International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391

A Critical Assessment of Safe Drinking Water in Different Villages of Jorhat District of Assam

Jaya Kalita Gogoi

Research Scholar, Centre for Studies in Geography, Dibrugarh University, Assam, India

Abstract: ***The welfare of a State or of a Nation depends on the healthy and vigorous society to a significant extent. And the health and wellbeing is very much influenced by the eminence of water consumed by the people. Water is one of the most valuable resources that should not be taken for granted. Water conservation is closely related to sustainable development, which has emerged as the development paradigm of this decade. Access to safe drinking water is vital for the promotion and strengthening of public health and also a basic human right. The stipulation of safe water prevents the diffusion of waterborne pathogens and reduces the exposure of individuals to chemical and material hazards that could be ingested through unhygienic and infected drinking water. The present study attempts to examine the critical assessment of safe drinking water consumed by the people in Jorhat district and its impact on the human health. To fulfill the purpose five villages have been selected and studied.***

Keywords: parameters, contamination, disease, turbidity, iron, arsenic.

1. Introduction

Water is one of the most precious and valuable resource that is gifted to man by nature. The quality of water, whether used for drinking, domestic purposes, food production or recreational purposes has an important impact on health. Water of poor quality can cause disease outbreaks and it can contribute to background rates of disease manifesting themselves on different time scales. Declining water quality has become a global issue of concern as human populations grow, industrial and agricultural activities expand, and climate change threatens to cause major alterations to the hydrological cycle. When water quality is compromised, its usage puts users at risk of developing health complications. National Primary Drinking Water Regulations (NPDWRs or primary standards) are legally enforceable standards that apply to public water systems. Primary standards protect public health by limiting the levels of contaminants in drinking water. Various forms of waterborne diarrheal disease probably are the most prominent examples, and affect mainly children in developing countries. According to the World Health Organization, such diseases account for an estimated 4.1% of the total Daily global burden of disease, and cause about 1.8 million human deaths annually. The World Health Organization estimates that 88% of that burden is attributable to unsafe water supply, sanitation and hygiene.

Water borne diseases are any illnesses caused by drinking contaminated water. Diseases can include infection from bacteria, viruses, or by small parasites. These organisms and viruses cause diseases like cholera, diarrhea, typhoid fever, malaria, dysentery etc. Typically, water quality is determined by comparing the physical and chemical characteristics of a water sample with water quality guidelines or standards. Drinking water quality guidelines and standards are designed to enable the provision of clean and safe water for human consumption, thereby protecting human health. If a disease is very common and frequent in a village, it is important to test the water quality and to identify the actual cause of disease and to take necessary steps to protect the public health.

2. Objectives

2.1 To analysis the critical assessment of safe drinking water consumed by the people in study area and to put forward water security plans.

3. Database

Both primary and secondary information have been used to conduct the present study. The primary data were collected from the field on water consumption from the five selected villages for the study. The water samples from different sources are also collected from the study area. The secondary information on various parameters on water was collected from various census publications, Government departments, Research works etc.

4. Methodology

The study was carried out both at theoretical as well as empirical levels. The empirical study was based on both primary and secondary data. Primary source information gathered by the researcher through direct observation where the researcher personally and directly observed the conditions and incidents of his field of study. Primary data was collected in the form household-level survey. In order to fulfill the objectives of the study five villages were chosen. The households of each sample village was selected randomly and an extensive household schedule was prepared for collecting almost all the relevant data related to the use of water from the study area. 60 Households in each village are taken to fulfill the objectives of the study. Thus the total of 300 households and 1364 population is taken for the study. Primary source information gathered by the researcher through questionnaire and schedule includes questions and information concerning different aspects of the subject of study. Secondary data sources include the population census, public or official documents.

Since the study is dwelt on the collection and the processing of primary and secondary sources of data, the study is

divided into two parts. The first part of the study includes the analysis of consumption of water by the people of the selected villages for the study for different purpose (specially drinking). In the second part of the study an attempt was made to analyze water quality which was done through water testing at District level Laboratory (PHE) Jorhat Division. Samples of water from Tube well, Pond and Urban Supply were collected to prepare water analysis report.

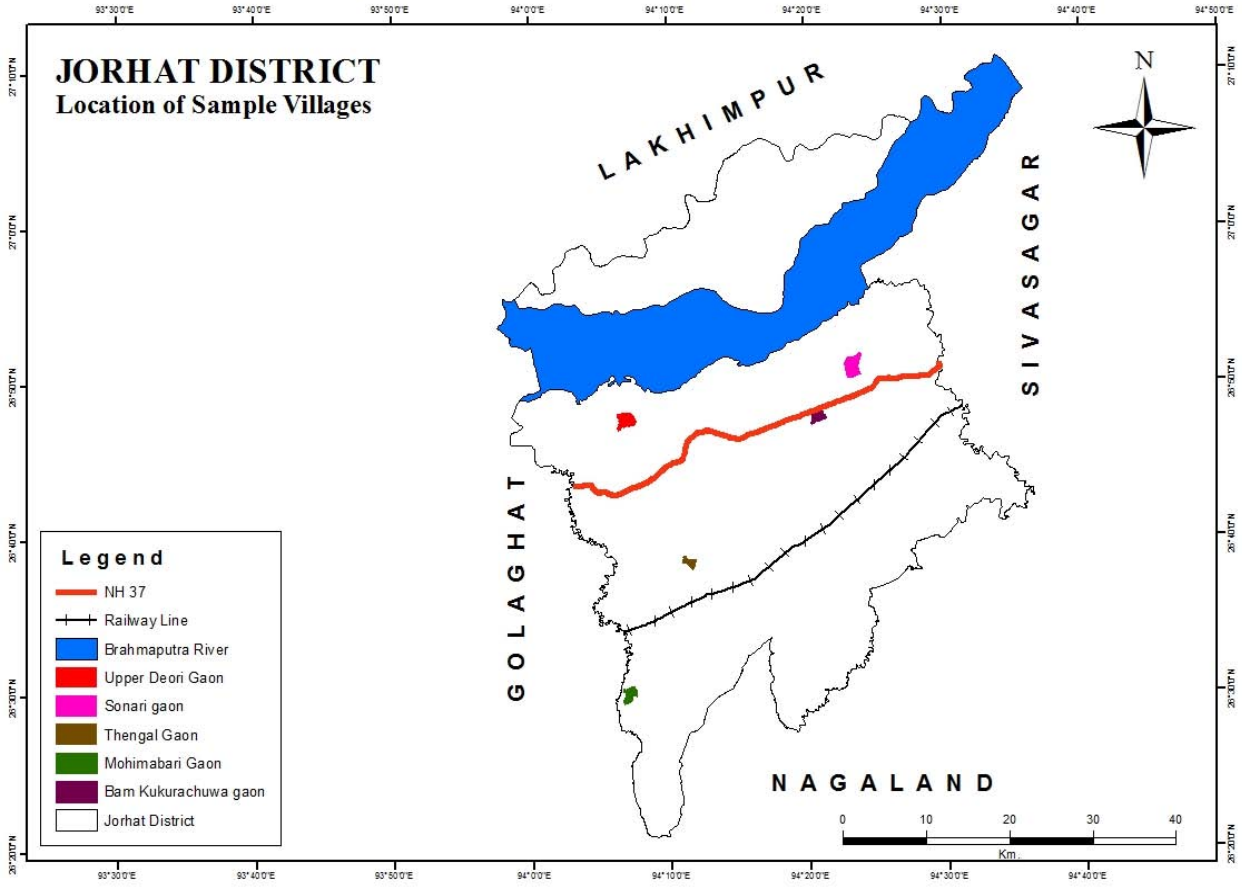
For the research work the methodology included the following aspects-
a) Selection and choice of indicators- b) Collection of data for these indicators c) Data processing and presentation. After data collection from the field, data was processed. Initially data were tabulated through coding, editing and classification. After calculation, interpretation was done using manual as well as computer packages.

5. Study Area

The Jorhat District is situated in the eastern part of Assam and located between 26º20' to 27º10' North latitudes and 93º57' to 94º 37' East longitudes. The district is spread over an area of 2851 sq. km. which containing a total population of 1091295 (2011 census). The mighty river Brahmaputra is on the north part of the district. The general slope of the land in this area is from south-east to north-east. The climate of Jorhat is characterized by hot and humid summer and cool winter. The annual mean temperature is about 27^0C during the summer and 18.8^0C during the winter. The average annual rainfall is 2044.99 mm. About 64% of the total annual rainfall is received during the monsoon season. The present Jorhat District consists of three sub-divisions namely - Jorhat, Majuli and Titabor. The district is divided into 6 revenue circles and 8 development blocks.

The five villages were taken for the study in order to fulfill the objectives. The selection of five villages for the study is based on situation. The five villages are- 1. Upper Deori gaon from the North-West Development Block (Dhekorgorah) 2. Thengal gaon from the Jorhat Development Block (Baghchung) 3. Mohimabari gaon from the Titabor Development Block (Titabor) 4. Sonari Gaon from the Kaliapani Devlopment Block (Kaliapani) 5. Bamkukurachua from the Central Development Block (Chipahikhola).

Map 1: Location of Sample Villages



6. Water Consumption in the Study Area

The safe water is very much essential for the promotion and protection of health. Provision of safe water prevents transmission of waterborne diseases. Diarrheas and other waterborne diseases still rank among the leading causes of illnesses in the country. The five villages were selected in order to know the water quality in the Jorhat district.

The people in the village are using different sources of water for household and drinking purpose. Pond water, Tube well and Supply water are the different sources of water for them. Now-a-days the supply water is gaining importance as the

supply water is available in the village under different projects. The water quality of the supply water is much better than the other two sources. But still people are using pond water and tube well for household and drinking purpose. Out of 300 surveyed household in five villages 140 households are using tube well, 118 households are using Supply water and 42 households are using pond water for different household and drinking purposes.

Table 1: Source of Water in the surveyed Households

Village	*Pond*	*Tubewell*	*Supply Water*
Upper Deori gaon	0	60	0
Thengal gaon	7	23	30
Mohimabari Gaon	4	6	50
Sonari gaon	13	16	31
Bamkukurachua	18	35	7

Source: Field survey 2013-14

The water sources of the five villages are studied and the samples of different sources are collected and tested in District level Laboratory, Jorhat in order to know and analyze the water quality. Different parameters of water are tested. The selected parameters in order to analyze the water quality are Turbidity, Iron, Arsenic, Fluoride and Bacteriological test. Other parameters of water like Conductivity, pH value, Hardness, Alkalinity etc are found between desirable and permissible limit. Table No. 2, 3 and 4 shows the water Analysis of Pond Water, Tube well Water and Supply Water for five villages.

Table 2: Water Analysis of Pond Water in Five villages

Parameter Name	Desirable -Permissible Limit	Results					
		Upper Deori Gaon	Thengal Gaon	Mohimabari Gaon	Sonari Gaon	Bamkuk-urachua	Unit
1. Turbidity	5.0-10	-	54	1	10	5	NTU
2. Iron	0.3-1.0	-	5.55	0.57	0.45	0.23	mg/lt
3. Arsenic	0.05 (No Relaxation)	-	0	0	0	0	mg/lt
4. Fluoride	1.0-1.5	-	0	0	0	0	mg/lt
5.Bacterio-logical test	COLIFORM						
Excellent	No Coliforms/100 ml	-					
Satisfactory	1-2 Coliforms/100 ml	-				1 MPN/100 ml	
Suspicious	3-10 Coliforms/100 ml	-					
Unsatisfactory	Above 10 Coliforms/100 ml	-	92 MPN/100 ml	90 MPN/100 ml	90 MPN/100 ml		

Source: District level Laboratory (PHE) Jorhat Division, Jorhat

Table 3: Water Analysis of Tubewell Water in Five villages

Parameter Name	Desirable-- Permissible Limit	Results					
		Upper Deori Gaon	Thengal Gaon	Mohimabari Gaon	Sonari Gaon	Bamkukurachua	Unit
1. Turbidity	5.0-10	Nil	31	Nil	90	Nil	NTU
2. Iron	0.3-1.0	0.16	6	0.23	5.70	.10	mg/lt
3. Arsenic	0.05 (No Relaxation)	-	0.026	0	.002	-	mg/lt
4. Fluoride	1.0-1.5	-	0.12	0	-	-	mg/lt
5. Bacteriological test	COLIFORM						
Excellent	No Coliforms/100 ml	No Coliform					
Satisfactory	1-2 Coliforms/100 ml			1 MPN/100 ml		1 MPN/100 ml	
Suspicious	3-10 Coliforms/100 ml						
Unsatisfactory	Above 10 Coliforms/100 ml		Above 50 MPN/100 ml		Above 50 MPN/100 ml		

Source: District level Laboratory (PHE) Jorhat Division, Jorhat

Table 4: Water Analysis of Supply Water in Five villages

Parameter Name	Desirable--Permissible Limit	Results					
		Upper Deori Gaon	Thengal Gaon	Mohimabari Gaon	Sonari Gaon	Bamkuk-urachua	Unit
1. Turbidity	5.0-10	-	3	Nil	Nil	Nil	NTU
2. Iron	0.3-1.0	-	0.58	0.14	.09	0.18	mg/lt
3. Arsenic	0.05 (No Relaxation)	-	0.009	0	0	0	mg/lt
4. Fluoride	1.0-1.5	-	Nil	0	0	0	mg/lt
5. Bacterio-logical test	COLIFORM						
Excellent	No Coliforms/100 ml	-					
Satisfactory	1-2 Coliforms/100 ml	-	1.5 MPN/100ml	1 MPN/100 ml	1 MPN/100ml	1 MPN/100 ml	
Suspicious	3-10 Coliforms/100 ml	-					
Unsatisfactory	Above 10 Coliforms/100ml	-					

Source: District level Laboratory (PHE) Jorhat Division, Jorhat

6.1 Water eminence and human health

Turbidity is a measure of the cloudiness of water. High turbidity indicates contamination and pollution. Turbidity is found to be high in pond water of Thengal Gaon that is 54 NTU. Turbidity is high in Tubewell water of Thengal Gaon and Sonari Gaon that is 31 NTU and 90 NTU respectively (NTU - Nephelometric Turbidity Unit). Higher turbidity levels are often associated with higher levels of disease causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as Nausea, diarrhea and headaches. Turbidity in drinking water is caused by particulate matter that may be present from source as a consequence of inadequate filtration. Turbidity level in water sources is suitable in Upper Deori Gaon, Mohimabri Gaon and Bamkukurachua.

The contamination of Iron is found to be high in pond water and tubewell water of Thengal Gaon that is 5.55 and 6 mg/lt (milligram per litre). The contamination of Iron is again found to be high in Tubewell water of Sonari Gaon that is 5.70 mg/lt. It is found to be less in Upper Deori, Mohimabari and Bamkukurachua. Iron gives bitter taste (unpleasant) sweet astringent taste, causing staining. Excessive Iron in water causes Chronic Dysentery; skin irritation etc. The Iron unit is suitable in Supply water of the Thengal Gaon, Upper Deori gaon, Mohimabari gaon, Sonari Gaon and Bamkukurachua. Arsenic and Fluoride are on desirable and permissible limit in all the villages. Slight Arsenic is found in Tubewell water of Sonari Gaon .002 mg/lt.

Excessive bacteria are found in pond water of Thengal Gaon, Mohimabari Gaon and Sonari Gaon. It is 92 MPN/100 ml in Thengal Gaon and 90 MPN/100 ml in Mohimabari and Sonari Gaon (MPN refers to most probable number), which is unsatisfactory. The tubewell water of Thengal Gaon and Sonari Gaon is unsatisfactory having above 50 MPN/100 ml in both the villages. Tubewell water of Mohimabari Gaon and Bamkukurachua is satisfactory having 1 MPN/100 ml and UpperDeori is Excellent with No coliforms. The result of supply water is satisfactory in Thengal Gaon, Mohimabari gaon, Sonari Gaon and Bamkukurachua. In Upper Deori Gaon only the analysis of Tubewell water is done as the 60 households are using tubewell water. Bacteria cause many diseases like Diarrhea, Typhoid, Jaundice, Chronic Dysentery etc. Bacterial growth in water is never a good sign. Whether the bacteria are harmless, or harmful, it can be a sign that the source is contaminated. Though coliform are not typically harmful, there are cases in which it can result in illness, especially for those with lowered immune systems. As a result, treating the water and removing the bacteria is essential.

Table 5: Households using Unsafe Water in Percentage

Households using unsafe water in %				
Villages	Pond	Tubewell	Supply	Total Households
Upper Deori gaon	0	0	0	0
Thengal gaon	12	38	0	50
Mohimabari Gaon	7	0	0	7
Sonari gaon	22	27	0	49
Bamkukurachua	0	0	0	0

Source: Field Survey 2013-2014

Thus, in Thengal gaon 142, in Mohimabari 17 and in Sonari Gaon 143 persons are using unsafe water.

Table 6: Percent of population without access to safe drinking water

Villages	*Percentage of population without access to safe drinking water (%)*
Upper Deori gaon	0
Thengal gaon	54
Mohimabari Gaon	7
Sonari gaon	50
Bamkukurachua	0

Source: Field Survey 2013-2014

Therefore, as per the water analysis, it was found that the people of Thengal Gaon and Sonari Gaon are using most unsafe and unhygienic water. People of Mohimabari are consuming good quality of water and the best quality of water is consumed by the people of Upper Deori Gaon and Bamkukurachua as per Table No. 5 and 6. Thus as per the investigation through MPW (Multipurpose Worker), field level extension worker and Aasha Karmis of Thengal Gaon, Sonari Gaon and Mohimabari, the occurrence of Diarrhea, Dysentery and skin irritation is high in Thengal Gaon. Maximum numbers of water borne diseases are recorded in hospitals and sub centers of Thengal gaon and Sonari Gaon. The occurrences of water borne diseases are less in Mohimabari village and Upper Deori Gaon. Few cases of Diarrhea and dysentery are recorded in Mohimabari Gaon and Upper Deori Gaon. In Upper Deori gaon 32 percent households filters water, 63 percent households in Thengal gaon, 28 percent households in Mohimabari, 100 percent households in Sonari gaon and 98 percent in Bamkukurachua. Optimal health is an important feature of population. The water resource should be used in judicious way in order to achieve good and healthy body.

6.2 Water Security Plans

Different Plans are required to minimizing the risk of contracting waterborne diseases, to provide optimal health service for the population.

a) System assessment –Though water for human consumption is usually treated, there's always the risk of accessing water that has not been treated, which is why the water used in an area must be protected at the source. To determine the drinking water source as a whole can deliver quality water that ensures good human health is important.
b) Operational monitoring – Operation and maintenance measures implemented at village level to ensure skills and finance for operation and maintenance, expansion etc and to ensure that the health-based targets are met.
c) Management plans -- Test the drinking water twice in a year to ensure that it is safe. This required the attentiveness of the people. It also includes the spreading of knowledge to the rural population about the harmful water borne diseases. Initiatives to manage the safety of water do not only support public health, but often promote socio-economic development and well-being as well. By organizing workshop in rural areas to provide knowledge about water related problem by the concerned departments.

6.3 Other Instructions

i) By adding sunlight and UV rays to the water source. UV light added to the source is widespread because it does not require the use of chemicals and it is a simple process. It is not effective when the bacterial growths have reached high levels, like 1,000 colonies of bacteria to every 100 ml of water, but it can be used before the bacteria gets to that point.
ii) Filtration and boiling of water is very much essential. Water filters are designed to remove impurities from water. Boiled water kills bacteria before it can cause damage to the body. Boiling water before drinking and after filtering gives best possible results.
iii) If the Turbidity, Iron is high than filtration should be double.
iv) The process of sedimentation and decantation is useful. Sedimentation includes the process of settling down of heavier insoluble particles in water and decantation involves the transferring the clear liquid after sedimentation without disturbing the sediments (insoluble heavy particles).
v) Water treatment by slow sand filtration which is a simple and costs little.

7. Conclusion

Water is the core of sustainable development and is critical for socio-economic development, healthy ecosystems and for human survival itself. Indicators on water quality can be used to demonstrate progress toward the targets, by plotting trends in water quality over time and over space. Every year, more people die from unsafe water than from all forms of violence, including war. The most significant sources of water pollution are lack of inadequate treatment of human wastes and inadequately managed and treated industrial and agricultural wastes. Safe water prevents the transmission of waterborne pathogens and reduces the exposure of individuals to chemical and physical hazards. Optimal health is an important feature of population. The water resource should be used in judicious way in order to achieve good and healthy body, balanced development and sustainable outcomes. It is vital for reducing the global burden of disease and improving the health, welfare and productivity of populations.

References

[1] Ahuja, Ram. (2009). *Research Methods.* Rawat Publications, Jaipur.
[2] Ahuja, Ram. (1999). *Social Problems in India*, Rawat Pulications, Jaipur.
[3] Bhattacharyya, N.N. (2008). *Biogeography*. Rajesh Publications, New Delhi.
[4] Ghosh Roy, M.K. (2011). *Sustainable development, Environment, Energy & Water Resources*, Ane Books, Pvt. Ltd. New Delhi.
[5] Lalitha, S., & Michael Vetha Siromony, P. (2014). Drinking water issues in Rural India: Need for stakeholders' participation in Water resources management, *Future of Food: Journal on Food, Agriculture And Society*, 2(1), 93-110
[6] Neumayer, E. (2001). Convergence in access to safe water and adequate sanitation: An analysis across countries and time. *International Journal of Water*, 1 (2), 210-216
[7] Paterson, J.H. (1972). *Land, Work and Resources*: *An Introduction to Economic Geography*. The Chaucer Press, Bungay, Suffolk. pp. 8-9.
[8] Riley et al. (2011). Biological approaches for addressing the grand challenge of providing access to clean drinking water. *Journal of Biological Engineering* 5 (2).
[9] Singh, A.K. (2006). *Environment and Water Resources Management*, First Edition, Delhi, Adhyayan Publishers and Distributors, Delhi.
[10] Singh, R.B. (1988). *Studies in Environment and Development*. Commonwealth Publishers, New Delhi. P. 292.
[11] Sinha, R.N.P. (1992). *Geography and Rural Development*. Concept Publishing House, New Delhi.