Potable Water Quality Characteristics of the Rural Areas of District Hangu, Khyber Pakhtunkhwa-Pakistan

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***Abstract*– The study assessed the bacteriological quality of potable sources of rural areas of District Hangu, Pakistan. The importance of the reference water quality data was felt owing to the spreading of the diarrhea in two rural areas of District Hangu in summer 2010. Response was made to the potential hazard identification and removal before it affects the peoples' health. A total of thirty five water samples were collected and tested for faecal coliforms, pH and turbidity. All water samples were found within World Health Organization (WHO) guide values for pH and turbidity. It was observed, that twenty two water samples were deteriorated bacteriological either at source level or in between the source and household level. Results revealed that for an effective multi-barrier approach to succeed as a consumer end water quality risks should be addressed in an effective and sustainable manner, source protection and the ways in which people collect, transport, store and use water at household should also be improved, which includes overall hygiene and awareness of the inter-linkages between water safety and ill-health.**

***Keywords*–** Diarrhea, Faecal Coliforms, Source Protection and Water Quality

I. INTRODUCTION

Safe drinking water and hygienic sanitation are prerequisites for health, but these associations achieve greater importance when large numbers of displaced people seek shelter in overcrowded settlements where there are no established facilities to encourage hygiene and other barriers to prevent the transmission of disease. The greatest risk from microbes in water is associated with consumption of drinking water that is contaminated with human and animal excreta [1].

It has been reported in a "Community Health Study" that 30 % of all reported cases of illnesses and 40% of deaths in Pakistan, one way or another are related to water borne diseases [2].One of the prime reasons of water contamination is the presence of the harmful bacteria.

In previous, various researches have been made to sort out the water quality parameters in some areas of Khyber Pakhtunkhwa. On the base of studies conducted by Hussain [3] the water of district Abbottabad was found unfit for human consumption owing to the bacteriological contamination. Studied were also made in Districts Peshawar, Kohat and D. I. Khan on potable water. The water samples results in District Peshawar and D. I. Khan revealed that water were found unsafe for human consumption due to contamination [4].Aziz *et* al. investigated the tube well potable water in District Peshawar and concluded that the incidence of water borne diseases could not directly linked with poor quality of tube well water in the locality provided the supply lines and storage tanks are prevented from being contaminated [5].

In view of the above, it was of utmost importance, to carry out regular water quality testing and sanitary inspections, treatment and conducting hygiene promotion sessions, to control the diarrhea outbreak. So that any hazard could be identified and removed before it affects the peoples' health. Therefore the principal aim of this study was to know the level of bacteriological contamination of drinking water in the various stages of drinking water cycle (i.e at the source, storage tanks and at house hold level containers).

II. MATERIALS AND METHOD

A) Sampling Procedure

Thirty five water samples were collected from tube wells, dug wells, storage tanks and house hold containers in both villages of District Hungu. The samples were collected in 120 ml sterilized sample plastic bags. The sample size, collection, preservations and analysis were conducted according to the standard methods for water quality testing and proper procedure and precautionary measures were followed while collecting samples from the field [6]. During sample collection sanitary surveys were conducted on the sample collection sites general cleanliness and observations were made on all possible sources of contamination.

B) Indicator Organisms

Indicator organism is the Coliform group of bacteria for detection of water contamination.

C) Membrane Filtration (MF) Method

The Membrane Filtration (MF) method was used to estimate microbial quality of drinking water for detection of feacal coliforms. In the initial step, an appropriate sample volume passes through a membrane filter with a pore size

small enough (0.45 micron) to retain the bacteria present. The filter was placed on an absorbent pad (in a petri dish) saturated with a culture medium (Lauryl Sulfate Broth) was used as medium for the detection of coliform organisms) that is selective for coliform growth. The petri dish containing the filter and pad was incubated, for 24 hours at the appropriate temperature of 44^0 C. After incubation, the colonies that have grown were identified and counted using a magnifying lens. Coliform density was reported as the number of colonies per 100 ml of the sample.

D) Water Testing Kit

Water samples for pH, turbidity, residual chlorine and microbial quality were tested on site by using Wagtech water testing kit, to ensure reliability of bacteriological testing results. The kit is used to measure microbiological quality, turbidity, free chlorine, total chlorine and pH.

III. RESULTS AND DISCUSSION

During the study period total thirty five water samples from the various stages of drinking water cycle (i.e., at the source, storage tanks and at house hold level containers) were collected from the both villages in District Hungu and tested only for pH, turbidity and bacteriological quality.

The detail results revealed that major water samples were contamination at household level as majority of the house hold utensils were observed dirty and poor handling and storage practice were observed during sampling.

Summarizing the microbial results of water quality of the collected water samples from the various sampling sites in response to the diarrhea outbreak showed that 63 % of unfit water samples with high degree of microbial water contamination.

Results of Sanitary surveys conducted during sampling revealed that all tube wells had proper well sanitary completion structures and Dug well seals had several cracks that may allow seepage of surface pollutant into underground aquifer. In contrast three out of the five Dug Wells water samples lacked any sort of well sanitary completion

Table 1: Detail of bacteriological quality in Shana Warai and Zargare, District Hangu

S. No	Sampling Site	WHO Guide Value for Bacteriological Quality of Drinking Water (Zero/100ml)	
		Total samples tested for microbial quality	% matching WHO guide value
1	Tube Wells	10	100
2	Dug Wells	05	40
3	Storage Tanks	05	20
4	House Hold Utensils	15	00

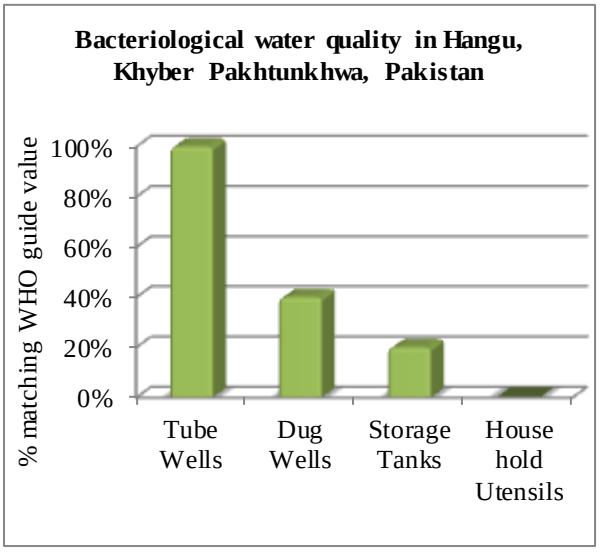

Fig. 1: Showing the percentage of water samples results matching with WHO guide value

Table 2: Summary of Microbial Water Samples Test Results

S. No	Microbial Fit Water Sample	Microbial Unfit Water Samples	Total Samples Collected
1	13	22	35

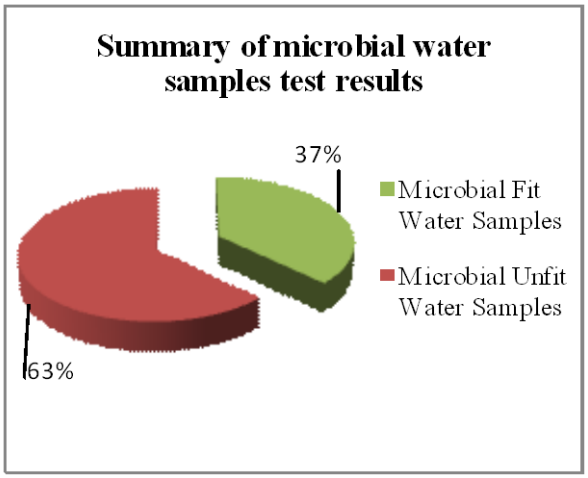

Fig. 2: Representing percentage of Fit and Unfit water samples

structures, with no well seal protection cover, round concrete apron and proper drainage, and water test results revealed serious water contamination in these Dug Wells. While the pH, Turbidity of all thirty five water analysts were found within WHO guideline values.

At household level it was observed that all were faecally contaminated samples were related to use of uncovered wide-mouth containers that allowed hands to come into contact with water; some containers used were not clean;

contaminated cups, bowls, or buckets were being used to draw water. It seems that faecal contamination of water occurred principally during collection and storage due to poor water handling and overall unhygienic situation.

Even fully protected sources and well-managed systems do not guarantee that safe water is delivered to households [1]. Previous studies show that even water collected from safe sources is likely to become faecally contaminated during transportation and storage. Safe sources are important, but it is only with improved hygiene, better water storage and handling, improved sanitation and in some cases, household water treatment, that the quality of water consumed by people can be assured [7].

The study revealed that mainly due to lack of knowledge of the inter-linkages between water safety, adequate hygiene and disease and lack of appropriate size narrow-mouthed containers, proper source protection, and soap for personal hygiene are the effective ways to reduce the water borne diseases.

IV. CONCLUSIONS

On the basis of water samples collected from the two rural areas in District Hangu showed the bacteriological water contamination in the Dug wells, Storage tanks and house hold containers that play a vital role in the incidence of water borne disease. Tube well source was not primarily associated with the poor quality of water while the cross water contamination in the distribution line also imparted their role as the storage tanks were found contaminated. The physical parameters of all the water samples collected (under study) in both areas were found within WHO limits Conclusion was drawn which was based mainly due to lack of knowledge of the inter-linkages between water safety, adequate hygiene, disease and lack of appropriate size narrow-mouthed containers, proper seal top cover to protect dug wells, antibacterial soap for personal hygiene are the effective ways to reduce such type of water borne diseases.

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