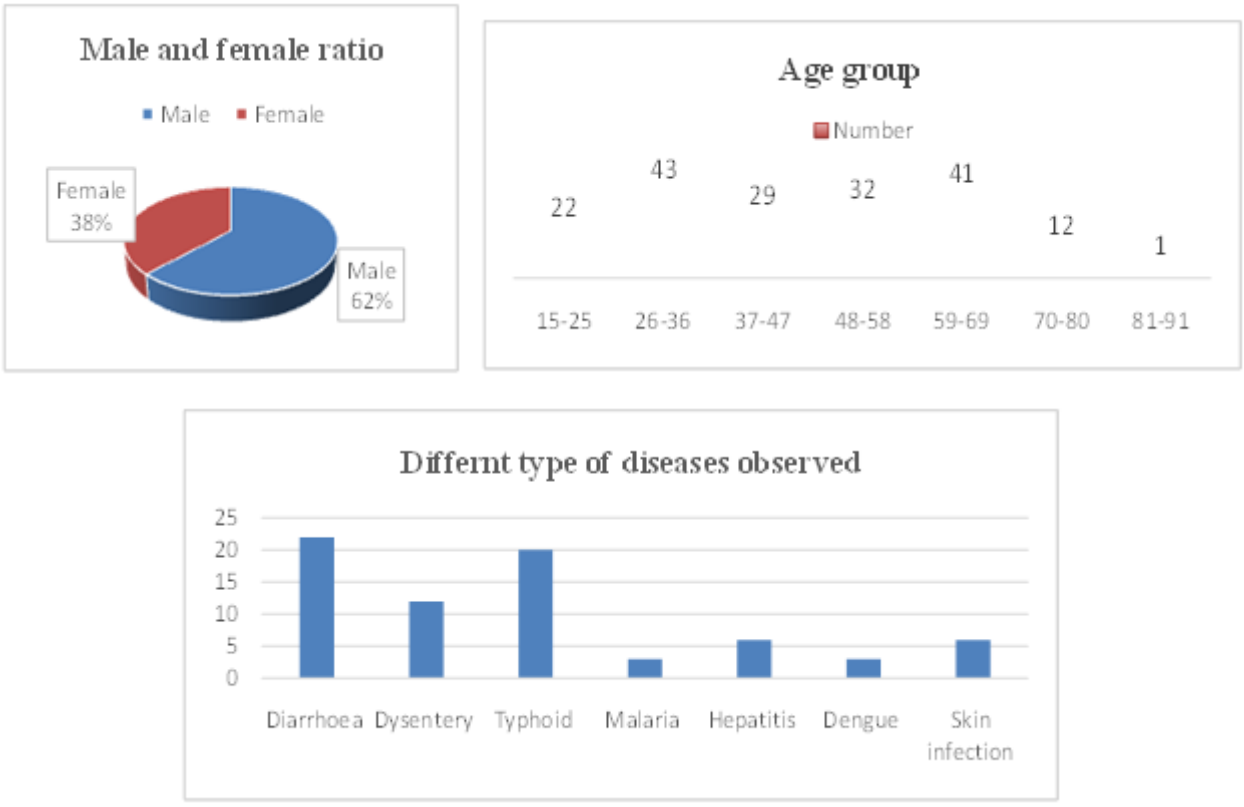

Figure 1: Male – Female ratio, Age group, Different type of diseases observed in study areas

Figure 2: Collection of data from the Hospital for WBD

4. Discussion

Globally, waterborne illnesses are a major public health concern, especially in areas with poor access to clean water and sanitary facilities. Three water-related illnesses are the world's largest cause of death, taking 1.8 million lives annually, according to UNICEF.

This study reveals majority of outbreaks, though infrequent, are usually associated with sewage-contaminated or inadequately treated water. Contaminated water sources serve as the primary reservoir for various contaminants, including bacteria, viruses and chemicals. These contaminants can enter the human body through ingestion, inhalation, or contact with contaminated water. Inadequate sanitation and poor hygiene practices further facilitate

the spread of waterborne diseases. Waterborne infections continue to present a substantial impediment to achieving ambitious public health objectives. The intricacy of water-borne pathogens introduces multifaceted biological challenges for researchers, demanding comprehensive expertise in microbiology, biochemistry, and genetics, as well as cutting-edge technological tools.

As evident from the field studies, many rural areas in Balurghat lack sufficient infrastructure for water purification and sanitation. While urban regions may have some access to piped water systems, rural areas frequently rely on open wells, hand pumps, and natural water bodies, which are prone to contamination. Moreover, the scarcity of healthcare facilities and limited awareness about hygiene and sanitation practices exacerbate the spread of waterborne diseases. Many residents in these areas are unaware of the importance of safe water storage, proper hand-washing techniques, or the necessity of boiling water before consumption. The prevalence of waterborne intestinal pathogens such as bacteria, viruses and protozoa in domestic water sources poses a serious health risk to humans (7). In spite of ongoing advancements in drinking water treatment and public health regulations, Legionnaires' disease is becoming one of the primary causes of waterborne disease-related hospitalizations and deaths in the United States (US). Legionella spp. thrives in engineered water systems, and growing evidence suggests that climate-related environmental shifts are enhancing conditions that support their survival, spread, and human contact (8).

The need for clean drinking water has grown in importance over the past few years due to the world's population, civilisation, and contamination sources. Numerous aquatic illnesses, including those linked to microbes or disinfectants, affect millions of people annually (9).

Every year, millions of people suffer from gastrointestinal infections and other disorders caused by microbial pollutants such bacteria (*Escherichia coli, Vibrio cholerae, Salmonella* spp.), viruses, and protozoa (*Giardia lamblia, Cryptosporidium parvum*). The assessment emphasizes the importance of better water management, stricter pollution regulations, and the development of innovative treatment technologies to reduce waterborne diseases. Addressing these concerns is critical for protecting public health, especially in areas prone to water scarcity and microbiological pollution (10).

Environmental factors further complicate the management of these pathogens. In Balurghat region of Dakshin Dinajpur, West Bengal, WBDs affecting vulnerable populations and causing illnesses such as diarrhoea, cholera, dysentery, typhoid fever, and hepatitis A (Fig.2), pose challenges which requires innovative research, improved diagnostic methods, and targeted interventions to enhance water quality and sanitation. By focusing on these efforts, it is possible to mitigate the impact of WBDs and improve public health outcomes in Balurghat and similar regions worldwide. In this investigation, similar factors causing water borne diseases was observed in rural as well as municipality areas. However, in outskirts the prevalence of diseases was more than in the town. A study revealed the prevalence of water-borne disease among the elderly is higher in rural areas (22.5%) than in urban areas (12.2%) (11). Important factors influencing the prevalence of water-borne illnesses in India's senior population include the participant's sex, educational and employment position, BMI, housing type, type of lavatory and water source.

Conclusion

Despite numerous initiatives by the Government at various levels and other organizations focused on water safety, waterborne diseases remain a significant public health and environmental issue. The lack of piped water and the

reliance of rural residents on surface water, which is frequently contaminated with faecal matter, are undoubtedly the primary reasons for the increasing prevalence of these diseases. The availability of water and poor hygiene practices among these rural populations are also critical concerns, as they significantly contribute to the spread of water-washed diseases. Additionally, poor environmental practices that promote the breeding of insects and other vectors in residential areas further exacerbate the prevalence of waterborne diseases. More research is needed to tackle the problem and raise awareness among the local population about the causes, incidence, sanitation, environmental cleanliness, and treatment strategies. Collaborative efforts among local Government, health authorities, and community organizations are crucial in addressing these ongoing public health challenges in Balurghat.

Efforts to curb the spread of waterborne diseases in Balurghat should focus on developing sustainable water management systems and community-based hygiene education programs. Government and non-Government organizations should work together to enhance access to clean water, build proper sanitation facilities, and promote public health awareness. Furthermore, regular monitoring of water sources and the implementation of early-warning systems for contamination can be vital in preventing outbreaks. The Government has introduced various initiatives to tackle these persistent water-related health issues, including the installation of deep tube wells and arsenic removal plants. However, the effectiveness of these measures has been limited due to inadequate maintenance and the continued use of contaminated surface water sources by many residents. Community-based interventions, such as promoting household water treatment methods and improving hygiene practices, have shown promise in reducing the incidence of waterborne diseases in some areas of Dakshin Dinajpur.

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