

## QUALITY ASSESSMENT OF DRINKING WATER FROM VARIOUS SOURCES OF ABBOTTABAD

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### **ABSTRACT**

#### **OBJECTIVES**

The key objective of this study was to analyze drinking water collected from different sources in Abbottabad region.

#### **METHODOLOGY**

A cross sectional study design was used to collect water supplies samples from house hold taps in water tanks, in the mountains from springs, pipe water from deep wells from different areas of Abbottabad during March 2012 to October 2012. The samples were analyzed for their physical, chemical and microbiological qualities to identify the contamination in drinking water and to suggest suitable solution to prevent the water borne diseases.

#### **RESULTS**

A cross sectional design was used. The water samples collected from all sources were found contaminated with bacterial colonies. The result of the assessment confirms in the study area that the quantity of Lead(Pb) /100ml water is more than the permissible value (0.01)/100ml recommended by the WHO for Pakistan. Elevated lead quantity is detected in 100% samples both from the sources and house hold water.

#### **CONCLUSION**

The presence of bacteria is the main cause of drinking water contamination. There is no difference between the amount of lead from house hold sample and source point. It can be due to geology of the soil as well as the leaching of lead from the rusted pipe lines. Therefore, it is suggested that health education and treatment of drinking water may improve public health in the Abbottabad region.

**KEYWORDS:** Drinking Water, Quality, Water-Borne Diseases, Assessment, Contamination

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### **INTRODUCTION**

Water is one of the most important and most precious natural resources. It is essential in the life of all living organisms from the simplest plant and microorganisms to the most complex living system known as human body. Water is the combination of oxygen and hydrogen atoms, with a chemical formula, H<sub>2</sub>O and known to be most abundant compound (70%) on the earth surface.<sup>1</sup> Access to safe drinking water is key to sustainable development and essential to food production, quality health and poverty reduction. Satisfactory safe drinking water supply must be made available to consumers.<sup>2</sup> Water and sanitation is one of the

most neglected sectors in Pakistan. Most of the people do not have access to safe drinking water and sanitation.<sup>3</sup> The health of people can be improved in the developing countries through improvement in the quality and quantity of drinking water and safe disposal of human excreta by providing sanitation facilities.<sup>4</sup> The mortality rate is 4 billion per year worldwide and about 30% (1.2 billion) of this is due to contaminated water.<sup>5</sup> The water supply agencies primarily focus on the quantity rather than the quality of drinking water. Weak institutional arrangement, lack of well-equipped laboratories, no periodic water quality monitoring and the absence of a legal framework for drinking water quality issues have aggravated the situation. Abbottabad became thickly populated after 2005 earthquake due to migration of people from Balakot, Batgram and Azad Kashmir. This increased the demand of water and sanitation in the area.<sup>3</sup> The District government is trying to provide the basic needs to the people. Inadequate water supply is a major problem of the developing countries. In places where water is available, the main issue regarding the quality of drinking water is the microbial contamination.<sup>4,5,6</sup> In addition to the above, inorganic contaminants are also present in drinking water. Use of unsafe water containing Lead, Arsenic and fluoride are the leading causes of health problems worldwide but it is masked by the public health affect of the microbiological contamination.<sup>3</sup> Chemical testing of water is done globally but very little information is available of fluoride and arsenic in the drinking water.<sup>7</sup> Heavy metal like lead, cadmium, chromium and mercury can deteriorate water quality. They are carcinogenic and dangerous for the human health. A monitoring program implemented in Cambodia reported the increase level of lead, selenium, Molybdenum and chromium.<sup>8</sup> A study done in most area of the Nigeria confirms the presence of lead and cadmium above the WHO limit for drinking water in water samples from hand dug wells in the residential area near the municipal dump.<sup>9</sup> Ensuring safe drinking water, especially in urban settlements is a major public health concern in Pakistan. There is scarcity of evidence regarding quality of drinking water in urban settlements of Pakistan. The aim of this study was to assess to the quality of drinking water from various sources in Abbottabad, Pakistan.

## METHODOLOGY

A cross sectional design was used to assess the samples of drinking water. Multi stage cluster sampling technique was followed. A list of union

councils in district Abbottabad was prepared and randomly two union councils Nawanshahr and Mirpur were selected. Again list of villages and streets was prepared situated in these two union council. Habibullah colony and village Shoaibzai were selected randomly. In village Shoaibzai three streets were randomly selected and the same procedure was adopted in Habibullah colony. Habibullah colony is in cantonment area. It gets water from the deep tube wells, while residents of Muhallah Shoaibzai received tap water which is basically spring water collected in the mountain area in a water tank and then distributed through iron pipes. Due to limited resources water sample is collected from two source point and nineteen house hold. The water sample was collected in a bottle of 150 ml polythene sterilized bottle provided by the COMSATS university Abbottabad microbiology Laboratory. Taps were properly washed with water and allowed to flow for two minutes before collecting the water sample to avoid contamination. The samples were brought to the laboratory in three hours. Standard methods like color, odor, taste, electric conductivity, P<sup>H</sup>, turbidity, coliform count and detection of arsenic and lead (through atomic adsorption spectrometer, analyst 700 Perkin Elmer, made in USA) were done.

## RESULTS

Sample	Parameter	Odor	Taste	E.C	PH	Turbidity	TDS	Coliform/100ml	As	Pb
1	Colorless	Odorless	Tasteless	570	7.7	1.7	314	>300	0	0.65
2	Colorless	odorless	Tasteless	530	7.7	1.8	292	>300	0	.695
3	Colorless	odorless	Tasteless	510	7.6	1.9	281	>300	0	.726
4	colorless	odorless	Tasteless	480	7.9	1.9	264	>300	0	.606
5	colorless	odorless	Tasteless	440	7.8	2.1	242	>300	0	.606
6	colorless	odorless	Tasteless	420	7.9	2.2	231	>300	0	.739
7	colorless	odorless	Tasteless	400	8	2.2	220	>300	0	.752
8	colorless	odorless	Tasteless	350	8	2.5	192	>300	0	.752
9	colorless	odorless	Tasteless	330	8.1	2.7	182	>300	0	.752
10	colorless	odorless	Tasteless	290	8.2	2.7	160	>300	0	.770
11	colorless	odorless	Tasteless	310	8.1	2.4	171	>300	0	.696
12	colorless	odorless	Tasteless	300	7.7	2.8	165	>300	0	.651
13	colorless	odorless	Tasteless	330	8.2	2.4	182	>300	0	.550
14	colorless	odorless	Tasteless	280	8.2	2.8	156	25	0	.650
15	colorless	odorless	Tasteless	425	8.0	2.4	182	>300	0	.650
16	colorless	odorless	Tasteless	390	8.6	2.4	182	>300	0	.696
17	colorless	odorless	Tasteless	393	8.67	2.4	182	>300	0	.726
18	colorless	odorless	Tasteless	385	8.65	2.4	182	>300	0	.606
19	colorless	odorless	Tasteless	434	8.6	2.4	182	>245	0	.739
20	Colorless	odorless	Tasteless	460	8.75	2.4	182	>300	0	.752
21	colorless	odorless	Tasteless	398	8.18	2.4	182	26	0	.770

## DISCUSSIONS

The results show that all the samples were colorless, odorless and tasteless. E.coli count was exceeding the limits set by WHO criteria. The Maximum Contaminant Level (MCL) for bacteria in drinking water is zero which is the total coliform colonies per 100 milliliters of water as established by the Environmental Protection agency (EPA). The result of the chemical analysis of the drinking water show that the amount of Lead (Pb) /ppm is increased in 100% of the water sample from the permissible amount of 0.01ppm/100ml recommended by the WHO.<sup>7</sup> The result of the data show the amount of lead in 100% samples between the range of "0.50-0.77" which is injurious for the health. The symptoms of lead poisoning are Headache, Irritability, Abdominal pain, vomiting, Anemia, weight loss, poor attention Span, learning difficulties etc.<sup>8,9</sup> During a study in the logon valley lead concentrations exceed the above standard level in 95% of the samples. The logon valley is a rural area with no industrial activities or uncontrolled dumping. Lead in water could originate from sources other than human pollution and it could be due to the geology of soil.<sup>10,11</sup> The findings of our study are in consistent with a study conducted in Lahore urban area in 2009. The result shows that in most of the cases bacteriological contamination was found.<sup>6</sup> The pipe material used in the study area was galvanized iron and asbestos cement and was 30 to 35 years old. Water supply and sewerage

line in some area were laid side by side without any consideration of distance between both the pipelines. This situation is also one of the causes of bacteriological contamination in water distribution system. Intermittent nature of water supply further aggravates the situation in producing negative pressure in the pipe line. The sewerage water is sucked by the leak pipe lines and it contaminates the drinking water. Our results are similar to another study conducted in District Charsadda. The result shows the quantity of lead, Cadmium, Nickle and iron were exceeded from the permissible quantity set by the different organization. Coliform bacteria were also found out in many cases and it confirms the biological contamination in drinking water. This study also established the relation of rusted pipe line and transportation of water as major source of contamination in District Charsadda.<sup>12</sup> Our findings are same as in a study done In Pakistan, where microbial contamination in drinking water has been highlighted as a major cause of illness and deaths among people, especially children who are most vulnerable.<sup>13</sup>

## LIMITATIONS

This study has several methodological limitations such as small a sample size particularly for a descriptive study, non-probability sampling, single-site study and only a descriptive level of analysis. Further research may be conducted by addressing these shortcomings.

## CONCLUSION

The presence of coliform bacteria in water sample in almost 100% of the drinking water samples may indicate high prevalence of water borne diseases in the study area. It was also observed that the water pipe lines passes through the sewerage drains. The rusted pipe line was found damaged in most areas and it may create negative pressure in the pipe line that suck the sewerage water. It contaminates the drinking water in the pipe line. The possibility of establishing relation of increase amount of lead in the area may be due to the rusted pipelines that supply water to the community. There is no difference in the quantity of lead found out from the house hold sample and the source point. The increase amount of lead at the house hold sample may be correlated with the rusted pipe lines but such increase of lead from the sample of source point raise another question. Therefore, there is a need to conduct geological study to find out the composition of the soil of the study area. Public health authorities shall ensure that rusted pipelines are changed to avoid lead contamination of water. Water treatment plants may also be installed to purify water and for the short term solution community may be educated to boil water to prevent water-borne diseases.

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