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CHEMICAL ANALYSIS OF DIFFERENT WATER SAMPLES AND ISOLATION AND CHARECTERIZATION OF BACTERIA

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ABSTRACT: The health burden of poor water quality is enormous. It is estimated that around 37.7 million Indians are affected by waterborne diseases annually, 1.5 million children are estimated to die of diarrhoea alone and 73 million working days are lost due to waterborne disease each year. The resulting economic burden is estimated at $600 million a year. The problems of chemical contamination is also prevalent in India with 1,95,813 habitations in the country are affected by poor water quality. The major chemical parameters of concern are fluoride and arsenic and many more chemicals and metals are a major problem due to rapid industrialization. To evaluate the quality of drinking water, wer collected river water, mineral water and ground water (bore) and tap water. A total of 18 samples were collected and physical, chemical parameters and microbiological studies were done. Coliform detection was done by presumptive test using lactose bile broth. Out of 18 samples, 10 were positive for presumptive test and 8 samples were negative. All the tubes were noted for MPN index and positive samples were streaked onto Eosine Methylene Blue (EMB) agar medium and total of ten bacterial colonies with different colony morphologies resembling E. coli (green metallic sheen), lactose fermentors (Klebsiella and Enterobacter), non-lactose fermentors (Pseudomonas), and one Proteus and *Salmonella enteritidis* wer obtained.
Key words: water analysis, *Pseudomonas, Salmonella enteritidis,* water quality index

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INTRODUCTION

Water contamination refers to degradation of water quality from a public health or ecological view point. A pollutant is any biological physical and chemical substance that is present in an identifiable surplus and is known to be injurious to other desirable living organisms [1-4]. Water pollutants include heavy metals, sediments, certain radioactive isotopes, phosphorus, nitrogen, sodium, arsenic, heat, fecal coliforms bacteria, other pathogenic bacteria, virus and protozoan pathogens. The pollution of municipal water by human and animal sources is the major threat to the public health in poor countries. Water contaminated with excreta from animal or anthropogenic sources, which may be the carrier or active cases of infectious diseases serve as the vector of disease [5]. Consumption of that water in any respect may cause the fatal disease [6, 7]. Fresh water is precious resource that must be conserved and closely monitored for chemical pollutants and microbial contamination [8]; because surface waters are uncovered to environmental elements like wild life droppings, urban and agriculture run-off and they require extensive treatment. When the rain water flows as run-off, it passes through the ground surface and gets collected in rivers, lakes and ponds. On its way, the water gets polluted by dangerous salts, acids, minerals, and pathogenic bacteria and radioactive. Substances [9].

Polluted water is a major vehicle of a number of water borne diseases that have shaped history in the past and will surely continue to do so in the future. In world today the waterborne diseases are the major health concern. Approximately 4 billion cases of diarrheal diseases reported which represent 5.7% of the worldwide disease burden in the year 2000 (WHO 2000). Post-collection pollution may results in the failure of measures taken to prevent contamination at the source level. To avoid this problem care must be taken during collection and storage of drinking water and to ensure the safe quality of water at point of use. Further to control this problem of contamination the protected sources i.e. boreholes, stand pipes or wells should be established for water quality improvement. It has observed that the drinking water gets more contaminated at household level than sources, which indicates the contamination during collection of water [10]. The polluted water can result into major epidemics of waterborne disease by waterborne bacterial pathogens . Human excreta are the major source of waterborne infection. Bacteria capable of growing in clean water include 1.Burkholderia pseudomallei, 2. Naegleria fowleri 3. Atypical Mycobacteria and 4. Legionella [11-15].

Historically, improvement of principles, rules and regulations associated to drinking water quality targeted water distribution systems. In the nineteenth century in Europe, this was to find out the solution to problems of waterborne epidemics of infectious disease [16-18]. For the provision of safe drinking water, the guideline standards for drinking water were established. The filtration and, later, disinfection techniques were adopted to control the pollution of drinking water. The term indicator was emerged for indication of the occurrence of fecal coliforms as well as pathogenic bacteria in drinking water. This technique was adopted for analysis of possible presence of bacterial pathogens [19]. World Health Organization (WHO) has promoted this idea to control drinking water quality , quality of recreational water and the quality of wastewater reused in agriculture. Assessment, safety and water treatment procedures are given priority. Suitability of water quality is established by turbidity, pH, indicator bacteria, and free residual chlorine for drinking waters and for wastewater reuse the enteric helminths count and trematode eggs are used as a standard method. In several countries, risk assessment is done to establish drinking water treatment needs on the basis of disease from reference pathogens. Isolation and control of indicator bacteria have played effective roles in reducing the incidences of epidemics by waterborne bacterial pathogens.. However, the volume of water examined by taking 31 irregular 100 ml water samples from a large water body frequently only represents a millionth of 1% of total water body. Hence the absence of indicator in these little samples may not report their actual concentration in the water. To determine the fecal contamination of water, the organisms used are known as indicator organisms which become the indication of fecal contamination. This kind of contamination by any pathogenic microorganisms that occur in intestinal tract of the human and animals may too be present in water.

MATERIALS AND METHODS

Water Samples Collection:

Water (River, Mineral and Tap and Bore) samples, 18 in number were collected from different areas. River samples were collected from Godavari, manjeera and Krishna (both filtered and unfiltered: total 6 in No.) Mineral water samples were collected from Aquafina, Oora, Biselari, Kinley, TATA water plus and Aqua safe (total 6 in No.). Tap and bore water were collected from BHEL Tap, BHEL Bore, Tarnaka Tap, Tarnaka Bore, Saidabad Tap and Saidabad Bore (6 in No.).

Physical and chemical analysis of water samples

All the methods used for water analysis used are as follows and are acoording to the methods prescribed in in the 'Standard Methods for the Examination of Water and Wastewater' (Standard Methods 19th edition, APHA, AWWA, WEF, 1995).

Physio- Chemical Parameters:

It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested with different physic-chemical parameters. Selection of parameters for testing of water is solely depends upon for what purpose we going to use that water and what extent we need its quality and purity. Water does content different types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Some physical test should be performed for testing of its physical appearance such as temperature, color, odour, pH, turbidity, TDS etc, while chemical tests should be perform for its BOD, COD, dissolved oxygen, alkalinity, hardness and other characters. For obtaining more and more quality and purity water, it should be tested for its trace metal, heavy metal contents and organic i.e. pesticide residue.

It is obvious that drinking water should pass these entire tests and it should content required amount of mineral level. Only in the developed countries all these criteria's are strictly monitored. Due to very low concentration of heavy metal and organic pesticide impurities present in water it need highly sophisticated analytical instruments and well trained manpower. In this study we tested different physic chemical parameters monitoring quality of water.

pH

pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water. pH was positively correlated with electrical conductance and total alkalinity.

EC (Electrical Conductivity)

Conductivity shows significant correlation with ten parameters such as temperature, pH value, alkalinity, total hardness, calcium, total solids, total dissolved solids, chemical oxygen demand, and chloride and iron concentration of water.

Alkalinity

It is composed primarily of carbonate (CO_3^{2-} and bicarbonate (HCO3-), alkalinity acts as a stabilizer for pH. Alkalinity, pH and hardness affect the toxicity of many substances in the water.

Sulphate

It is measured by nephelometric method in which the concentration of turbidity is measured against the known concentration of synthetically prepared sulphate solution. Barium chloride is used for producing turbidity due to barium sulphate and a mixture of organic substance (Glycerol or Gum acetia) and sodium chloride is used to prevent the settling of turbidity.

Ammonia (Nitrogen)

It is measured spectroscopically at 425 nm radiation by making a colour complex with Nessler's reagent. The conditions of reaction are alkaline and cause severe interference from hardness in water.

Calcium

It is measured by complexometric titration with standard solution of ETDA using Patton's and Reeder's indicator under the pH conditions of more than 12.0. These conditions are achieved by adding a fixed volume of 4N Sodium Hydroxide. The volume of titre (EDTA solution) against the known volume of sample gives the concentration of calcium in the sample.

Magnesium

It is also measured by complexometric titration with standard solution of EDTA using Eriochrome black T as indicator under the buffer conditions of pH 10.0. The buffer solution is made from Ammonium Chloride and Ammonium Hydroxide. The solution resists the pH variations during titration.

Sodium

It is measured with the help of flame photometer. The instrument is standardized with the known concentration of sodium ion (1 to 100 mg/litre). The samples having higher concentration are suitably diluted with distilled water and the dilution factor is applied to the observed values.

Potassium

It is also measured with the help of flame photometer. The instrument is standardized with known concentration of potassium solution, in the range of 1 mg to 5 mg/litre. The sample having higher concentration is suitably diluted with distilled water and the dilution factor is applied to the observed values.

Chloride

It is measured by titrating a known volume of sample with standardized silver nitrate solution using potassium chromate solution in water or eosin/fluorescein solution in alcohol as indicator. The latter indicator is an adsorption indicator while the former makes a red colored compound with silver as soon as the chlorides are precipitated from solution.

Silicates & Phosphate

These are also measured spectroscopically. Yellow colour is developed from the action of phosphates and silicates on molybdate ion under strong acidic conditions. The intensity of colour is directly proportional to the concentration of phosphate and silicates in the sample. Phosphate complexes are reduced by weak reducing agents such as ascorbic acid or tartaric acid (potassium antimonyl tartarate) where as silica complexes require strong reducing conditions of hydrazine or bisulphite. The colour of reduced complex is sky blue.

Water Quality Index

WQI is computed to reduce the large amount of water quality data to a single numerical value that expresses the overall water quality at a certain location and time based on several water quality parameters. It is also defined as a rating reflecting the composite influence of different water quality parameters on the overall quality of water.

According to the concept of indices to represent gradation in water quality was first proposed by Horton (1965). The main objective of water quality index is to turn complex water quality data into information that is understandable and useable by the public.

Water Quality Index based on some very important parameters can provide a simple indicator of water quality.

Culturing in Petri dishes

Nutrient media for the organisms, which grow, was prepared as per composition a sterile in autoclave at 121°c, 15 lbs pressure for 15 mins.Transfer the sterilized media into Petri dishes and allowed it to solidify. Transferred 0.1ml of aliquots from 10^{-3}, 10^{-5}, and 10^{-7} to different Petri dishes and three control Petri dishes were also maintained. Incubate all the plates at 37°c for 24 hrs and plates were observed for the development of colony and gram staining was performed for the observed colony. The pure cultures obtained (of the bacterial species) were cultured in NAM medium by incubating at 37°cfor 24 to 48 hrs in the form of agar plates, slants and also cultured in Nutrient broth.

RESULTS AND DISCUSSION

Collection of water samples

A total of 6 river samples (Krishna, Manjeera, Godavari filtered and unfiltered), 6 different mineral water samples and 6 tap and bore samples from BHEL, Tarnaka and saidabad.

Table 1: Collection of water samples

S. No	Water samples	Code
River water		
1.	Krishna filtered	KF1
2.	Krishna Unfiltered	KUF2
3.	Manjeera filtered	MF3
4.	Manjeera unfiltered	MUF4
5.	Godavari filtered	GF5
6.	Godavari unfiltered	GUF6
Mineral water		
7.	Aquafina 500 ml	AF7
8.	Oora 200 ml	OO8
9.	Biselari 500 ml	BI9
10.	Kinley 500 ml	KI10
11.	TATA water plus	TA11
12.	Aqua safe 200 ml	AS12
Tap & Bore water		
13.	BHEL Tap	BT13
14.	BHEL Bore	BB14
15.	Tarnaka Tap	TT15
16.	Tarnaka Bore	TB16
17.	Saidabad Tap	ST17
18	Saidabad Bore	SB18

The physical and chemical analysis of three water samples one from river water, one mineral water and tap water were analysed and given in tables (12, 13, and 14).

Table 2. Raw water: Physical and Chemical analysis

S. No	Physical Parameters	Units	Results	Desirable Potable Limits as per IS: 10500
1.	pH	--	7.74	6.50 – 8.50
2.	Electrical Conductivity	µ. Mhos/cm	566	--
Chemical Parameters				
3.	Dissolved Solids	mg/l	355	<500
4.	Total Hardness as $CaCO_3$	mg/l	240	<300
5.	Alkalinity to Phenolphthalein as $CaCO_3$	mg/l	Nil	Not Specified
6.	Alkalinity to methyl orange as $CaCO_3$	mg/l	140	<200
7.	Non – Carbonate hardness as $CaCO_3$	mg/l	100	Not Specified
8.	Calcium as $CaCO_3$	mg/l	104	<187
9.	Magnesium as $CaCO_3$	mg/l	136	<123
10.	Sodium a $CaCO_3$	mg/l	83	Not Specified
11.	Potassium as $CaCO_3$	mg/l	02	Not Specified
12.	Chloride as $CaCO_3$	mg/l	70	<352
13.	Sulphate as $CaCO_3$	mg/l	62	<208
14.	Nitrate as $CaCO_3$	mg/l	09	<36
15.	Fluoride as F	mg/l	0.52	<1.0ss 0
16.	Total Silica as SiO_2	mg/l	3.90	Not Specified
17.	Iron as Fe	mg/l	Nil	<0.3
18.	Colour	(Hazen)	Colour less	<0.5/Colourless
19	Turbidity	(NTU)	>100	<5.0

Table 3. Tap water: Physical and Chemical analysis

S. No	Physical Parameters	Units	Results	Desirable Potable Limits as per IS: 10500
1.	pH	--	6.68	6.50 – 8.50
2.	Electrical Conductivity	µ. Mhos/cm	56	--
Chemical Parameters				
3.	Dissolved Solids	mg/l	29	<500
4.	Total Hardness as $CaCO_3$	mg/l	12	<300
5.	Alkalinity to Phenolphthalein as $CaCO_3$	mg/l	Nil	Not Specified
6.	Alkalinity to methyl orange as $CaCO_3$	mg/l	20	<200
7.	Non – Carbonate hardness as $CaCO_3$	mg/l	Nil	Not Specified
8.	Calcium as $CaCO_3$	mg/l	08	<187
9.	Magnesium as $CaCO_3$	mg/l	04	<123
10.	Sodium a $CaCO_3$	mg/l	14	Not Specified
11.	Potassium as $CaCO_3$	mg/l	Nil	Not Specified
12.	Chloride as $CaCO_3$	mg/l	08	<352
13.	Sulphate as $CaCO_3$	mg/l	14	<208
14.	Nitrate as $CaCO_3$	mg/l	Nil	<36
15.	Fluoride as F	mg/l	<0.10	<1.0ss 0
16.	Total Silica as SiO_2	mg/l	0.14	Not Specified
17.	Iron as Fe	mg/l	Nil	<0.3
18.	Colour	(Hazen)	Colour less	<0.5/Colourless
19	Turbidity	(NTU)	<1.00	<5.0

Table 4. Mineral water: Physical and Chemical analysis

S. No	Physical Parameters	Units	Results	Desirable Potable Limits as per IS: 10500
1.	pH	--	7.72	6.50 – 8.50
2.	Electrical Conductivity	µ. Mhos/cm	553	--
Chemical Parameters				
3.	Dissolved Solids	mg/l	345	<500
4.	Total Hardness as $CaCO_3$	mg/l	200	<300
5.	Alkalinity to Phenolphthalein as $CaCO_3$	mg/l	Nil	Not Specified
6.	Alkalinity to methyl orange as $CaCO_3$	mg/l	120	<200
7.	Non – Carbonate hardness as $CaCO_3$	mg/l	80	Not Specified
8.	Calcium as $CaCO_3$	mg/l	112	<187
9.	Magnesium as $CaCO_3$	mg/l	88	<123
10.	Sodium a $CaCO_3$	mg/l	72	Not Specified
11.	Potassium as $CaCO_3$	mg/l	02	Not Specified
12.	Chloride as $CaCO_3$	mg/l	80	<352
13.	Sulphate as $CaCO_3$	mg/l	56	<208
14.	Nitrate as $CaCO_3$	mg/l	07	<36
15.	Fluoride as F	mg/l	0.48	<1.0ss 0
16.	Total Silica as SiO_2	mg/l	4.14	Not Specified
17.	Iron as Fe	mg/l	Nil	<0.3
18.	Colour	(Hazen)	Colour less	<0.5/Colourless
19	Turbidity	(NTU)	2.60	<5.0

MPN method results

Coliform detection by most probabable number (MPN) index

Table 5: MPN index and 95% confidence limits for various combinations of positive results when five tubes 10ml, 1.0ml, and 0.1ml dilutions are used

S. No	Sample	Combination of Positives	MPN index for 100 ml	95% confidence limits	
				Lower	Upper
1.	KF1	4-1-1	21	9	55
2.	KUF2	4-2-1	26	12	65
3.	MF3	3-2-1	17	7	40
4.	MUF4	3-1-1	14	6	35
5.	GF5	5-1-0	30	10	120
6.	GUF6	4-3-1	33	15	77
7.	AF7	1-1-0	4	1	15
8.	OO8	1-1-1	6	2	18
9.	BI9	1-2-0	6	2	18
10.	KI10	2-0-0	4	1	17
11.	TA11	2-1-0	7	2	21
12.	AS12	2-1-1	9	3	24
13.	BT13	3-0-0	8	3	24
14.	BB14	3-1-1	14	6	35
15.	TT15	3-2-1	17	7	40
16.	TB16	2-2-0	9	3	25
17.	ST17	4-1-1	21	9	55
18.	SB18	3-1-0	11	4	29

Table 6: Presumptive Test Results

S. No	Sample	10 ml	1 ml	0.1 ml
1.	KF1	4	1	1
2.	KUF2	4	2	1
3.	MF3	3	2	1
4.	MUF4	3	1	1
5.	GF5	5	1	0
6.	GUF6	4	3	1
7.	AF7	1	1	0
8.	OO8	1	1	1
9.	BI9	1	2	0
10.	KI10	2	0	0
11.	TA11	2	1	0
12.	AS12	2	1	1
13.	BT13	3	0	0
14.	BB14	3	1	1
15.	TT15	3	2	1
16.	TB16	2	2	0
17.	ST17	4	1	1
18.	SB18	3	1	0

Table 7: Confirmatory tests results

S. No	Sample	Growth on EMB agar plate
1.	KF1	No growth
2.	KUF2	Colorless colonies and metallic sheen
3.	MF3	Green Metallic sheen colonies
4.	MUF4	Non lactose fermenting colonies
5.	GF5	Blue / Dark pink colour colonies
6.	GUF6	Non lactose fermenting colonies
7.	AF7	No Growth
8.	OO8	No Growth
9.	BI9	No Growth
10.	KI10	No Growth
11.	TA11	No Growth
12.	AS12	No Growth
13.	BT13	No Growth
14.	BB14	Green Metallic sheen colonies
15.	TT15	Green Metallic sheen colonies
16.	TB16	Pink slightly Mucoid colonies
17.	ST17	Green Metallic sheen colonies
18.	SB18	Mucoid colonies

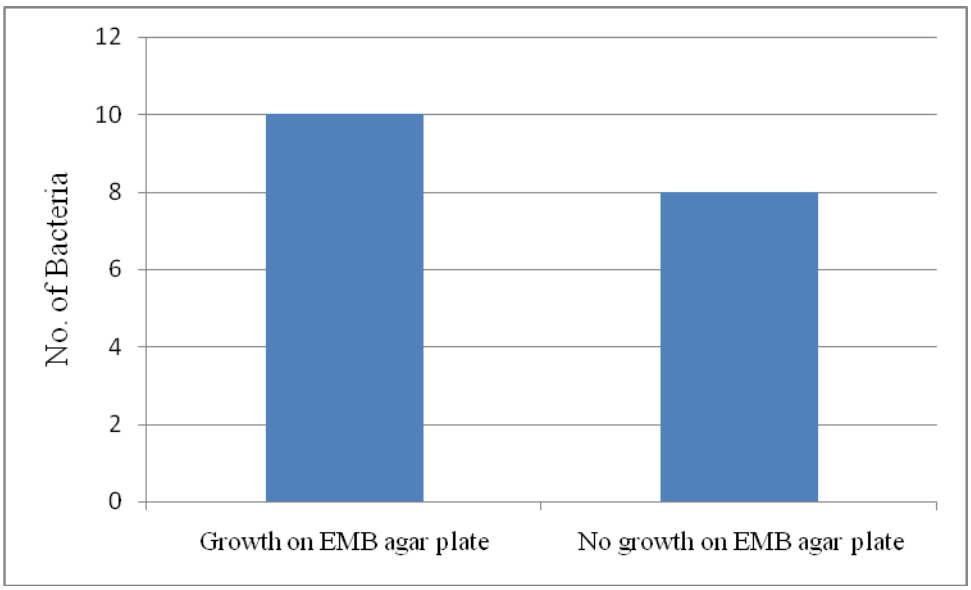

Figure 1: No. Bacteria showed positive for coliform test

A total of 10 bacterial isolates (coliforms, lactose fermentors and non-lactose fermentors) grew on EMB agar medium and were cheked for complete test.

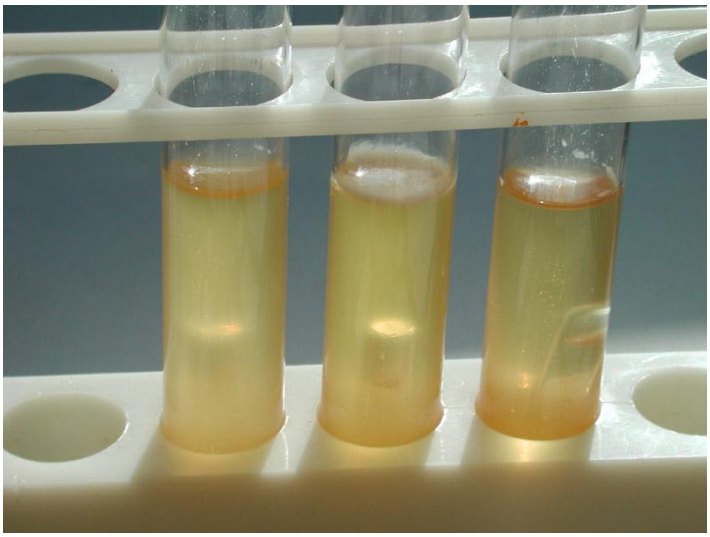

Figure 2: Bacteria shown positive results on coliforms tests

Table 8: Completed Test results

S. No	Bacterial isolate	Completed test	Gas formation
1.	WMF1	Green Metallic sheen colonies	Positive
2.	WBB2	Green Metallic sheen colonies	Positive
3.	WTT3	Green Metallic sheen colonies	Positive
4.	WST4	Green Metallic sheen colonies	Positive
5	WGF5	Dark pink color colonies	Positive
6.	WTB6	Slightly mucoid pink colonies	Negative
7.	WSB7	Mucoid colonies	Negative
8.	WMUF8	Non lactose fermenting colonies	Negative
9.	WGUF9	Non lactose fermenting colonies	Negative
10.	WKUF10	Non lactose fermenting colonies	Negative

Of the 10 bacterial isolates obtained from positive presemptive test, E. coli was easily identified using green metallic sheen. Bother Enterobcter and Klebsiells were lactose fermentors, *Salmonella enteritidis* is NLF (non lactose fermentor) but can utilize acid produced by *E. coli* and grow on EMB agar. In this study, plate with metallic sheen in 24 hours was showing contamination with *S. enteritidis* and lost of metallic sheen. Literature showed that lost in metallic sheen is due to acid consumption by S. enteritidis in EMB agar plate (Figure 3). NLF like Pseudomonas and proteus were also observed in this study.

Coliforms showed colony morphology on Eosin Methylene Blue Agar (EMB)

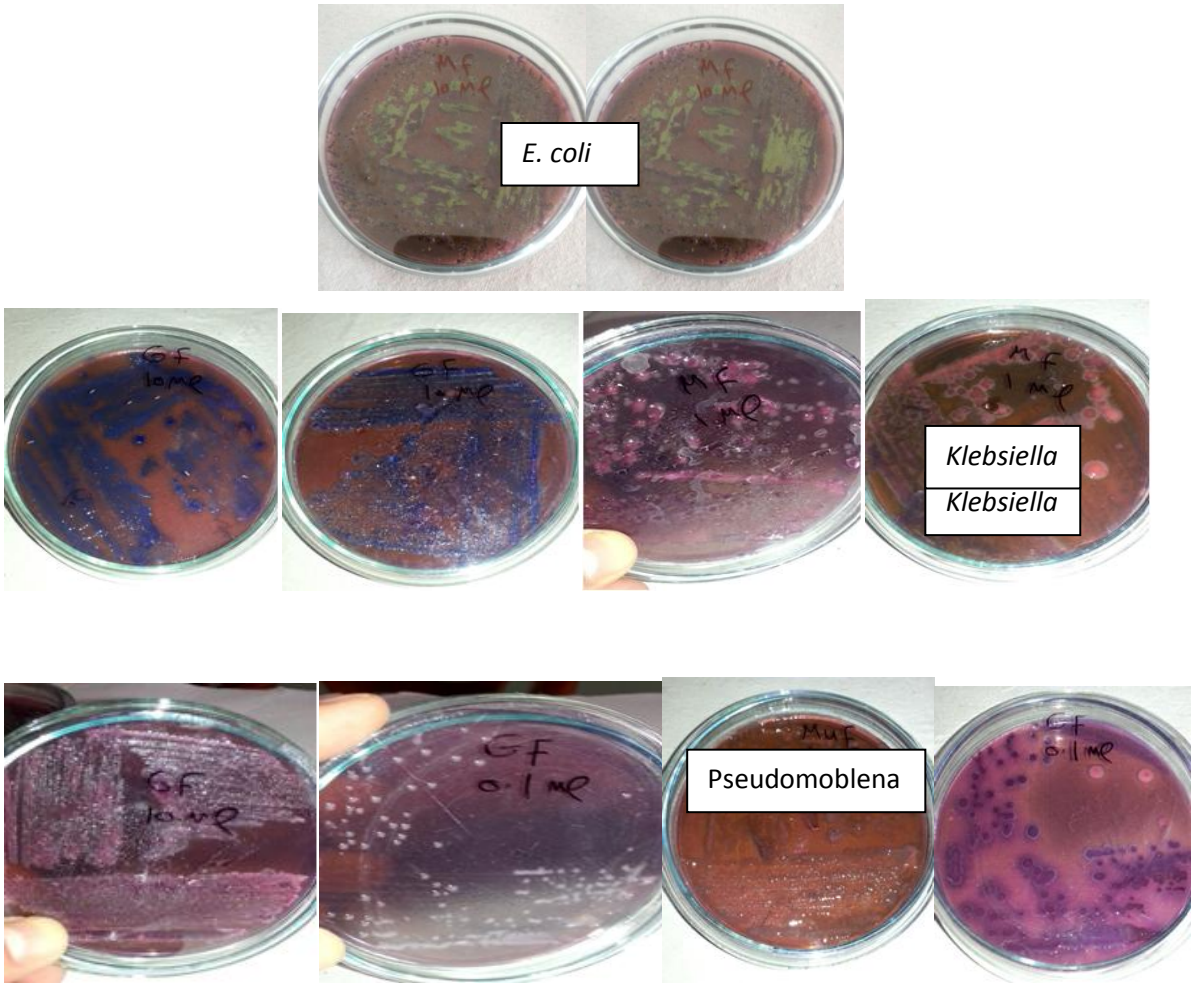

Figure 3: Coliforms showed colony morphology on Eosin Methylene Blue Agar

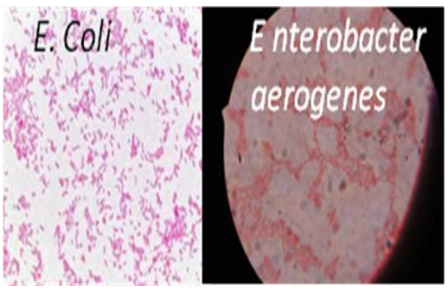

Figure 4: Gram staining results:

Table 9: Colony characteristics of coliforms on EMB agar (This study)

S. No	Bacteria	GS	Growth	Lactose Ferment	Colony characteristics
1.	*E. coli*	-	+	+	Dark blue-black colonies with metallic green sheen indicating vigorous fermentation of lactose and acid production which precipitates the green metallic pigment.
2.	*Enterobacter aerogenes*	-	+	+	Showing good growth of brown, dark-centered, mucoid colonies indicating lactose fermentation and acid production.
3.	*Klebsiella pneumoniae*	-	+	+	Showing good growth of brown, dark-centered, mucoid colonies (smaller than *Enterobacter*) indicating lactose fermentation and acid production.
4.	*Pseudomonas aeruginosa*	-	+	-	Showing good growth but no fermentation of sugars or acid production.
5.	*Proteus vulgaris*	_	+	-	Showing growth of pink colonies indicating non-lactose fermentation and some acid production.
6.	*Acinetobacter baumannii*	-	+	-	Showing a colony with a classic blue-grey center. This should not be mistaken for evidence of lactose fermentation.
7.	*Stenotrophomonas maltophilia*	-	+	-	(a gram-negative non-glucose-fermenting bacillus) showing good growth and non-lactose-fermenting morphology.
8.	*Salmonella enteritidis*	-	+	-	Showing good growth of grey mucoid colonies with no fermentation of lactose or acid production.
9.	*Clostridium perfringens*	+	-	-	Maintained under anaerobic conditions and showing no growth.
10.	*Bacillus subtilis*	+	-	-	Showing poor growth.
11.	*Micrococcus luteus*	+	-	-	Showing no growth.
12.	*Staphylococcus aureus*	+	-	-	Showing no growth.
13.	*Streptococcus* group B	+	-	-	Showing no growth.

Table 10: Biochemical identification of isolates on EMB agar

S. No	Sample	Gram staining results	Biochemical Identification
1.	WMF1	Negative	*E. coli*
2.	WBB2	Negative	*E. coli*
3.	WTT3	Negative	*E. coli*
4.	WST4	Negative	*E. coli*
5	WGF5	Negative	*Proteus spp.*
6.	WTB6	Negative	*Enterobacter aerogenes*
7.	WSB7	Negative	*Klebsiells spp.*
8.	WMUF8	Negative	*Pseudomonas spp.*
9.	WGUF9	Negative	*Pseudomonas spp.*
10.	WKUF10	Negative	*Salmonella enteritidis*

DISCUSSION

The provision of clean drinking water has been given priority in the Constitution of India, with Article 47 conferring the duty of providing clean drinking water and improving public health standards to the State. The government has undertaken various programmes since independence to provide safe drinking water to the rural masses. Till the 10^{th} plan, an estimated total of Rs.1, 105 billion spent on providing safe drinking water. One would argue that the expenditure is huge but it is also true that despite such expenditure lack of safe and secure drinking water continues to be a major hurdle and a national economic burden. On one hand the pressures of development is changing the distribution of water in the country, access to adequate water has been cited as the primary factor responsible for limiting development. The average availability of water is reducing steadily with the growing population and it is estimated that by 2020 India will become a water stressed nation. Groundwater is the major source of water in our country with 85% of the population dependent on it. Water quality is affected by both point and non-point sources of pollution. These include sewage discharge, discharge from industries, run-off from agricultural fields and urban run-off. Water quality is also affected by floods and droughts and can also arise from lack of awareness and education among users. The need for user involvement in maintaining water quality and looking at other aspects like hygiene, environment sanitation, storage and disposal are critical elements to maintain the quality of water resources. Chemical parameters were also analyzed at a lab, which had shown that the water from the different drinking water sources meets the potable limits as prescribed by BIS, Bureau of Indian Standards and even the tap water and mineral water also met the same specifications. Microbiological studies also revealed that out of 18 samples, 8 samples had no coliforms and 10 samples showed presence of coliform bacteria. Mostly river water and bore water had coliform bacteria, it is necessary to do proper pre-treatment before using this water for drinking to avoid the microbial pathogens and water borne infections. However, in this study all the mineral water samples obtained were good and had no coliform presence.

CONCLUSION

This study was done to evaluate the quality of water, drinking water, mineral water and river waters used for drinking and also ground water samples from local regions. A total of 18 samples were collected and physical, chemical parameters and microbiological studies were done. Coliform detection was done by presumptive test using lactose bile broth. Out of 18 samples, 10 were positive for presumptive test and 8 samples were negative. All the tubes were noted for MPN index and positive samples were streaked onto Eosine Methylene Blue (EMB) agar medium and total of ten bacterial colonies with different colony morphologies resembling E. coli (green metallic sheen), lactose fermentors (Klebsiella and Enterobacter), non-lactose fermentors (Pseudomonas), and one Proteus and *Salmonella enteritidis* wer obtained.

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