



A Study on Quality of Drinking Water in Patna

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Abstract: The most important source of water is groundwater available throughout the year. Patna is one of the densely populated cities of the world with population 60 lakhs. Even though the water quality is not the best one, no suitable sample was found with high concentration of fecal and coliform bacteria. The water was not wholesome but it was potable. Water quality parameters such as alkalinity nitrate and TDS suits well above the drinking water standards. The drinking water possess the most challenges in the country like India and also in Patna. Rapid urbanization puts pressure on needs of human society and in times to come one would have to fully rely on packaged drinking water with economic losses for marginalized sections of society. Safe drinking water is a basic human need. Freshwater is a basic human need. Climate changes EL-NINO EL-NINA leads to increased water. Access to safe drinking water is a global concern. 80% of communicable diseases are related to poor environmental and health conditions due to unsafe drinking water and also poor hygiene and practices of good sanitation. Finding safe water to drink is a global concern.

Keywords: *Water quality index, Drinking water, Patna, water distribution, water pollution*

1. INTRODUCTION

On conducting investigation to assess drinking water quality parameters, levels of Ph, Do, EC, TDS, NO_x-, were in coherence with the levels of standard parameters. Arsenic possessed the main problem in drinking water. There need to be a minimal concentration of iron in drinking water. Using contaminated water for drinking purposes a serious threat to society[1,2]. Drinking water contains all physio-chemical parameters in all sampling sites, consistent with WHO, no extreme variations in water sample was observed[3–7]. Using water quality parameters and aesthetic characteristics of water has a significance on human health. Fecal and total coliform have been contaminated and all the water sources except the tap water[8]. Bharat ka Norman – drinking water is one of the components. Arsenic and fluoride contaminants have been priority all over[9]. Study describes different gaps in the knowledge related transmission pathway of illness as well as changing perceptions with respect to time[10].one should intervene to ensure clean and safe water for drinking. A risk assessment study of water impact on human health is necessary[11]. There remains a need of proper maintenance to the distribution system and chlorination to just avoid water borne disease to have a considerable improvement in the health and quality of people[12]. Contamination with sewage lines remains a critical issue with high prevalence of symptoms as a part of significant water pollution[13]. For drinking purpose spring water match the limitation as per BIS and WHO drinking. Such as chemical and physical properties of the water as per drinking water standards[14–16] India remains one of the largest populated countries in world with no

access to clean water and marginalized sections most burdened by it. Different states in different parts of the India are poorer and illiterate, so diseases which are due to water pollution occur[17–20]. Several districts possess the problem of contamination with fluoride, arsenic, iron and bacteria. Patna also known by Patliputra is facing severe crisis of fresh and safe water to drink. The oldest supply system of water transportation in conduits possess a larger problem for all of us. Water is the biggest necessity of all humans Placing of sewers in parallel to water supply systems is the most dangerous problem for everyone as spilling or contamination is the major reason. Non uniform supply of water will possess a lot of problems if the situation is not brought under control. PATNA is thus having problems of water availability in different societies. Inadequate spilling with disastrous contamination is the due to poorest water supply and one of the oldest supply network[21]. Water remains polluted with germs and most of the wastewater in urban is used for agricultural activities with 69.99% TO 79.99% grain security and living standards of rural as well as urban communities. Excessive fertilizer is affecting drinking water quality. Urbanization and especially in developing countries leads to water quality degradation in drinking water with increased deforestation and desertification[22,23]. The objective of this article includes a. To analyze water quality in Patna b. To study different sources of safe drinking water as well as good sanitation within different sections of population in Patna district c. To find different water borne disease in district of Patna. d. To study different measures being taken by NGOs, the govt., the population to tackle the prevailing drinking water oriented issue. Hypotheses of this research include a. The water quality of Patna is good but still not very much satisfactory. b. Contaminated water arises because of the contact mixing with the sewage and drinking water. c. Irreparable loss in cases of humans by drinking such contaminated water in localities remains the neglected issue.

2. MATERIALS AND METHODS

Raw data from random sample survey of 100 households were collected from Kankeerbagh, Mithapur Danapur and Patna city, Feedback from surveyed families was collected in form of questionnaire, To supplement the work CPCB boards, various center for science and environmental is used, The research work based on methodology

2.1 Initial-field survey

Study of all associated relevant documents with govt. Related Data collection available at concerned website.

2.2 Field survey

Data collected by surveying 100 samples in a time bound manner after field survey data analysis to check the quality parameters of ground water, data representation in cartographic manner

2.3 Area of study

The study area is located between the genetic plains. Patna the state capital of Bihar with 25 degrees 37' NORTH and 85 degrees 13' east having 18 lakh population with 72 wards and remains one of the most important area in terms of trade.

Sample collection was done in winter season. Samples of water from bore well was collected in different container. Prior to collection of samples, water from dug well was then pumped out for 25 minutes or till the water temperature could be stabilized. The Samples which were collected in different container were added according to standard specified procedure. Sample preserved in different iceboxes were sent to lab

within a 6 hours' time from collection time and related analyses. Sample analyzed were according to Standards for the study of drinking water and waste water. Results WERE FOUND on comparison with specified water standard, which is always done by World Health Organization (WHO).

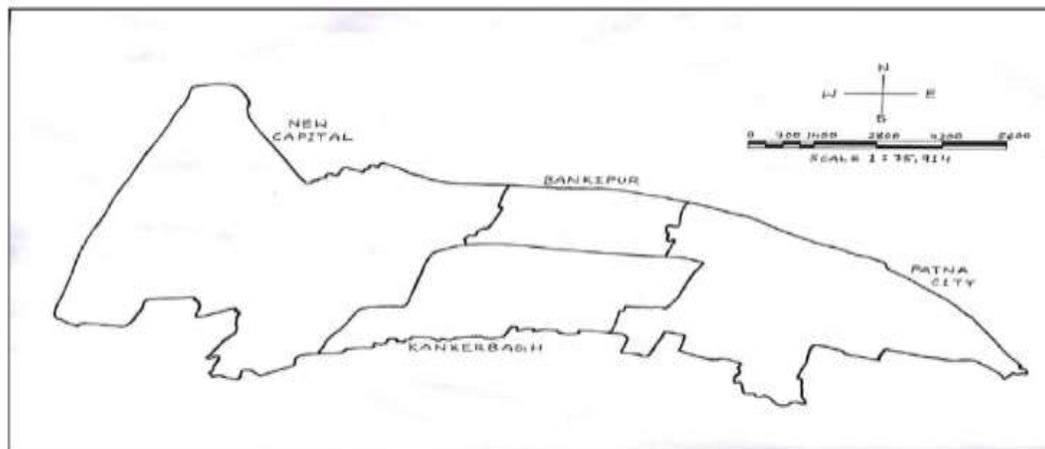


Fig 1 Study area : Patna Municipal Corporation Area

2.4 Analyses in microbiology

Winter time collection of all samples was done. Samples collected from dug wells were collected in glass containers. Broths were used in such a manner that-

- coliform incubation at 30 ± 0.5 degree for 2.5 h.rs in broth 1
- Transfer to the water bath in $42 \text{degree} \pm 0.1$ degree and was incubated to a period of 20 hrs.
- coliform presence is identified by release of acidic reaction as well as gas production

2.5 Statistical data Analysis

All obtained data depicting different biological and physiological parameters were sent for correlation related analysis. Correlation done on software version 16 which is used for statistics.

3. RESULTS AND DISCUSSION

TDS 170 mg/l ranging to 1263.6mg/l and ph of water ranged from 6.2 to 6.98. Conductivity analysis of test samples was found to be between $220 \mu\text{S}/\text{cm}$ ranging to $2009 \mu\text{S}/\text{cm}$. The Alkaline samples ranged from 1263 mg/l to 5768mg/l. The Chloride varies from 2.0 mg/l to 120 mg/liter.

Table-1 Water quality index of drinking water

Parameter	Concentration of parameters(mg/l)	weightage	Relative weight	Standard concentration(mg/l)	Quality rating	Sub index
TDS	533.78	4	0.12	488	107.89	13.99
Chloride	62.32	3	0.10	239	24.88	2.55
Total hardness	346	3	0.09	295	112.67	11.44
Calcium	90.56	3	0.069	70	120.67	8.11
Magnesium	27.87	4	0.258	25	92.7	6.09
Nitrate	7.88	3	0.114	40	16.99	4.345
Sulphate	19.88	2	0.114	195	9.99	1.298
Fluoride	0.44	3	0.114	1	51.77	6.998
Alkalinity	352.66	4	0.009	194	175.67	17.10

WQI=72.75

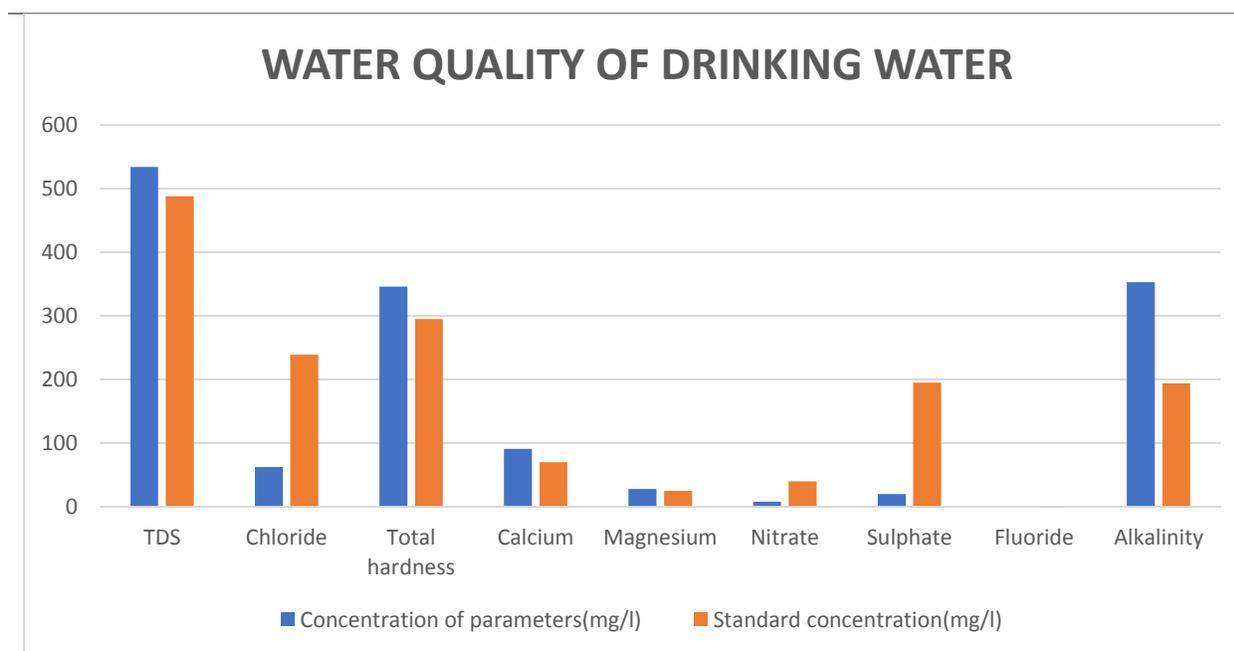


Fig.-2 Water quality index of drinking water

Table-2 water quality parameters in different circles

Circles	Temp	PH	TD S	COD	Po4	T.F.S	K	T.S.S	Ca	Mg	Cl	Alkn.	t- h/mg/l
New capital circle	32/27	7.2	224	3.99	0.059	71.99	2.19	11.99	33.45	30.11	15.99	190	206
Kankerbag h	33/28	7.1	211	3.98	0.0079	66.98	2.39	9.99	62.49	22.78	19.98	219	249
Bankipur	34/26	7.5	245	3.97	0.0039	71.98	2.59	33.33	37.67	28.56	17.56	201.1	222
Patna city	33/31	7.4	248	4	0.08	119.99	2.67	32.56	32.1	27.7	18.0	199.9	211

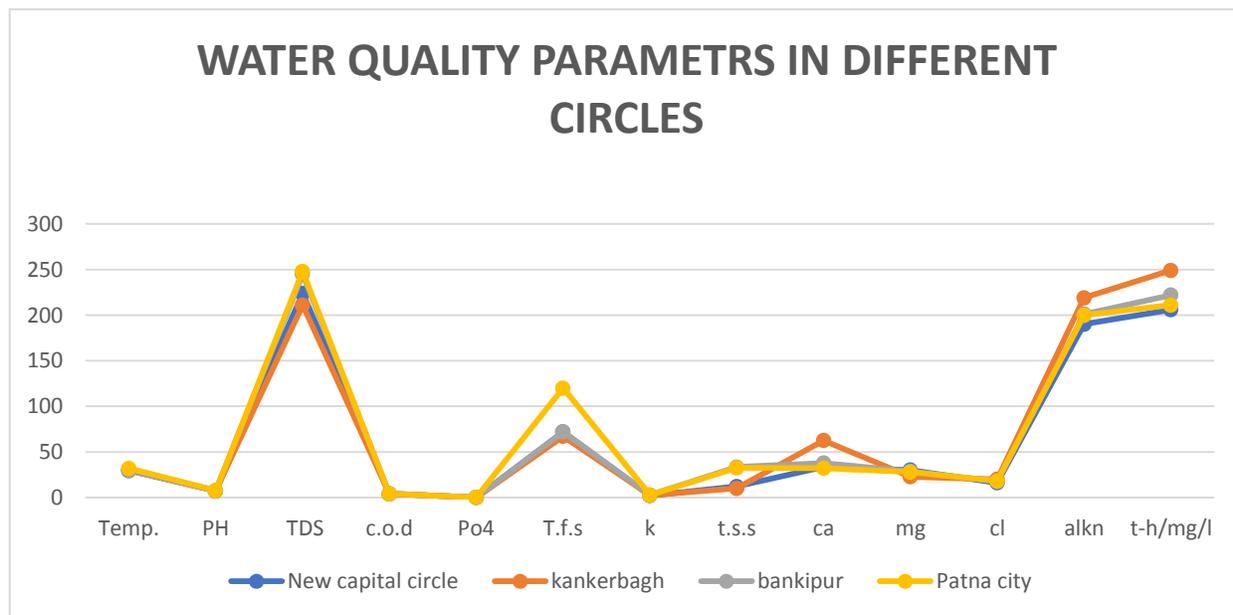


Fig.-3 water quality parameters in different circles

3.1 Demography in families and their social and economic condition in region

Demographic study with social and economic condition to let us know the situation prevailing so as to make plan for future. Doing a survey of 100 families, it is evident that 66 percent families reside as a nuclear family. Average age of all respondents remains in group of 40/50 years while an average family in Patna of seven members. Major sample of population belong to higher and lower income with lower or bpl families. Sample populations of illiterate 12 percent population while rest were literate with primary education level. The residents educated up to matriculation and above are aware that water pollution is there and preventive measures need to be taken in this regard so that water borne diseases do not spread.

3.2 Environmental hazards

Difficult life to live for all as too many environmental hazards engulf the city. Water logging the common biggest problem especially in major areas in majority of localities. Dirty water percolation up to aquifer and that leads to contamination in ground water in saturation level the major source of drinking water. In case of the old circles, the roads of higher areas compared with different localities and prone to faulty planning. Large number of well settled unplanned dwellings remain the cause of biggest concern.

3.2 Sources of drinking water among sample population

The biggest source of drinking water was ground water with easy availability of 65 percent and 91.87 had own boring. Only 5 percent use the govt. supply with 4 percent as bpl families. Boring is dug in depth ranging from 120-150ft. with 25 percent getting aquifer level of 120 to 150 ft, 33percent of the inhabitants had submersible in 200 feet and above. During summer months aquifer levels declines and mud mixes with water in many dwellings.

3.3 Duration of water supply by government

Drinking water supply without intermittent disturbances in continuous manner is important. patna will have scarcity as a result 5 percent depends on govt supply. 5 percent of residents of city get less than 4 hrs. And 35 percent of residents generally get water for 6 hrs. A day. City tanks are almost functional but the distribution of water remains a problem throughout this year. Water duration in govt.

3.4 Status of government supply of water

Supply of clean water is for drinking purpose. Irregular water supply and ill maintained pipes lead to alternative residents. Those with boring have least complaints about water supply.

3.5 Physical Condition of Supply pipes and Sewerage pipes

“City water pipeline system approximately 800 km length, and in which nearly 400 km require replacement for stopping high leakages”, as given in govt department of public health and sanitation, city capital. 70 per cent of urban Patna and outskirts Patna rural 50 per cent sewerage pipes are satisfactorily good while 48 per cent of Raza bazaar and 45 per cent of Bankipur, with residents unsatisfied with present condition of pipes poorly maintained or the residents haven't complained the pipe related condition.

3.6 Maintenance of supply systems and sewage systems

Non uniform supply is the main problem and resulting contamination also is blamed. Network supplies are becoming older day by day and the challenges need to be addressed urgently water carrying capacity, repair of old networks, different problems arise. Possibility of contamination is increasing day by day. Distribution systems are old fashioned. Pipes remain irregular in different parts of this area. No complaints of any kind of maintenance problems with anyone.

3.7 Drinking Water pollution

Human and nonhuman activities are now a days trying to change water quality parameters. The country is facing a shortage of quality drinking water. Findings revealed that more than 70 percent of available samples had excess bacterial count which means unfit for drinking purpose. Water pollution affects human health, the mental and social being of human society. Odor free water is not available in most areas. The recent initiatives of the state is to provide potable water to every household is bearing fruits now. Har ghar, nal ka jal has been launched. This is the initiative by the govt. owing to old piped supply and obsolete system of water supply. Only 42 wards suffer from arsenic problem, 20 is affected by fluoride concentration, water quality lab testing is now at Patna accredited by NABL. Not only humans but animals get affected. They die on consuming unsafe drinking water. Sometimes ecosystem goes for algal growth as contaminated drinking water finds source to rivers.in Patna stray dogs and cattle are causing a menace to all societies and this has to be stopped at all costs. We should never leave the taps running in colleges also. Drinking water pollution is mostly attributed to negligence from societies towards different human forms. Drinking water is polluted when the intermixing of water pipeline with sewage pipeline takes place. Water pollution of Danapur, Patna and Naubatpur remain the same. Collection of samples subjected analysis reveal mud in water at most places. This water is turbid, non-transparent so it creates a lot of problems for each one of the people residing in Patna. What is the solution? Strange to hear that people say it is the work of society.

3.8 Water tanks cleaning

A large amount of water is contaminated and thus physical chemical parameters get affected very badly. Water tank cleaning is a vital for all water purposes.

3.9 Vulnerability of Diseases

Improper ill maintained supply of drinking water in open defecated localities, slums with mosquito breeding's make residents vulnerable to disease. Young children of 18-25 age are most affected. Most of the students in apartments have poor drinking water supply. Illiteracy and economic backwardness remain the backbone for major hurdle in disease spread. All the microorganisms that remain toxic due to cholera, typhoid, giardiasis, amoebic dysentery, scabies affect human health. It affects a lot to young children who miss their schools. When it comes to teenager, they face a lot of mood swings. Old people now a days are more prone to diseases. Women suffered from mental tension in every possible manner.

3.10 Type of water borne diseases

Summer season brings deadly diseases to its doorstep with typhoid and e coli remain prevalent in 75percent population. Economic burden in form of money to cater health needs is a cause of concern as the entire area is mostly economically backward. Dominance of population in all areas is a major concern. Besides gvt runs a lot of programmers to eradicate poverty. Diarrhea: children under five years of age group get affected. Symptoms remain from moderate to severe in most cases with dizziness, pale skin, tiredness, fatigue and loss of consciousness if untreated. Cholera: vibrio cholera bacteria causes cholera due to consumption of contaminated food or drinking water. Abdominal cramps accompanied by vomiting, diarrhea those with immune depressed likely to get infected.

Typhoid: caused by salmonella typhi bacteria transmitted via contaminated water. Patients suffer from loss of appetite and nausea, constipation, body weight loss.

Hepatitis A: liver affected by hepatitis a virus. Oral contamination takes place. Hepatitis patients are the most affected but can suffer from severe complications if not treated in time.

Dysentery: an infection in intestines were blood presence and mucus in stool with severe amount of blood and diarrhea occurs. Vomiting, fever, nausea, dehydration, stomach cramps and pain occur.

3.11 Escaping water borne diseases

- Avoiding water stagnation all around
- Using clean water
- Washing hands properly with soap
- Avoiding leftover foods or pre-cut fruits
- Using antiseptic in all possible manners that is possible
- Using drinking water in all possible ways by boiling, sterilizing it.
- Cleaning before use and no street food is possible
- Covered stored water is necessary by avoiding dampness and by not staying wet.

4. CONCLUSION

One cannot imagine the life without water. Without water no life is there. In humans water helps a lot in transporting nutrients throughout the body. Water maintains right PH balance in our body. We should use water judiciously. Govt of India has started JAL JEEVAN HARIYALI mission in this regard. Various organizations are using different information dissemination systems to spread the judicious use of safe drinking water. Har ghar nal ka jal is a great start in this regard. But illiteracy, economic backwardness remains the biggest hurdle in human society.

Drinking water is very necessary to all of us. If we do not recycle reuse the drinking water, everybody will have to buy that water bottle in near future. Let us join hands now for a safe future in this regard. Awareness among individuals in different societies remains the key concern for all of us now. Moreover, the participation at all levels of govt. is necessary now a days but let us see what more can be done. Negligence from all sides be it govt., people and human societies remains a big concern. Everybody knows sustainability and use of resources judiciously and sustainability.

Suggestions

- Soak pits and septic tanks should be properly constructed.
- Every agency should work in coordination with each other.
- Regular tank cleaning by both govt. And private parties.
- Replacement of old master plan by new master plan.
- Water distribution networks should be properly maintained by govt dept.'s.
- Use of Ro should be increased in every dwelling to improve water quality and timely monitored by residents. Change of filters in such units should be done at a period of 6 months for every year and by doing so one can prevent water borne diseases.
- Important dissemination of information in case of any major breakdown is necessity of all such activities arising out in entire localities.
- Awareness programs through various NGOs should be organized throughout the year to spread the necessity of drinking safe water and to prevent water borne diseases spreading in localities and various dwelling units
- Drinking water quality can be enhanced if a dedicated workforce comes into play as there is scarcity of engineers and well experienced private agencies.
- Bleaching powder distribution should be carried out at a faster rate for wells and rivers disinfection.
- Storm water management is necessary to improve drinking water quality.
- Planting some trees can also help in ground water recharge and improve the water quality.
- Green agriculture should use the water from showers and washbasins for irrigation as fresh drinking water is being used by them, such uses can make the availability of drinking water to all human beings in scarce in near future.
- Drinking water should be avoided in commercial activities as such activities can hamper the equitable balance of sustainability on earth.
- People should involve themselves in initiative like Jal Jeevan Hariyali mission taken by the govt of India.
- All houses should have well storage water tanks with the least interference from all sections of societies
- Every house must have a R.O. in their house to get a full clean drinking safe and wholesome water
- All societies need to be well equipped with all types of water distribution systems.

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Data Availability

All data generated or analyses during this study are included in this article.

Declaration

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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