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First Evidence of Bacterial Contamination in Drinking Water Sources of Goalpara District of Assam

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Abstract The aim of this study was to evaluate the bacterial contamination of drinking water collected from various sources of Goalpara district, Assam, India. E.coli, Klebsiella, Streptococci and enterococcus was isolated. The bacteria showing highest rate of infection belongs to the Enterobacteriaceae family. E. coli, the highest and Enterococcus shows the lowest numbers of contamination in this study. Balijana block was recorded as the highest contaminated area and stream water was recorded as the highest contaminated source. The data shows that the cause of contaminated drinking water in this area is due to poor sanitation, as well as unawareness about personal hygiene and cleanliness. The presnece of this bacteria in the drinking water increases the risk of water borne diseases and health issues.

Keywords: *drinking water, bacterial contamination, coliform bacteria, water borne diseases*

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1. Introduction

Goalpara is situated in the bank of Brahmaputra river and is endowed with scenic beauty. Hulukanda hill, located in the heart of Goalpara near the Brahmaputra river, is one of the natural scenic views in the town with various kinds of waterfalls and animals. There are other water bodies such as Hasila Lake, KumriLake and UrpadLake and many unnamed. The UrpadLake becomes the center of migratory birds from October till March. The evergreen forests on low hills create an undulating landscape. Goalpara district consists of Eight (8) development blocks- Kucdhowa, krishnai, Balijana, Kharmuja, Jalwswar, Lakhipur, Matia, Rangjuli. [1] As in other rural areas of India, Goalpara is also facing the issue of contamination of drinking water from a very long time.

Water contamination has a long presence in human history, with descriptions in the Sushruta Samshita about water-borne diseases resembling cholera in an Indian text written in Sanskrit as early as 500-400 B.C. [2] The inadequate availability of water, poor quality of water at source, ill-maintained water pipelines, unsafe despising of animal, human and household wastes, unawareness about good sanitation and personal hygiene etc. are some key factors responsible for poor drinking water quality in rural areas of India. [3] The infectious diseases caused by pathogenic bacteria, viruses and parasites are the most common and widespread health risks associated with drinking water in rural habitation. [4] The quality of the drinking water can be checked by its microbial examination. [5] The greatest risk from microbes in water is associated with consumption of drinking water that is contaminated with human and animal excreta, although other sources and routes of exposure may also be significant. [6]

The bacterium, E. coli, is considered as a bio indicator for faecal contamination of drinking water. It is excreted in the faeces of all warm blooded animals and some reptiles. The major pathogenic bacteria responsible for water borne diseases are spread by the faeco-oral route, in which water may play an intermediate role. [7] The public health burden is determined by the severity of the illnesses associated with pathogens, their infectivity and the population exposed. [8] Therefore, there has been an increasing interest in the application of quantitative risk assessment for microbial load in drinking water sources. [9]

The aim of this study to observe the quality of drinking water of Goalpara district and to evaluate if the water sources are contaminated with coliform or fecal coliform bacteria. We also try to find out the rate of bacterial contamination of drinking water source wise and area wise as we are getting reports of various water borne diseases especially from the rural areas of the district.

2. Materials and Methods

2.1. Study Area

The study was conducted in various areas of Goalpara district under Eight (8) development blocks- Kucdhowa,

krishnai, Balijana, Kharmuja, Jalwswar, Lakhipur, Matia, Rangjuli. Geographically Goalpara is located between North Longitudes of 25° 53' and 26° 15' and East Longitudes of 90° 07' and 91° 05'. The total human population of the district is a about 10,08,183 according to the 2011 census and it is ranked in 10th position in population at state level and constitutes 3.23% of state population.

The primary source of water in this district is mainly rain, river and streams as the district is also shares its boundary with Meghalaya, a hilly state. The study was conducted for an year from March' 2019 to April' 2020 which includes all the seasons.

2.2. Sample Collection and Processing:

A total of 194 samples were collected from various drinking water sources of Goalpara district in wide mouth autoclavable glass bottle of 1 L capacity by following WHO standard procedures. The water samples were collected aseptically and sample collectors are instructed to wear sterile surgical gloves during the sampling process. The sample containers were kept in airtight large ice-box by maintaing the temperature between 2-8°C and transported to the laboratory within 6 hours of their collection for further processing. [10]

Total coliforms are detected by MPN method and bacteria were isolated by spread plate method in Nutrient agar and MacConkey's agar media. [11] Suspected colonies of coliform groups are further identified on the basis of morphological, cultural and biochemical cheracteristics. [12]

3. Results

Out of 194 samples 52 samples were found positive for MPN test. E. coli, Klebsiella, Streptococci and Enterococcus were isolated from various sources of drinking water. E.coli is the primary organism isolated.

Table 1. Rate of isolated bacteria from the Positive water samples

Sl no	Isolated coliform bacteria	No of Positive samples	% of Positivity
1	E.coli	38	73
2	Klbsiella spp.	8	15.38
3	Streptococci	4	7.69
4	Enterococcus	2	3.84

Maximum number of water samples were collected from Matia block. Balijana block shows the highest rate of positivity with 30.36% whereas lowest positivity rate was found in Kusdhowa block (0.0%) though least numbers of water sample were collected from Kusdhowa.

Table 2. Block wise rate of contamination

Sl no	Block (Area)	No of samples	No of positive sample	% of Sample collection on total sample collected	% of contaminated sample area wise	% of contaminated sample on total sample collected
1	krisnai	35	5	18.04	14.29%	2.58%
2	balijana	16	6	8.24	37.50%	3.09%
3	kharmuja	11	3	5.67	27.27%	1.55%
4	jaleswar	19	5	9.79	26.32%	2.58%
5	lakhipur	26	8	13.40	30.77%	4.12%
6	matia	56	17	28.86	30.36%	8.76%
7	rangjuli	27	8	13.91	29.63%	4.12%
8	kusdhowa	4	0	2.06	0.00%	0.00%

Again, water samples from Reservoir (Pond) shows highest rate of contamination (75%), followed by stream (66.67%), dugwell (38.10%), borewell (9.09%) and tubewell(6.33%).

Table 3. Source wise rate of positivity

Sl no	Source	No of samples	No of positive sample	% of sample collection on total	% of contaminated sample source wise	% of positivity on total sample collected
1	Borewell	22	2	11.34	9.09	1.03
2	Tubewell	79	5	40.72	6.33	2.58
3	Dugwell	63	24	32.47	38.10	12.37
4	Stream	18	12	9.28	66.67	6.19
5	Reservoir (Pond)	12	9	6.19	75.00	4.64

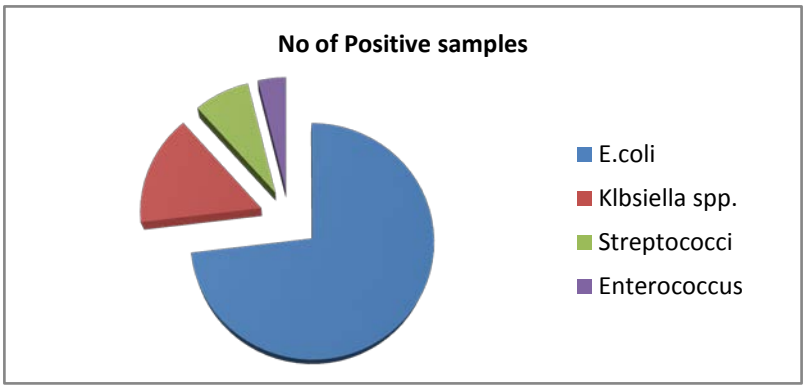

Figure 1. Percentage of Isolated Coliforms

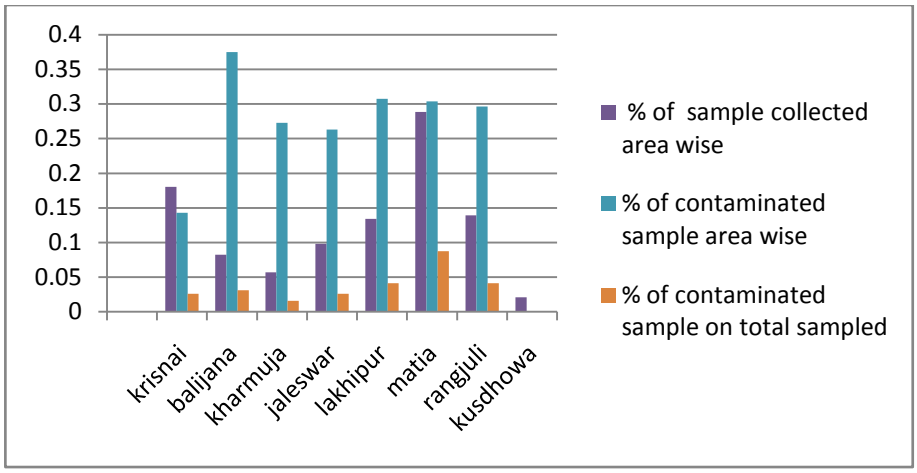

Figure 2. Rate of contamination (area wise)

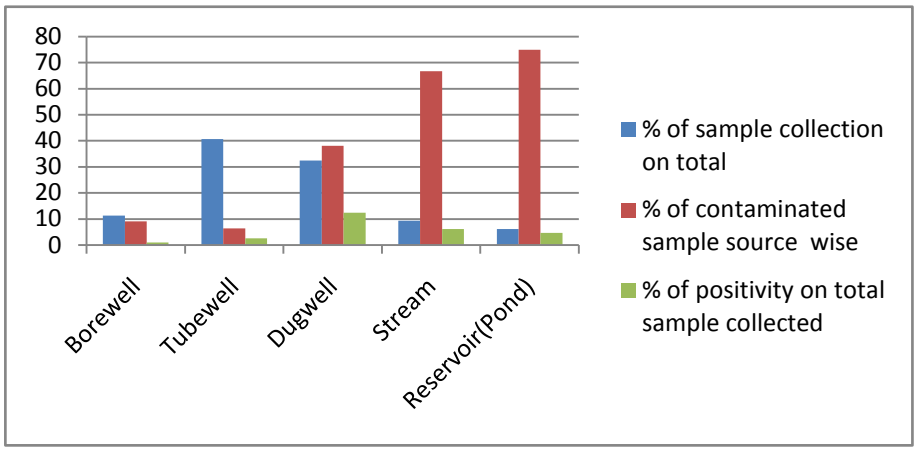

Figure 3. Rate of Contamination (sorce wise)

4. Discussion

The traces of contamination is found in each and every area of goalpara district either it may be total coliform or fecal coliform. Our data shows the importance of core attention to house hold contamination, environmental sanitation control and to increase the awareness about water contamination.

In our study highest rate of contamination was seen in resorvoir water i.e. pond as shown in Table 3, followed by stream water, dugwell and tube well respectively. Tube well was safest source of water as compared to other sources. Similar findings were seen in a study conducted by James Okot Okumu and Jaocob Otim in some regions of Uganda. They also found highest rate of contamination in surface water and spring.

E.coli was isolated as the primary organism from most of the water samples collected in our study. Other organisms isolated were Klebsiella, Enterococcus and Streptococcus. In a study conducted by Yassir Mohammed Eltahir and Amira Ahmed in South Darfur, Sudan found E.coli as the main organism followed by Enterococcus.

5. Conclusion

The contamination of drinking water is a serious issue as it is directly related to various water borne diseases. The data defines that the quality of drinking water used by the people of Goalpara district is unhygenic and unacceptable. As most of these samples were collected from the rural areas, we have to focus on improving the sanitation habits by generating awareness to inculcate washing of hands, covering of wells or reservoirs, drinking boiled water, using of filter etc. In some of the areas same water source is used for drinking as well as for all household works, such as washing cloth and utensils including bathing of cattles. So by adopting proper sanitary measures we can improve the qualityof drinking water and thus consequently prospering the life style of the people of Goalpara.

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Photos during sample collection:-