

# Bacteriological Assessment of Drinking Water Supplied Inside the Government Schools of Patna District, Bihar, India

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**Abstract** Contamination in drinking water comes in several ways in which soil and fecal contamination are major with respect to microbial agents. The aim of the study was to assess the contamination status of drinking water use by the students in government schools of Patna district, Bihar India. Total 12 samples of 9 government schools were collected aseptically in a 60ml sterile plastic container for bacteriological analysis to determine their suitability for drinking. Water samples were collected aseptically into 60ml sterile plastic container at 9 different government school campus. Twelve samples were subjected to microbiological analysis in order to evaluate the quality of potable water in circulation within the school and identify its sources of contamination. Most probable number or multiple tube tests was applied to detect the presence of coliform in a drinking water sample. Analysis was performed using culture and biological methods. Out of 12 samples, 9 samples show high MPN value. Biochemical test confirms the presence of bacteria like “*staphylococcus*, *klebsiella*, *salmonella*” etc, are absorbs in the water samples. This study emphasizes the need for regular monitoring of water Supply system inside schools.

**Keywords:** Patna, bacteriological analysis, most probable number, schools, drinking water, biochemical test

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## 1. Introduction

Life of all living organisms exists in water and for a healthy life, pure and safe drinking water is necessary [1]. In developing countries major deaths related to water born diseases caused due to consumption of contaminated water [2]. Drinking water obtained from various sources, in which surface and ground water sources are major, pathogens enter in water supply through the faecal matter of infected persons and transmitted to others. It causes many diseases like cholera, typhoid fever, dysentery, etc., [3]. So, Drinking water contaminated with microbes persists as a threat to people’s health and proper monitoring is required especially in developing countries including India.

Considering the nature of our Patna municipal setting where water distribution system is mostly compromised with polluted water seeping into water supplies, it is significant investigating there schools water supply for possible microbial contaminations to prevent infections among students in future.

Therefore the objective of this study was to assess the microbial contamination status of drinking water supply in selected Government schools in Patna district, Bihar, India.

## 2. Materials and Methods

A total of 12 drinking water samples were collected and represented in Table 1, from each sources according WHO guidelines for drinking water quality assessment a period of one month August 2017. Analytical works were carried out in the laboratory of the Department of Biotechnology, A.N. College in Patna.

### 2.1. Study Site

Study site Patna is situated between 24° 97’ - 25° 57’ North latitude and 84° 44’ – 86° 49’ East longitude at an elevation of about 129 meters above mean sea level. In the national physiographic, its mainland is sandwiched between the high Himalayan ranges in the far north and the hilly tracts of Chota Nagpur in the south (now in Jharkhand state). The most significant feature of the city is its linear characters. It is about 20 km long (from east to west) and 4 km width (from north to south).

### 2.2. Determination of Bacteriological analysis

Bacteriological analysis was carried out for indicator organism i.e. Total and Fecal coliform [4]. Using 10.3 g of

MacConkey broth were dissolved in 100 ml of distilled water and was autoclaved at 121°C for 15 minutes and then cooled at room temperature. Ten ml of this solution was filled in test tubes and a Durham's tube was added in an inverted position in each test tube plugged with non absorbent cotton plug. Again 5.15 g of MacConkey broth was dissolved in 100 g of distilled water and was autoclaved at 121°C for 15 min and then cooled in room temperature, 10 ml of this solution were filled in test tubes and a Durham's tube was added in inverted position in each test tube plugged with non absorbent cotton plug. Fifteen tubes MacConkey broth (Hi media Pvt. Ltd, Mumbai) arranged in three sets of test tubes. First set containing 10 ml of double strength MacConkey broth was inoculated with 10 ml of water sample. Second set containing 10 ml of single strength MacConkey broth was inoculated with 1 ml of water sample. Third set containing 10 ml of single strength MacConkey broth was inoculated

with 0.1 ml of water sample, respectively, were incubated, in an incubator at 37°C for 48 hours. After incubation, the acid and gas production had occurred in the form of bubble was counted and the MPN of coliform in 100 ml water sample were estimated [5].

The analysis is usually performed using culture and biochemical (Indole, Methyl Red Test and Citrate Test) test are represented in Table 4.

### 3. Result and Discussion

Twelve water samples from 9 different government schools were analysed using MPN method [6]. After determinant of MPN number of positive sample, for organism identification do the culture & for species identification the biochemical (Indole, Methyl Red Test and Citrate Test) test as per WHO guideline was performed [7]. Results are enlisted in Table 2.

**Table 1. Source of drinking water from different Schools**

S.No	Name of School	Water Type
1	Shastri Nagar Girl's High School	Hand Pump
2	Shastri Nagar Girl's High School	Municipal Supply Water
3	Shastri Nagar Girl's High School	Hand Pump
4	K.B. Sahay High School	RO water system
5	Miller High School	RO water system
6	Govt. School Adalat Ganj	Hand Pump
7	Govt. School Adalat Ganj	RO water system
8	Rabindra Balika High School	Municipal Supply Water
9	Rabindra Balika High School	RO water system
10	Patna Muslim High School	Municipal Supply Water
11	B.N Collegiate School	Municipal Supply Water
12	Bankipore Govt. Girl's High School	Municipal Supply Water

**Table 2. Biochemical analysis**

S.No	MPN	MPN Index	Indole Test	Citrate Test	Methyl Red Test
1	5-5-5	>1,600	-ve	+ve	+ve
2	5-5-4	1,600	-ve	+ve	+ve
3	5-5-5	>1,600	-ve	+ve	-ve
4	5-5-5	>1,600	-ve +ve	+ve -ve	-ve -ve
5	5-3-2	140	-ve	+ve	-ve
6	5-5-2	500	-ve	+ve	+ve
7	5-2-1	70	-ve	+ve	-ve
8	5-5-2	50	-ve	+ve	+ve
9	5-5-5	>1,600	-ve	+ve	+ve
10	5-5-5	>1,600	-ve	+ve	+ve
11	5-5-3	900	-ve +ve	-ve -ve	+ve +ve
12	5-5-2	90	-ve	+ve	-ve

Note : Positive reaction (+) and Negative reaction (-).

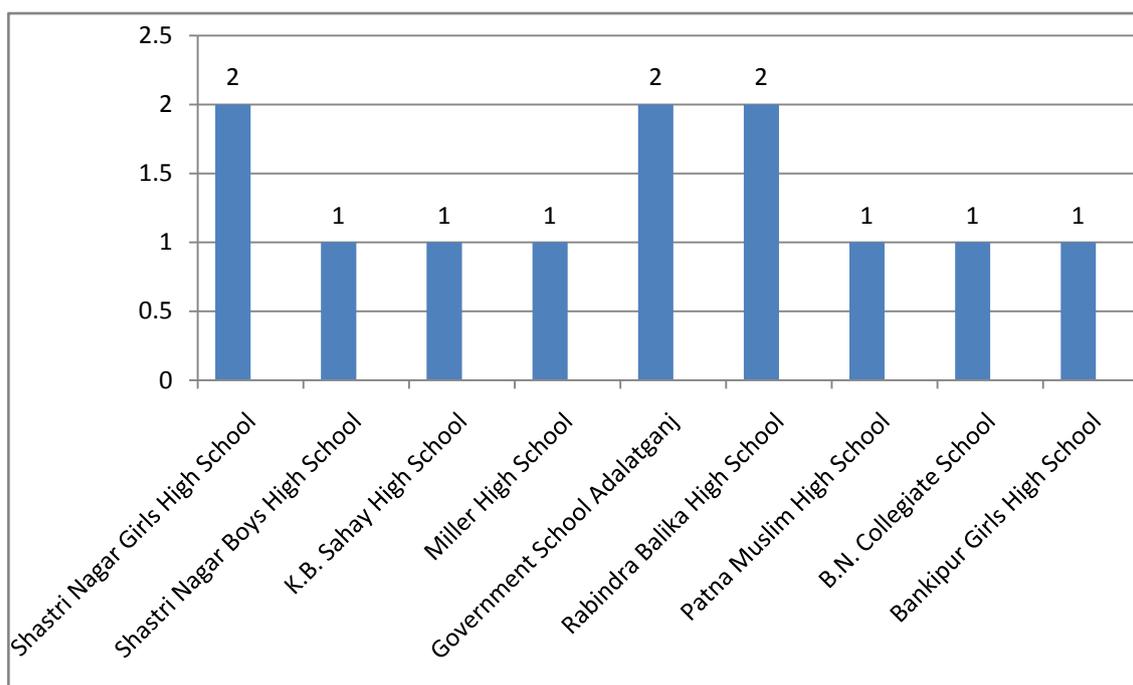
**Table 3. Bacterial Species found in the drinking water.**

Serial Number	Indole Test	Citrate Test	Methyl Red Test	Possible species
1	-	+	+	<i>K.pneumoniae</i>
2	-	+	-	<i>Pseudomonas</i>
3	-	+	+	<i>Salmonella</i> species
4	+	-	+	<i>E. coli</i>
5	D	-	+	<i>Shigella</i> species
6	-	+	-	Enterobacter species

Note: D = Different strains give different results.

**Table 4. Biochemical characterization**

S.No	Name of Test	Result Indication	Type of Bacteria
1	MPN	(-ve) Red/(+ve) Color Change	Coliform
2	Indole Test	(-ve) Pale yellow/(+ve) Red	Enterobacteriaceae ( <i>E.coli</i> ), <i>Klebsiella</i> , <i>Proteus</i> , <i>Enterobacter</i> , etc.
3	Citrate Test	(-ve) Green/(+ve) Blue	<i>Salmonella typhi</i> and <i>Escherichia aerogen</i>
4	Methyl Red Test	(-ve) Yellow/(+ve) Red	<i>E.coli</i> , <i>Bacillus</i> , <i>Proteus</i> , <i>Staphylococcus</i>

**Figure 1.** Biochemical test 1.MPN test, 2. Methyl red test and 3. Citrate test**Figure 2.** Number of water sample from different schools

Out of 12 samples 09 samples show exceeded MPN value which indicates presence of coliform. Bacterial species isolated from drinking water are enlisted in [Table 3](#). Different biochemical test for confirmation of different bacterial species were performed and enlisted in [Table 4](#).

#### 4. Conclusion

MPN and Biochemical test have been used extensively as a basis for regulating the microbial quality of drinking

water. In this study regulatory parameters were excessively above the WHO guidelines. The result of this study indicated that most of the sample highly contaminated. Finding of pathogenic microbes in water sample of different schools shows hazardous situation for waterborne epidemics among students. Drinking water source inside school get polluted with bacteria may be either due to malfunctioning of treatment plant or to the infiltration of sewage water through cross connecting leakage prints and back siphonage.

The result clearly showed that the quality of water consumed is precarious in controlling borne diseases

among students. About 80 % of all disease in developing countries caused due to unsafe water supply and insanitation according to WHO. In urban areas it is a major task to control the drinking water quality in distribution network. Regular monitoring of the water quality prevents disease and hazards.

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