

Evaluation of toxic components in underground drinking water and its effects on the health of the rural people of Hyderabad, Pakistan

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Abstract

Background: In rural areas, the people use underground water as it is the main and easy source of water. For this purpose they use hand pumps, bores, tube well and well water. Upon testing of hardness some sources give positive results that conforms the hardness of water.

Objective: The objective of the study was to ensure the safety use of underground drinking water and to evaluate the toxic components in various samples of underground drinking water by using different colorimetric and spectrophotometric techniques.

Methodology: This study was based on survey and experimental method. In this study, 5 liters of water was collected in clean plastic bottle from 3 different villages of Taluka Tandojam district Hyderabad. The evaluation of the toxic components in various samples of underground drinking water was carried out by using different colorimetric and spectrophotometric techniques A self-structured questionnaire was adapted for the assessment of health related issue and to find out the relationship between the type of drinking water and the morbidity.

Results: It was found that subjects who drank underground water on the regular bases were suffering from gynaecological problem, alopecia and gastrointestinal problems with highest percentage as 56.25 %, 55.71% and 52.85% respectively. Dermal and dental related problems were 28.57% and 27.14% respectively. Problem observed in urinary system was 12.85%.

Conclusion: Higher values of toxic components such as lead; arsenic etc significantly decreases the quality of drinking water. Therefore, the awareness programs on chemical contents in drinking water and their hazardous effects on human body should be organized at national level to improve the public health problems caused due to contaminated drinking water.

Keywords: Underground water, weight loss, physical changes, appetite loss, alopecia, arsenic, lead.

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1. Introduction

Water is essential part of our daily life and health whereas human body contains about 70% of water. It is essential for the survival of human being [1]. In Pakistan the main source of water is ground water and lake water, but mostly ground water is commonly preferred in rural areas of Sindh as there is no proper water supply channel spread in Pakistan [2]. This ground water or well water is playing important role in people's health as these are the

only source of water which causes some health related problems [3]. In Sindh, drinking water is considered as a major problem and due to drinking unhygienic water which causes many diseases such as gastritis, dermatitis, constipation, hypertension, cardiovascular related disorders and many miscarriages and other health related issues. All these ailments are considered to cause disturbance of electrolytes, minerals or ions imbalance but the toxic compound arsenic is considered as the hazardous

compound that plays a major role in effecting human health and causing toxic effects on human body. It is utmost important for the people to use drinking water after applying necessary steps to remove pathogens, turbidity and chemicals from the drinking water [4-6].

In rural areas, the people mostly use underground water as it is the major and easy source of water. For this purpose they use hand pumps, bores, tube well and well water. Upon testing the hardness of the drinking water in rural areas positive results have been observed that conforms the hardness of underground water. The water becomes hard when there is deposition of high amount of calcium, magnesium and limestone in that water. Beside minerals, there is high quantity of electrolytes and metals present in hard water. These electrolytes and metals may play important role in causing some health related problems in many individuals using such types of hard water [7-9].

Drinking hard water is not much harmful but it may cause some serious type of health related issues. There is a multivalent cations present in the hard water which is one of the major reason of hardness of water. These multivalent cations are basically positively charged metal ions [10]. Hardness of water is also considered as a problem especially if the water is acidic. In many areas of Pakistan underground water contains excessive amounts of iron. However, iron causes reddish stains on plumbing fixtures and clothing [11]. This study was carried out to evaluate the toxic components such as lead, arsenic, CaCO_3 , potassium, chloride, sulphates and phosphates the in underground drinking water and hazardous effects of these components on the health among the people of Hyderabad, Pakistan.

2. Material and Methods

This study was based on survey and experimental method. In this study, 5 liters of water was collected in clean plastic bottle from different villages such as: Mossa Khatyaan, Mureed Sipyo and Masu Bhurguri villages of Taluka Tandojam district Hyderabad. Various qualitative tests were carried out including detection of salt content, mineral content, pH of various samples and other chemical content's detection. A self-structured questionnaire was adapted for the assessment of health related issue to evaluate the relation between the type of drinking water and the cause of morbidity. The questionnaire was filled by the people of the areas from where the water sample was collected. Beside this the residents of the respective areas were asked questions regarding health issues they are facing. The purpose of the study was to ensure the safety use of underground drinking water and to assess the toxic components in various samples of underground drinking water by using different colorimetric and spectrophotometric techniques as carried out in the study conducted by Arain *et al* and Akhtar *et al* [7, 12].-

3. Result and Discussion

A total of 140 respondents were taken in this study out of which 92 (65.71%) were male and 48 (34.29%) were female as shown in the Figure 1. As compares to the males, the female respondents were too less due to reason of fact that in Pakistan and especially in rural areas of Pakistan women have traditionally been expected to live under the constraints of purdah [13].

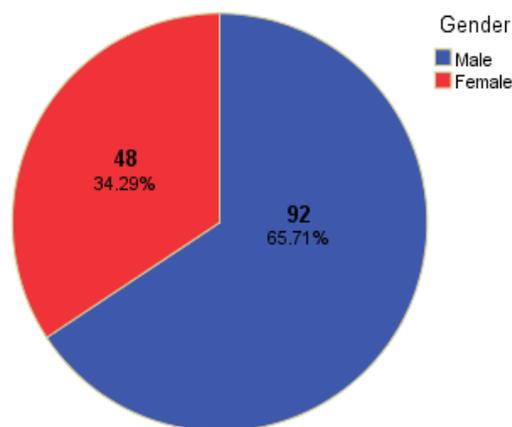


Figure 1: Number of respondents with respect to gender

In this study, random samples of underground water were collected from different areas of Hyderabad and were subjected to qualitative analysis including pH, conductivity and TDS. However, quantitative analysis of various ions and toxic chemicals were also tested which includes CaCO_3 , Chloride ion, arsenic, phosphate, potassium, lead and sulphate. Among the three samples it was identified that arsenic was found in all the three sample were the content of arsenic were more in sample 1 as shown in the table 1. An estimated 36 million people in the Bengal Delta are at risk from drinking arsenic-contaminated water. Numerous other occurrences worldwide have been reported [14], and some of these, such as those in Taiwan, have been recognized for many years. An estimates from the World Health Organization for 1990 reported that 43% of the world's population do not have adequate sanitation and 22% do not have clean drinking water [15]. The rising demands for sanitary water often cannot be met by surface water supplies. This has led to increased dependence on ground-water resources in many parts of the world. The consequences of ground-water development often include over drafting, land subsidence, and the use of ground water unfit for human consumption. The recent increased utilization of ground water in India and Bangladesh has caused new health issues [16-18]. This research study has revealed that the main cause of many diseases is the underground source of water which people using in daily life [19].

Table 1: Analytical Results of Water Samples

Tests and chemicals detected with normal ranges	Water sample 1 (Mossa Khatyaan village)	Water sample 2 (Mureed Sipyo village)	Water sample 3 (Masu Bhurguri village)
pH (5-7)*	7.65	7.42	7.65
Conductivity (must be less than 4.3 ms/cm)*	11.54	8.42	11.37
TDS	Beyond meter range	Beyond meter range	Beyond meter range
CaCO ₃ (mg/ L)	140	168	166
Chloride (4mg/L)*	6.1	6.4	6.8
Arsenic (µg/ L)	85	55	16
Phosphate (5mg/lit)*	7	7.4	6.4
Potassium (2-3ppm)*	5	5	6
Lead (µg/ L)	0.003	0.0009	0.003
Sulphate (250mg/lit)*	350	450	385

In our study we observed the highest reported cases of GI related issues among the respondents of both sex and out of 140 respondents 74 (52.85) cases of GI problems have been reported in this study. 78 (55.71%) cases of hair loss have been reported which the 2nd highest problem is observed in this study among the respondents of either sex which may be due to the frequent use of contaminated underground drinking water. Whereas, the reported ratio of disease related to pregnancy were found to be high among female respondents and this may be due to arsenic containing water as shown in table 2. Arsenic affects people regardless of sex. It is a known carcinogen [20] and has mutagenic and teratogenic effects [21,22]. Chronic exposure to arsenic may affect all of the organs and systems of the human body. Arsenic readily crosses the

placental barrier and thus affects fetal development. Reproductive and developmental effects of inorganic arsenic on humans and on animal species have been reported. There is extensive documentation of reproductive and fetal developmental effects in a variety of animal species [23, 24]. In contrast, there are few reports about effects of arsenic in drinking water on human pregnancy outcomes [25,26]. Higher spontaneous abortions (69.57/1,000 live births) and stillbirths (7.68/1,000 live births) were observed in the high arsenic area (where drinking water arsenic > 0.1 mg/L), compared to the control area (where drinking water arsenic < 0.1 mg/L); among controls, the rates for spontaneous abortions and stillbirths were 51.14/1000 live births and 2.84/1,000 live births, respectively [25].

Table 2: Assessment of Health and medical condition

Symptoms/Score	Absence of symptoms	%	If reported	%
Weight loss	108	77.14	32	22.85
Physical Changes(If any)	92	65.71	96	34.28
GI problem(If any)	66	47.14	74	52.85
Upset excretory system(if any)	122	87.14	18	12.85
-Appetite loss(If any)	114	81.42	26	18.57
History of taken medicine(If any)	58	41.42	82	58.57
History of Disease (If any)	50	35.71	90	64.28
Hair loss	62	44.28	78	55.71
Onycholysis	116	82.85	24	17.14
Alopecia (If reported)	134	95.71	6	4.28
Skin disease or reaction	100	71.42	40	28.57
Problem Associated with teeth	102	72.85	38	27.14
Problems associated with pregnancy(for married women) If seen (Total Women Married=32)	14	43.75	18	56.25

Skin related and teeth related problems with varying or moderate percentages that is 28.57 % and 27.14 % have been observed and reported (Table 2). The results of this study have shown increased levels of water contamination such as calcium carbonate, arsenic and lead. However, these increased levels may cause different problems as these chemical contaminants are hazardous for human health [27, 28]. It is utmost important that before drinking such underground water we need to purify it by simple means of reverse osmosis which cannot fully remove such chemical constituents but can partially remove which decreases the risks of diseases [29]. The hard water (the main source is underground water) use is seemed to be

the great cause of mortality in rural areas of Sindh, Pakistan by causing different disorders and diseases [7, 30]. Therefore, there is a need to purify drinking water to overcome the serious diseases.

4. Conclusion

Higher values of toxic components such as lead, arsenic etc significantly decreases the quality of drinking water. Therefore, the awareness programs on chemical contents in drinking water and their hazardous effects on human body should be organized at national level to improve the public health problems caused due to contaminated drinking water.

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