

DRINKING WATER QUALITY AND SEASONAL VARIATIONS IN SELECTED GOVERNMENT SCHOOLS OF ELURU, W.G.Dt., ANDHRA PRADESH

K.S.V.K.S. Madhavi Rani¹, R.Indira², N. Lakshmi Prasanna³, N.Nirmala⁴

^{1,2,3,4} Associate Professors, Department of Zoology, Ch.S.D.St.Theresa's College for Women (A), Eluru

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ABSTRACT: Water is the most essential element to human life next to air. It is essential for the functioning of every single cell and organ system in the human body and it is one of the prime elements responsible for life on earth. Our drinking water today, far from being pure, contains many deadly commercial chemicals and is unsuitable for human consumption. This study on Potable water analysis is to ensure safe drinking water available at government schools, identify problems and bring responsibility towards water resources. Water samples were analysed during rainy and winter seasons on Physico-Chemical and Biological parameters by using standard methods.

KEY WORDS: Water Quality, Physico - Chemical and Biological parameters

I. INTRODUCTION:

Water is one of the most important elements needed for life on earth. It is responsible for various activities of the human body like transportation of nutrients, respiratory gases and carrying away the waste material(1). It regulates the activities of fluids, tissues, cells, lymph, blood and glandular secretions. A small loss of water leads to dehydration, displaying symptoms of irritability, fatigue, nervousness, dizziness, weakness, headache within no time. The drinking water quality has a great impact on people's health and longevity (2). Being a basic need of human development, health and wellbeing, safe drinking water is an internationally accepted human right (3) and it has been enlisted as one of the targets in the Millennium Development Goals (MDGs). We should not worry about this global alarm. Awareness and action lies entirely upon us and we need to become our own educators, physicians and innovators. The present study aims at studying drinking water quality and seasonal variations in selected Government Schools of Eluru, W.G.Dt.

II. METHODOLOGY:

Water samples were collected from different government schools of Eluru municipal Corporation ones in a week during rainy season and winter season and were analysed. Physico- Chemical and Biological parameters like pH, EC, Turbidity, TDS, Total alkalinity, Total hardness, Calcium, Magnesium, Sulphate, DO and COD were analysed by using standard analytical methods-pH by pH meter, EC by EC meter, TDS by TDS meter, Turbidity, Sulphate by Nepheloturbidity-132, Alkalinity by Volumetric method by H₂SO₄, Total hardness, Ca²⁺, Mg²⁺ by Complexometric method by EDTA and DO, COD by winklers method. The results were correlated to similar studies (4,5,) and were also compared with the standard values given by WHO and the Indian BIS(10500:1991) (6).

III. RESULTS AND DISCUSSION:

Table-1: Analysis during Rainy season: Physical Parameters during Rainy Season

Sample No.	pH	EC (µS/cm)	Turbidity (NTU)	TDS (mg/L)
1	7.67	0.6	0	280
2	7.99	1.6	0	540
3	7.74	1.1	1	860
4	7.64	0.6	0	310
5	7.64	0.8	0	290
6	7.86	0.7	1	290

7	7.64	2.4	0	1480
8	7.4	2.6	0	1490
9	7.34	2.6	0	1390
10	7.64	2	0	1120
11	7.64	2.1	0	1250
12	7.06	0.6	0	340
13	7.08	0.6	1	280
14	7.53	1.6	0	890
15	7.46	0.6	0	240
16	7.26	0.6	2	270
17	7.5	1.2	0	740
18	7.64	1.8	0	1050

pH:The maximum pH was recorded as 7.99 at sampling station 2 and the minimum was 7.06 at sampling station 12. When compared with the standard values of WHO and BIS i.e. 6.5-8.5., the water samples are found to be in the permissible limit at all locations .

Electrical conductivity:Conductivity is the measure of mineral content. The maximum E.C was recorded as 2.6 at sampling station 8 and 9 and the minimum was only 0.6 at many station locations which included 1,4,12,13,15,16 .In most of these samples , Electrical conductivity values are within desirable limits

Turbidity:The maximum turbidity recorded was 2.0 at station 16. The minimum value was 1.0 at stations 3,6,13. At all other stations ,the turbidity values are zero indicating that all the samples are clear in appearance.

TDS:TDS values in the study area range from a minimum of 240 mg/l(St.15) to a maximum of 1490 mg/l(St.8). When compared with the standard values, the water samples are found to be in the permissible limit at all locations . The values ranged from 1050 mg/l to 1490mg/l at station numbers 18,10,11,9,7,8.

Table-2:Chemical Parameters during Rainy Season

Sample No	Alkalinity (mg/L)	Hardness (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sulphate (mg/L)
1	301	210	12.6	102.8	46
2	304	296	48	142.34	86
3	480	420	48	210	64
4	301	216	12.2	130.2	61
5	302	220	39.6	87.4	62
6	307	224	26	106.4	68
7	652	346	48.6	156.2	198
8	640	456	64.5	176.5	164
9	640	540	82.6	210.2	196
10	460	410	62.2	764.5	196
11	560	340	54.5	160.4	156
12	315	212	26.4	106.4	56
13	305	196	22.2	97.57	64
14	514	426	100.2	112.6	175
15	302	208	36.2	79.11	96
16	396	242	32.2	108.2	112
17	522	332	32	164.2	104
18	604	480	54.6	216.25	202

Total alkalinity:Total alkalinity of all the samples was found to be within the permissible limit 300-600 mg/l except at station 18(604mg/l), stations 8,9(640mg/l), station 7(652mg/l).It may be due to the presence of slightly higher values of carbonates, bicarbonates ,chlorides , sulphates in these samples

Total Hardness:The total hardness values of the present study ranged from 186mg/l -540mg/l.The values were within the permissible limit .

Calcium:Calcium values ranged from 12.2mg/l (Station 4) to 100.2mg/l(Station 14). In all samples, the values are within the permissible limit

Magnesium:The minimum value observed was 79.11mg/l at station 15 and the maximum value of 764.5mg/l was observed at station 10. In all stations, the values are very high and not in the permissible limit.

Sulphate:The values range from 46mg/l at station 1 to 202 mg/l at station 18.All samples are in desirable limit except sample 18.

Table-3:Biological Parameters during Rainy Season

Sample No.	DO (mg/L)	COD (mg/L)
1	4	32
2	2.56	64
3	2.86	96
4	2.56	64
5	2.86	64
6	2.86	64
7	2.24	64
8	2.86	64
9	2.24	96
10	2.24	96
11	2.24	96
12	2.24	64
13	2.24	64
14	5.20	96
15	2.24	64
16	2.24	96
17	1.6	64
18	1.92	96

D.O:

In the present study, DO ranged from 1.6 mg/l to 5.20 mg/l.

COD:

In the present study, the COD ranged from 32mg/l to 96mg/l.

Physico -chemical parameters indicate the quality of water .In the present study ,it was found that most of the parameters were within the permissible limit of WHO ,so that the water in the study area is suitable for drinking purpose.

IV. ANALYSIS DURING WINTER SEASON:

Table-4:Physical Parameters during Winter Season

Sample No.	pH	EC (µS/cm)	Turbidity (NTU)	TDS (mg/L)
1	7.67	0.5	0	290
2	8.05	1.5	0	550
3	7.87	1	1	840
4	7.62	0.6	0	300
5	7.28	0.7	0	280
6	7.91	0.7	2	280
7	7.71	2.4	0	1410

8	7.33	2.5	0	1480
9	7.29	2.3	0	1340
10	7.78	2	0	1140
11	7.57	2.2	0	1240
12	7.02	0.5	0	350
13	7.93	0.5	1	260
14	7.62	1.5	0	830
15	7.48	0.5	0	280
16	7.25	0.6	2	250
17	7.5	1.3	0	740
18	7.52	1.9	0	1080

pH:The maximum pH was recorded as 8.05 at sampling station 2 and the minimum was 7.02 at sampling station 12. When compared with the standard values, the water samples were found to be in the permissible limit at all locations.

Electrical conductivity: Conductivity is the measure of mineral content. The maximum E.C was recorded as 2.5 at sampling station 8 and the minimum was only 0.5 at many station locations which included 1,12,13,15. In most of these samples, Electrical conductivity values were within desirable limits.

Turbidity: The maximum turbidity recorded was 2.0 at station 6 and 16. The minimum value was 1.0 at stations 3 and 13. At all other stations, the turbidity values were zero indicating that all the samples were clear in appearance.

TDS: TDS values in the study area ranged from 250 mg/l (St.16) to 1480 mg/l (St.8). When compared with the standard values, the water samples were found to be in the permissible limit at all locations. The values ranged from 1060 mg/l to 1480 mg/l at station numbers 18,10,11,9,7.

Table-5: Chemical Parameters during Winter Season

Sample No	Alkalinity (mg/L)	Hardness (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sulphate (mg/L)
1	240	220	11.2	126.58	49
2	312	324	43.2	142.41	82
3	496	428	44.8	208.34	62
4	224	224	11.2	129.22	63
5	220	200	38.4	68.56	63
6	232	216	22.4	105.49	75
7	692	340	43.2	152.96	213
8	636	440	68.9	176.69	182
9	638	552	80.1	232.07	209
10	480	420	64.1	171.42	214
11	704	380	54.5	160.87	182
12	248	220	22.4	108.12	58
13	228	204	22.4	97.57	76
14	516	452	101.0	131.86	172
15	216	208	35.2	79.11	91
16	195	244	30.4	110.76	113
17	544	332	32.0	166.14	109
18	608	460	52.9	216.25	212

Total alkalinity: Total alkalinity of all the samples was found to be within the permissible limit 300-600 mg/l except at stations 18(608mg/l), station 8(636mg/l), station 9(638mg/l), station 7(692mg/l), station 11(704mg/l). It may be due to the presence of slightly higher values of carbonates, bicarbonates, chlorides, sulphates in these samples.

Total Hardness:The total hardness values of the present study ranged from 200mg/l -552mg/l.The values were within the permissible limit .

Calcium: Calcium values ranged from 11.2mg/l (Station 4) to 101mg/l(Station 44).

In all samples, the values are less than the permissible limit except Station 14(101mg/l)

Magnesium:The minimum value observed was 68.56mg/l at station 5 and the maximum value of 216.25mg/l was observed at station 18. In all stations, the values were very high and were not in the permissible limit.

Sulphate:The values range from 49mg/l at station 1 to 214 mg/l at station 10.All samples are in desirable limit except station 9(209mg/l), station 18(212mg/l), station 7(213mg/l), station 10(214mg/l) where higher values were observed

Table-6:Biological Parameters during Winter Season

Sample No.	DO (mg/L)	COD (mg/L)
1	3.24	96
2	2.56	64
3	2.24	96
4	2.56	160
5	2.56	64
6	2.88	64
7	1.92	64
8	2.88	64
9	1.6	96
10	1.92	96
11	2.24	96
12	1.92	64
13	2.24	64
14	2.56	96
15	2.24	64
16	1.6	96
17	1.6	64
18	1.92	96

D.O:

In the present study, DO ranged from 1.6 mg/l to 3.24 mg/l.

COD:

In the present study,the COD ranged from 64mg/l to 96mg/l.

In the present study ,it was found that most of the parameters were within the permissible limit of WHO ,so that the water in the study area is suitable for drinking purpose.

Correlation matrix

Correlation matrix for water quality parameters for two seasons were calculated and the results were as below.

Table-7: Correlation Matrix during Rainy Season

<i>correlation matrix</i>	<i>pH</i>	<i>EC</i>	<i>Turbidity</i>	<i>TDS</i>	<i>Alkalinity</i>	<i>Hardness</i>	<i>Calcium</i>	<i>magnesium</i>	<i>Sulphate</i>
Ph	1								
EC	0.1118 87	1							
Turbidity	0.1434 22	- 0.1021 9	1						
TDS	0.0632 11	0.9780 88	- 0.0888 1	1					
Alkalinity	0.0803 25	0.9256 05	- 0.0832 7	0.9553 49	1				
Hardness	0.0489 15	0.8718 03	- 0.0321 9	0.8837 17	0.82748	1			
Calcium	- 0.0207 9	0.7750 09	- 0.0539 5	0.7650 17	0.70437 9	0.8256 1	1		
Magnesium	0.0731 1	0.7982 12	- 0.0087 6	0.8215 96	0.79034 9	0.9160 94	0.6257 53	1	
Sulphate	- 0.0118 2	0.7779 66	- 0.0267 2	0.7959 03	0.76886 9	0.6394 83	0.6084 4	0.528783	1

Table -8: Correlation Matrix during Winter Season

<i>correlation matrix</i>	<i>pH</i>	<i>EC</i>	<i>Turbidity</i>	<i>TDS</i>	<i>Alkalinity</i>	<i>Hardness</i>	<i>Calcium</i>	<i>magnesium</i>	<i>Sulphate</i>
Ph	1								
EC	0.1197 9	1							
Turbidity	0.1417 76	- 0.0129 5	1						
TDS	0.0874 02	0.9729 8	0.0066 53	1					
Alkalinity	0.0886 44	0.9276 13	-0.0119	0.9677 88	1				
Hardness	0.0665 02	0.8899 24	0.1421 88	0.8935 6	0.88804	1			
Calcium	0.0196 98	0.7834 8	0.1131 99	0.7639 83	0.74069 7	0.8192 44	1		
magnesium	0.0929 32	0.5182 66	0.0239 13	0.5217 26	0.45495	0.5385 7	0.3912 17	1	
Sulphate	- 0.0120 5	0.7612 31	- 0.0609 2	0.7814 97	0.78015 7	0.6749 19	0.6210 21	0.486529	1

Correlation studies of rainy season indicate that TDS values are strongly correlated with E.C.(0.978088).Alkalinity values are strongly correlated with E.C and TDS(0.927613), (0.955349).Hardness is strongly correlated with TDS and alkalinity(0.88371) (0.82748).Calcium is strongly correlated with hardness (0.82561).Magnesium is also strongly correlated with hardness(0.916094). Correlation studies of Winter season

indicate that TDS values are strongly correlated with E.C (0.97298). Alkalinity values are strongly correlated with EC and TDS(0.927613), (0.967788).Hardness is strongly correlated with TDS and alkalinity(0.89356) (0.88804).Calcium is strongly correlated with hardness (0.819244).Magnesium and sulphates are weakly correlated with hardness .It gives information that hardness is caused due to carbonates and bicarbonates which are related to alkalinity.

V. CONCLUSION:

In India, investments in community water supply and sanitation projects have increased steadily from the I plan to the X plan. But the health benefits in terms of reduction in waterborne disease are not in par with the investments made. Though health sector is bearing the burden of water and sanitation related infectious diseases, presently it does not have adequate expertise for monitoring and surveillance of community water supply programmes in the country (7). A need is there to promote sanitary inspection along with the community based water quality monitoring at the grass root level to identify the problems and to take measures.

Supporting awareness drives: One of the major challenges is to make people aware on the need to consume safe water as per the guidelines of WHO(8) .There are examples where despite being provided potable water by the government, people drink water from contaminated surface sources. An integrated campaign results in wide spreading of information.

Testing and remedial action: There is an urgent need to enhance the monitoring network by establishing monitoring stations across all regions and seasonal assessments of all water sources. community participation is much needed.

School Water Supply Programme : India has the largest number of school going children. As per the National Family Health Survey, only 75 percent of the children in the age group of 6-14 years are attending schools(9).The Government of India has launched School water supply, Sanitation and Hygiene Education programme (SSHE) through the Ministry of Rural Development , Swachabharat Programmes , Sarva Shiksha Abhiyaan of the Ministry of Human Resource Development for setting up schools with all facilities for effective water supply and sanitation. As the, students are the future citizens of our nation, we all should address the problem of Safe drinking water to be supplied to the school going children. This will not only provide a hygienic environment in schools, but also the children will convey the message back home.

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