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Geography

"A Study of Potability of Drinking Water in Churu Tehsil with Reference to Sustainability"

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Abstract

The present study intended to calculate the Water Quality Index of drinking water in order to assess the qualitative aspect of drinking water supply of the Churu Tehsil by comparing it with existing standards for important parameters. Water Quality Index is calculated from physico-chemical analysis of eight parameters taken together, which indicating the heavy pollution load in water. The result of this study indicate that the drinking water supply of the Churu Tehsil do not conform the recommendation standards, and hence it is suggested to take all necessary precautionary measures before it is sent to public consumption to avoid adverse health impacts and to prevent various intestinal epidemics. It is concluded that WQI is a useful tool and can be used in comparing the water quality of different sources.

Keywords: water quality index, qualitative aspect, drinking water

Introduction

Drinking water or potable water is water o f sufficiently high quality that it can be consumed or used without risk o f immediate or long term harm. Over large parts of the world, humans have inadequate access to potable water and use sources contaminated with disease vectors, pathogens or unacceptable levels o f dissolved chemicals or suspended solids. Such water is not potable and drinking or using such water in food preparation leads to widespread acute and chronic illness and is a major cause o f death in many countries. In general, the requirements for a potable water source may be considered to be good-tasting, free from odors and preferably cool and 1 that devoid of disease-producing organisms. It should also be colorless and clear, be non-corrosive and free from objectionable gases, such as hydrogen sulfide, and objectionable staining minerals, such as iron and manganese. It should also be plentiful and low in cost. The quality of water resources is a subject of ongoing concern. The assessment of long-term water quality changes is also a challenging problem. During the last decades, there has been an increasing demand for monitoring the quality of the water resources. Water quality is a term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

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The primary bases for such characterization are parameters which relate to drinking water, safety of human contact and for health o f ecosystems. The particular problem in the case of water quality monitoring is the complexity associated with analysing the large number of measured variables and high variability due to anthropogenic and natural influences.

Population is considered as important factor for water supply in urban centers as well as in rural areas. Increasing population is creating tremendous pressure on the water supply and sources of water supply. Expanding cities are facing acute water shortage due to increase in consumption of water as a result of growing population. Requirement for drinking and domestic water depends on physical and on level of socio-economic development. World Health Organization has estimated that about 200 liters of water per person per day is required for these purposes. In Indian context, it is estimated 200 liters per day per person in urban areas and 70 liters per day per person in villages. Level of extraction of water from different sources for drinking and other purposes indicates the consumption level of the family. It also shows that how far it deviates from the actual requirement to that of ideal requirement of water per family.

Review of Literature

H.P. Sarma (1997) studied the quality of drinking water in the Darrang District with particular reference to Mangaldoi Sub-Division. He found that drinking water in many areas of the Darang district was of poor quality and the prevalence of water borne diseases in the district might be related to that. He found conductance value high and pH value low in many cases. He also remarked that the study would inspire further investigation with emphasis on particular aspects of water quality and health.

R. Vidyasagar Rao (1997) in his article "Water and Sustainable Development: Indian Scenario" discusses various issues related with water and various strategies and measures contemplated to tackle the problem. The article discusses various measures for water conservation and demand management like water saving devices, improving water use efficiency, water pricing and recycling and reuse of water and the implementation of various measures for maintaining water quality like regulations concerning water quality, watershed management to reduce erosion and sedimentation, application of clean technology and monitoring of water quality.

Mithra et al (2010), in their paper on, "Drinking water in an urban areas in South India", showed that globally, 1.1 billion people lack access to improved drinking water supply and drink water that is contaminated. Hence, study of water treatment assumes utmost importance in order to ensure the safety of the water consumed especially in fast developing cities. This study provides information of drinking water management practices in the study area. The study examined the sources, the treatment and storage facilities of drinking water in households and also assessed the free chlorine levels in the drinking water.

Hypothesis of the Study

For the research study the following hypothesis has been formulated:

- Increasing pressures on water resources adversely affects its quality and simultaneously human health.
- Respondents have a little awareness about drinking water quality.

Objectives of the Study

The present research has been formulated the following objectives for the study on the quality of drinking water in the study area:-

- To determine availability of Potable water in the study area.
- To suggest measures for sustainable availability of potable water.

Study Area

Churu district is the part of Thar desert located in the western part of Rajasthan State extending between 27° 24' to 29° 00' North latitudes and 73° 40' to 75° 41' East longitudes. It is bounded in the north by Hanumangarh district; in the west by Bikaner district; in the east by Sikar and Jhunjhunu districts of Rajasthan and Hissar of Haryana; and in the south by Nagaur district of Rajasthan. The district covers an area of 13784.38 sq. kms With population of 20, 39,547 (Census 2011). The boundaries, as they exist today, were carved out finally in 1959, on the basis of the regional languages, suggested by the States Re-organization Commission and presently comprise the six tehsils viz. Rajgarh, Taranagar, Churu, Sardarshahar, Ratangarh and Sujangarh. It is linked by roads and railways with Delhi, Jaipur, Bikaner, Jodhpur, Sri Ganganagar, Hissar etc. The district is connected with the national highway no.11 and 65 passing through Rantangarh Churu and Rajgarh tehsils.

Churu is characterized by shifting sand dunes. Churu experiences harsh and dry desert climate conditions with extremes of temperature (reach 50^0C in summer and 0^0C in winter) with irregular erratic low rain fall about 32mm. per annum. The area has scanty vegetation.

There is no perennial surface water source in the study area. Therefore ground water becomes very important for fulfilling the requirements of drinking water. Rapid growth of population and increasing water demand are key factors for the over exploitation of water which also affects the quality of water.

Groundwater in the study area is affected with high range of fluoride, chloride and nitrate contaminants. Few blocks in the study area are highly brackish and saline, facing the problem of unavailability of safe drinking water. Therefore Govt. planned a project name 'Apani Yojana' to ensure the supply of potable drinking water in these blocks. This project supplies canal water in few blocks of the study area like-Rajgarh, Taranagar, Churu etc.

Irregular, erratic low rainfall, extreme temperature, arid climatic conditions are unfavourable for the development of water resources in the study area.

Data Collection and Research Methodology

Primary and secondary data has been used in the present study.

First hand information has been collected through questionnaire. The source of secondary data has been collected from topographical sheets, gazetteer, census hand book and statistical book.

Experimental and descriptive research methodology has been used for the study.

Statistical Tools and Techniques

Different statistical techniques has been used to present different socio economic data in proper manner. Percentile analysis has been used for socio economic data analysis. For Experimental analysis WQI index has been find out.

Sampling

To evaluate contamination of potable drinking water, water samples were collected during 2016.

Sample Size and Period of the Study

Drinking water samples from a total of 20 sampling sites of 20 villages of Churu Tehsil were collected. The total water collection in the year of 2016 is divided in to two seasons, one is pre monsoon and another one is post monsoon. The sampling is carried out, during April 2016 for pre monsoon season and in September- October 2016 for post monsoon season from manually operated tube wells and hand pumps of varying depth, bore well, fresh water pond, Johra, govt. water supply, water cooler and Kui/Kundi/Tanka.

Results and Discussions

Table 1.1
Classifications of Drinking Water in the Study area with respect to WQI values in Pre Monsoon Season

Name of the Sampling Site	No. of Samples	WQI Range	Quality Category
Churu Rural	01	0-25	Excellent
Asloo Station, Bas Dhakan, Kotwad Tal, Kunsisar, Dhameri, Satra, Churu (M Cl + OG), Indrapura, Jhariya, Motisar	10	26-50	Good
Thailasar, Asalkheri, Boontiya, Hunatpura, Gajsar, Sirsali, Ranasar, Suratpura	08	51-75	Poor
Nil	0	76-100	Very Poor
Dhadhar	01	Above 100	Unsuitable for Drinking

According to the results, it is concluded that in pre-monsoon season only three sampling sites namely *Churu rural* exhibit excellent water quality for drinking, and 10 sampling sites namely Asloo Station, Kotwad Tal, Gajsar, Kunsisar, Dhameri, Satra, Churu (M Cl + OG), Indrapura, Jhariya and Motisar indicate good ground water quality for drinking. The Dhadhar sampling site in pre monsoon is not directly suitable for potability because they are classified as poor, very poor and unfit categories as per the WQI ranges.

Table 1.2 : Classifications of Drinking Water in the Study area with respect to WQI values in Post Monsoon Season

Name of the Sampling Site	No. of Samples	WQI Range	Quality Category
Churu (Rural)	01	0-25	Excellent
Asloo Station, Kotwad Tal, Gajsar, Kunsisar, Dhameri, Satra, Churu (M Cl + OG), Indrapura, Jhariya, Motisar	10	26-50	Good
Thailasar, Asalkheri, Bas Dhakan, Boontiya, Hunatpura, Dhadhar, Ranasar, Suratpura	08	51-75	Poor
Nil	00	76-100	Very Poor
Sirsali	01	Above 100	Unsuitable for Drinking

In post monsoon season there is *Churu rural* a single sampling site under the excellent category and only 10 sampling sites namely Asloo Station, Kotwad Tal, Gajsar, Kunsisar, Dhameri, Satra, Churu (M Cl + OG) and Indrapura fall in the category good for drinking. The rest 8 sampling sites are not suitable for potability as according to their WQI ranges they are classified as poor, very poor and unfit for drinking purposes. The Sirsali sampling site in post monsoon is not directly suitable for potability because they are classified as poor, very poor and unfit categories as per the WQI ranges.

Most of the stations are having drinking water of very poor and unsuitable categories with water quality ranging from 75 to 100 and >100 respectively.

Conclusions

Conclusively, following inferences can be drawn from the research study:

1. It can be concluded that the drinking water from some sites of Churu tehsil, district Churu of Rajasthan is not suitable for drinking; even sufficient quantities are not available. Disinfection and treatment of water is suggested before drinking. If proper care and management to ascertain quantity and quality is not applied, not the quantity but the quality of the drinking water will be deteriorated to the much extent. Very shortly a situation may come when not only the insufficient quantity but that too highly impure, will be left with us to offer to our offspring.
2. Overexploitation is not only emptying the aquifers but also contaminating the water. The shortage and contamination of water is slowly affecting the lives of people as well as the environment around them. The water left underground, has impurities from the soil and rocks under neath, and is not very much suitable for drinking purposes. Thailasar, Bas Dhakan, Gajsar, Churu (Rural), Suratpura groundwater sources are not suitable for drinking purpose.

3. The fresh water ponds, bawaries and waste water pond show the high level of coliform. Therefore, the water of these reservoirs is not safe for drinking. The water of water ponds have the highest level of coliforms and shows the highest degree of contamination, such water cannot be used for irrigation except limited conditions. The water of fresh ponds and bawries are suitable for irrigation and animals.
4. According to the results, it is concluded that in pre-monsoon season only three sampling sites namely *Churu rural* exhibit excellent groundwater quality for drinking, and 10 sampling sites namely Asloo Station, Kotwad Tal, Gajsar, Kunsisar, Dhameri, Satra, Churu (M Cl + OG), Indrapura, Jhariya and Motisar indicate good ground water quality for drinking. The Dhadhar sampling site in pre monsoon is not directly suitable for potability because they are classified as poor, very poor and unfit categories as per the WQI ranges.
5. In post monsoon season there is *Churu rural* a single sampling site under the excellent category and only 10 sampling sites namely Asloo Station, Kotwad Tal, Gajsar, Kunsisar, Dhameri, Satra, Churu (M Cl + OG) and Indrapura fall in the category good for drinking. The rest 8 sampling sites are not suitable for potability as according to their WQI ranges they are classified as poor, very poor and unfit for drinking purposes. The Sirsali sampling site in post monsoon is not directly suitable for potability because they are classified as poor, very poor and unfit categories as per the WQI ranges.
6. Most of the stations are having drinking water of very poor and unsuitable categories with water quality ranging from 75 to 100 and >100 respectively.
7. Most of the respondents (75%) are of the view that they are having adequate availability of water for drinking purpose. The inadequacy of water to few of the respondents was mainly due their residence away from major hamlets. The summer season put pressure on water sources but this is managed by the respondents through rain water harvesting structures.
8. Most of the respondents are aware of water quality as 60 % of them have answered in yes.
9. The respondents have also expressed their views about the quality of water available to them. 50 % of the respondents have claimed that they are getting good quality of water while 20 % of respondents are of the view that are getting poor and 10 % getting very poor quality of water. 10 % of respondents are unaware of status of drinking water quality.
10. Around 77.5 % of the respondents are aware of the ill effects of water quality on human health. But there are only aware of the general health problems due poor water intake i.e coloring of the teethes, weakening of the bones, jaundice, stomach related ailments etc.
11. Satisfaction of drinking water supply, 45 % of the respondents were satisfied by water supply while percentage of unsatisfied people are comparative low. The UNICEF has warned that 44 millions people in the country suffer from

consequences of drinking contaminated water, thereby seriously affecting the health of future generations who are growing up due to increasing diarrhea diseases.

12. The overall health status of the people in the district appears to be unsatisfactory. Outbreak of water-borne diseases such as typhoid, dysenteries, infectious hepatitis and water related diseases encephalitis, malaria, skin rashes etc are very common among the people in the district. Illiteracy and lack of awareness about their health and environment, poverty and large family size, poor drainage and sanitation system and absence of proper medical facilities are the main reasons for the poor health conditions of the people in the district. For the improvement of health status of the people in the district, the awareness regarding drinking water quality and the associated problems is most essential.
13. From the field survey it can be concluded that the supply of pure and safe drinking water was inadequate in the town areas and was almost non-existent in the rural areas in the district. Piped water is available only in limited locations and only a small segment of the total population was benefited by the public water supply scheme.
14. Tube wells, bore wells and hand pumps are the most common source of drinking water. Some of these may be safe for use while others may not be safe for drinking purposes. As a result scarcity as well as bacteriological contamination of water affects a large number of people.
15. Proper waste disposal and drainage system do not exist in the district. The slum areas in and around the urban centers have grown very rapidly and the residents in these areas neither have safe drinking water nor do have any system of waste disposal. Therefore it is in these areas where most diarrhoeal deaths occur.
16. Majority of the people in the district are living under the poverty line. Most of the rural families are unconscious about their sanitation. Many of the people use water directly from the sources for various domestic uses including drinking. Some of the people have ordinary sand and stone filters as the only treatment given to water before using it for drinking and cooking. Disinfection is seldom done. Most of the people are ignorant about the causes and consequences of water pollution.
17. Majority of them have no idea about the water-borne diseases. As a result outbreak of water borne diseases are very common among the people of the Churu district. Medical facilities even in modern time are not satisfactory. Increased deforestation and population growth also affect the water resources in the district.

Recommendations

Drinking water quality should be tested and evaluated on the basis of physical, chemical and biological parameters. Use of contaminated water can lead to various diseases. This study outlines that academia is needed to make water related research more strategic and effective at a regional level so that early identification of the

affected sources can be made. However, further studies are needed to assess the relationship between levels of contaminants with health risks. Moreover, present research provides spatial information and knowledge based on the water quality of the study area which will help in decisionmaking process by identifying the most sensitive zones that need immediate attention.

Assessing the scale of the problem (now and over time) involves field testing, laboratory testing, and monitoring; identifying appropriate mitigation strategies involves technological, economic, and socio-cultural analysis of possible responses; and implementation involves awareness raising and direct action by governments, donors, NGOs, and other stakeholders at local, national, and regional levels. So, a holistic approach involving medical practitioners, scientists and social workers will need to work coherently to find out a solution that can lessen sufferings of the humanity and making a provision for safe drinking water. Sustainability in the long run remains a major challenge.

Ultimately, the protection and treatment of water in the district lies in the hand of individuals. It is therefore, immediately required that the water source be properly protected from potential contamination of arsenic, iron, manganese, aluminium, lead cadmium and bacteriological etc. parameters and that appropriate treatment be selected for future use of water in the region. Thus, village level-microanalysis of the impact of water availability and water quality on the quality of life of people, particularly women and children, needs to be done in the study area. The present study, however, fulfilled the limited purpose of strengthening database which may be helpful in formulating strategy for future protection of water in the area.

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