



ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2017; 3(7): 240-244
www.allresearchjournal.com
Received: 01-05-2017
Accepted: 02-06-2017

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An analysis of water quality and its impact on human health with special reference to Sikar district, Rajasthan

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Abstract

Achieving efficient, powerful and fee effective water purification methods for the community are the important thing to human survival and improvement, as water control is a modern-day worldwide problem. Water is the number one aid vital for maintaining all human sports activities, so its provision in desired amount and great is of in reality significance. Water pollution impacts eating water, rivers, lakes and oceans everywhere in the world, which therefore harms human health and the natural environment. The existing go-sectional take a look at is centered on measuring the exceptional of consuming water in rural areas of Sikar district, Rajasthan and its outcomes on human health as instructed via the people living in those regions. Numerous analyses including bodily, chemical and microbiological assessment were performed at the water samples gathered from the villages. The samples have been located to have excessive pH, indicating alkalinity of the water samples, and high chromium content fabric. Microbiological high-quality changed into also questionable in most of the cases. At the opposite of those findings, majority of human beings dwelling in those areas have been not laid low with various water borne ailments. So the look at argues about the need and significance of water purification and water control systems in cutting-edge-day instances.

Keywords: Water quality, chromium, Physico-chemical, cross sectional study, Sikar, microbiological.

1. Introduction

Water covers over 71% of the earth's surface and is a very critical natural aid for people (countrywide surroundings studies council, 2007) ^[1]. But, only 2.5% of the earth's water is fresh and therefore suitable for intake. now not handiest that, however of that 2.5%, more than -thirds is locked away in glaciers and no longer in particular capable of help meet the growing needs of society (ward, 2003) ^[3]. It is the fundamental right of every man or woman to get pollutants unfastened water. A water pollutant affects drinking water, rivers, lakes and oceans everywhere in the international, which therefore harms human fitness and the herbal environment. Water pollutants include sewage and waste water, industrial waste, oil pollutants, marine dumping, atmospheric deposition, radioactive waste, underground storage leakages, worldwide warming, eutrophication and so forth. (Gambhir *et al.*, 2012) ^[4].

Water pollutants may not reason immediate impact at the health of the person however can prove deadly ultimately. Heavy metals from commercial procedures can accumulate in nearby lakes and rivers, proving harmful to the marine animals, different animals consuming this toxic water and people using animal merchandise. Pollution in industrial waste can purpose immune suppression, reproductive failure or acute poisoning. Microbial pollutants from sewage regularly result in infectious diseases like cholera and typhoid fever that are the primary purpose of toddler mortality. Water pollutants can be unfavorable to the economic system as it is able to be high-priced to treat and prevent infection. Waste that does not damage down quickly accumulates within the earth's waters and eventually makes its way to the oceans (water pollution guide) table 1.

Diarrheal diseases represent a major health hassle in developing international locations and also a high hazard to guests who visit those international locations. Conservative estimates region the global loss of life toll from diarrheal sicknesses at about two million deaths in line with 12 months (1.7 to 2.5 million deaths), rating 1/3 amongst all causes of infectious ailment deaths international (global fitness organization, 2012).

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Maximum of those deaths arise in kids below 5 years of age. A mean morbidity assault charge of 3.2 episodes of diarrhea in step with 12 months in step with toddler has been pronounced, but in some settings in growing international locations, this variety may be as excessive as 12 episodes per year consistent with child (international fitness organization, 2012) desk 1.

Evidence has been accumulating for long-term consequences of such heavy sickness burden in early formative years, on bodily and intellectual development of kids that could eventually translate into luxurious impairment of human fitness, and productiveness at a grownup age. Furthermore, outbreaks of cholera, shigellosis and typhoid fever most usually arise in aid-negative international locations, adding to the weight of sickness among the most vulnerable inclusive of refugees, internally displaced populations and corporations residing in shanty cities (global fitness enterprise, 2012). Water pollutants may be avoided with the aid of stopping pollutants from contaminating close by waters. There are a number of water treatments to prevent pollutants including organic filters, chemical components and sand filters. These easy strategies cost cash to hold, but prevention is a great deal inexpensive than cleansing up water pollutants that has already occurred (global health employer, 2012). Preserving the above data in thoughts, this study became completed to evaluate the water quality of villages of sikar district, Rajasthan and its effect on the health of individuals referring to water borne illnesses.

Table1. Indian data and statistics

Year	No. of diarrheal deaths in 0-6 years	No. of diarrheal deaths in 6+ years
2006	1,68,896	3,15,818
2011	1,81,986	3,40,296
2016	1,95,046	3,64,716

Source: National Commission on Macroeconomics and Health, Ministry of Health and Family Welfare, Government of India, 2005).

Methodology

Study area

A cross-sectional study was carried out in 5 villages Such as Ajeetpura, Deogarh, Arjunpura, Nagwa and Rampura to assess the health status of the individual pertaining to water borne diseases in the rural areas of Sikar district, Rajasthan.

Study tool

In total, 200 participants were interviewed with the help of a self-designed pre-tested semi-structured questionnaire. Prior to the interview, informed consent was obtained from the participants. Questionnaire was designed to elicit descriptive accounts of the informants' everyday life, water usage, water storage habits, personal hygiene habits and experiences with diseases. Data collected was statistically analyzed using Statistical Package for Social Sciences (SPSS 10).

Study period

The study changed into finished in a period of 6 months this is, July, 2016 to December, 2016. The observed commenced with the collection of water samples from the villages, with the help of sterilized check tubes. for the microbiological

sampling, water samples have been brought to the laboratory in clean sterile take a look at tubes and analyzed inside 24 h. those samples were taken from commonplace water assets, that is, from wherein the complete village gets its water supply. So, testing water samples from these common resources like water tank, tube wells, wells, and common water taps, might serve the purpose and shop sources. to envision the bodily, chemical and microbiological nice of ingesting water of the chosen villages, a complete of 12 water samples have been amassed, one from the households (selected randomly), one from not unusual taps (decided on randomly) and one from the water tanks of each village. The household web sites were selected randomly using a random sampling method. Physical parameters had been measured at once at the water surface by using traditional techniques. Standard photometric evaluation changed into employed for determination of chemical attention of copper, chromium and zinc. Microbiological evaluation the use of nutrient agar and McConkey agar were used for presumptive and showed coliform counts, using the colony depend and maximum possibly wide variety strategies.

Results

The age distribution of humans interviewed is given in table 2. The training popularity of the populace is given in figure 1. Consistent with the facts accrued, maximum of the subjects were illiterate (41%) or beneath metric skip (38%), so the extent of literacy changed into very negative among the subjects below observe.

Monthly income of the subjects

Majority of the subjects (65.0%) were from lower socio-economic group, earning a monthly salary of 0 to 5,000 rupees only. Mean salary of the studied population was Rs. 5,175 only

Sources for drinking water

Various sources for drinking water were tap (15.5%), well (13.0%), tube well (13.0%), and community water source supply (58%). Methods used for purification of drinking water included boiling (4.0%) and muslin cloth (7.5%), while 88.5% did not use any method for purification of drinking water.

Storage of drinking water

At some stage in garage of drinking water additionally, they did now not use any precaution mainly. About 92.5% saved water in earthenware pots, 6.5% in stainless steel containers, and 0.5% in plastic buckets as indicated in discern 3. Maximum of them did not use any separate glass for casting off water from the boxes in which water became stored. Population of the village, specifically kids, did no longer use simple hygiene measures like washing hands before disposing of water from the storage field. Maximum of the villagers knowledgeable that they wash their water-garage utensil once a month while a number of them washed it once every 2 to 3 months. Most of them were no longer aware about various precautions to be taken before and after storing water and to save you water-borne sicknesses.

Medical illness of the subjects

About 20% suffered from medical illnesses like diarrhea, vomiting, headache, stomach ache, dizziness, fever etc.

while 80% did not have any such symptoms as shown in Figure 2.

Laboratory results

Physical, Chemical and Microbiological test results are proven in table 3. Maximum probably numbers (MPN) is a suitable and broadly used method to decide the volume of microbiological first-rate of water. Most of the villages confirmed endless variety of microbial content, with the worst being Deogarh village. This is probably because of the favorable situations like temperature, pH and many others. Excessive value of MPN shows that water isn't appropriate for ingesting purpose. Most bacteria develop between pH 4 to 10 and showcase most suitable boom inside the variety of pH 6.5 to 7.5.

Table 2: Age distribution of the subjects.

S.N	Age group	Percentage
1.	16-20	11.5
2.	21-25	28.5
3.	26-30	18.0
4.	31-35	15.5
5.	36-40	12.0
6.	41-45	7.5
7.	46-50	6.0
8.	51-55	3.5
9.	56-60	8.5
10.	61-65	6.5

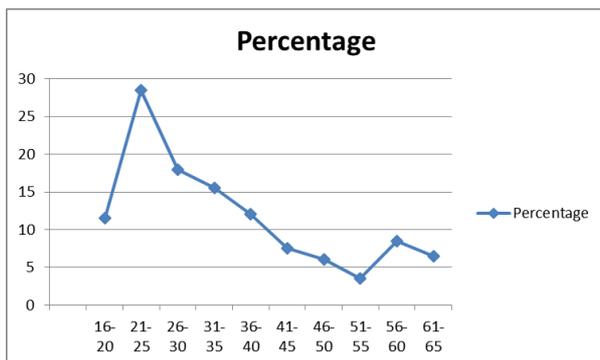


Fig 1

And rampura have round 458, 482, 523, 498 and 542 households, respectively. The district has a populace of 223,579 (2011 census), an area of 20-2.57 km², and a populace density of 213 people according to km². Sikar district is provided by means of specifically Sekhawati basin, and north western component falls underneath the basin, that is having inland drainage. Intensity of ground water is among 20 m to 100 m, commonly discovered in regions located to the west of aravalli levels covering barmer, jalore, Jhunjhunu, sikar, nagaur, churu, jaisalmer, sirohi, Jodhpur, Bikaner, Jaipur, hanumangarh and dausa districts, served specially by using Kantli River (ministry of water assets, government of India, 2008). The location receives an annual rainfall of about three hundred to 500 mm (authorities of rajasthan, 2009). As proven in the end result of the above examine also, the ground water is alkaline type, having ph value extra than 7. In India, majority of the rural population (about 72%) does not use any technique of water disinfection and haven't any sanitary bathrooms (74%) (International institute for populace sciences (IIPS) and macro global, 2007). Outside defecation

is also a common exercise among villagers, and may result in infection of the water supply system ensuing in outbreaks of diarrheal sicknesses (bora *et al.*, 1997; sarkar *et al.*, 2007) [3] [13]. According to the above examine additionally, majority of villagers (88.5%) did not use any method for purification of ingesting water and had bad expertise about the want and availability of secure ingesting water.

The most typical shape of disinfection in rural India is single-factor chlorination, the usage of bleaching powder. However, this may not be effective because of the opportunity of more than one websites of infection (Propato and Uber, 2004) [12]. Opportunity factor-of-use disinfection methods including solar water treatment (Kang *et al.*, 2006; rose *et al.*, 2006) [8] [14] or point-of-use chlorination (Arnold and Colford, 2007) [7] and storage of water in slim-mouthed vessels (Mintz *et al.*, 1995) [9], want to be explored. thinking about the contamination of all water samples on the household stage, end-consumer disinfection with chlorine is probably to be extra powerful in such settings (Clasen *et al.*, 2006) [2] and it have to be consistent with the who standards (world fitness business enterprise, 1993). It's been predicted that diarrheal morbidity may be decreased by using an average of 6 to 20% with upgrades in water deliver and by way of 32% with improvements in sanitation (international fitness business enterprise, 2004). Educating human beings and mass media campaigning can be used to popularize those techniques. However, sustainability of those methods over longer intervals or cost-effectiveness in rural India continues to be questionable. In the present study, use of chlorine for water purification turned into no longer established.

The have a look at villages had no organized sewage machine, open drains were common website online and there was localized collections of waste water. Animal faecal be counted was interspersed around houses (wherein animals had been tethered), and at the streets. Youngsters had been seen defecating on the streets. Also at positive factors, faeces were seen inside the sewage drains and across the localized waste water series spots. There was no system for collection and disposal of rubbish. In certain locations, rubbish was inseparable from human and animal faeces, so the probabilities of diarrheal sicknesses had been even extra, but at the contrary 80% of people residing in these villages did no longer report any symptom of diarrheal sicknesses. The reasons for this could be that they've evolved immunity closer to various water-borne bacterial and viral infections. The opposite purpose will be that people are unaware approximately those symptoms, their relevance and why reporting these signs and symptoms is critical. So their lack of know-how about these symptoms and sicknesses could have been chargeable for beneath reporting of the equal. The look at also indicated that the buildup of heavy metals over large areas and long periods of time resulting in slow harm to residing organisms necessitates cautious tracking of the enter, moves and consequences of such pollution (Ida, 2012) [6].

Other studies additionally got here out with similar results like a observe of ingesting water nice of wilderness affected region of Sikar district in Rajasthan which turned into accomplished to find out water pollution and to test the suitability of water for ingesting and irrigation motive in look at vicinity. In this study, it was discovered that nitrate fluoride and overall dissolved solids (TDS) were better, and water of observe area changed into discovered to be hard

(literature evaluate). In the take a look at on heavy steel contamination in ground water at outer skirts of kota metropolis, Rajasthan India, researchers analyzed 72 ground

water samples for dedication of infection degree of Fe, Pb, Ca, Zn, Mn, Cr, and it was located that lead and chromium concentrations have been high (Patil and Ahmed, 2011).

Table 3: Physical parameters

S. No.	Characteristic	Deogarh	Ajeetpura	Arjunpura	Nagwa	Rampura
1	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
2	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
3	Temperature (°C)	27.5	27.0	28.5	26.5	28
4	Turbidity	No turbidity	No turbidity	No turbidity	No turbidity	No turbidity
5	Clarity	Clear	Clear	Clear	Clear	Clear
Chemical assessment						
6	pH	8.742	8.346	8.731	8.563	8.274
Heavy metal						
7	Copper (ppm)	Nil	Nil	Nil	Nil	Nil
8	Chromium (ppm)	0.119	0.110	0.078	0.082	0.78
9	Zinc (ppm)	0.278	0.253	0.243	0.258	0.233

Table 4: Educational status of the subjects

S. No.	Villages	Nutrient agar (Colonies/100 ml of water)	Mckonkey agar (Colonies/100 ml of water)
1	+Control	Infinite	Infinite
2	-Control	Nil	Nil
3	Deogarh	8	Infinite
4	Ajeetpura	Nil	8
5	Arjunpura	Infinite	8
6	Nagwa	8	Infinite
7	Rampura	Nil	8
8	Pond water	Infinite	Infinite

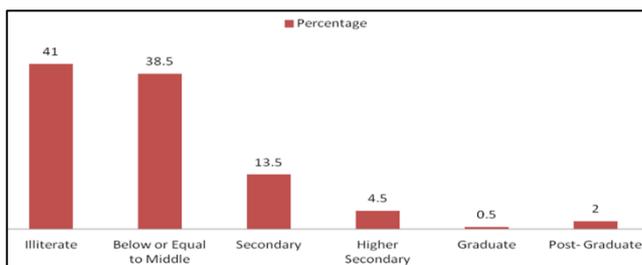


Fig 1. Educational status of the subjects

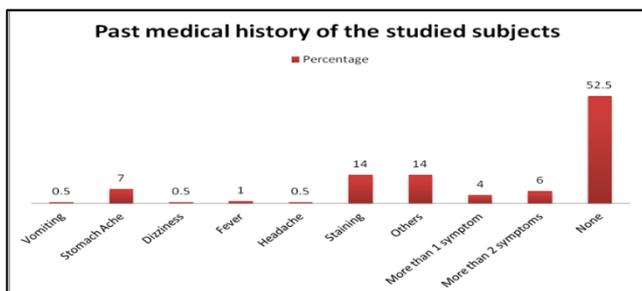


Fig 2. Past medical history of the subjects

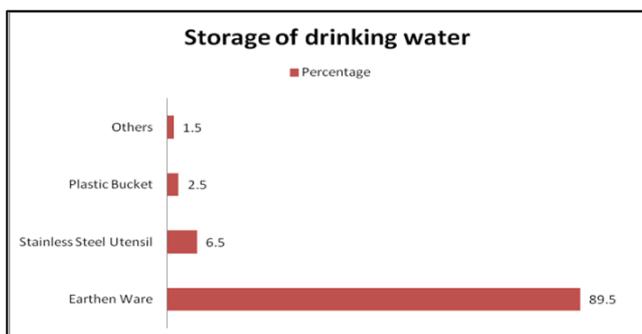


Fig 3. Storage of drinking water

Zinc

Zinc is a totally critical micronutrient in human being however if at very excessive concentrations, it is able to reason some poisonous effect. Zinc compounds are astringent corrosive to skin, eye and mucous membranes. They cause unique types of dermatitis known as “zinc pox”. Zinc is likewise aggravating to digestive tract, causing nausea and vomiting. The maximum permissible concentration of zinc in consuming water is 15 ppm in line with international health organization (who). The values of zinc content in all water samples of the take a look at were beneath the maximum permissible restriction in accordance to who (1996) norms (Patil and Ahmed, 2011).

Chromium

Chromium is likewise critical to organisms as a micronutrient, in lines from fats and carbohydrate metabolism. Chromium is also greater harmful in its lower oxidation state (iii). Chromium and chromates are capability carcinogens. The limit of chromium in consuming water is 0.01 ppm consistent with WHO. The values of chromium content in all water samples had been higher than most permissible level in step with who (1996) norms. That is a severe health danger and must be seemed upon by the concerned authorities (Patil and Ahmed, 2011). The restrictions of look at are the low sample length of the look at; fluoride, chlorine and other heavy metals ranges had been not examined because of resource constraints. Long time results of these effects have been now not studied within the sample population.

Acknowledgements

I am thankful to Shri JJT University, Churela, Jhunjhunu (Rajsthan) for supporting necessary materials during analysis.

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