

BACTERIOLOGICAL ANALYSIS OF DRINKING WATER IN URBAN AREAS OF DISTRICT PESHAWAR, KHYBER PAKHTUNKHWA

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ABSTRACT

Objectives: To establish whether drinking water of urban areas of Peshawar is fit for drinking or not, in view of WHO recommendation.

Material and Methods: Twenty-nine samples were collected from drinking water sources from different houses of urban areas of sadder, Tehkal and Warsak Road of District Peshawar, Pakistan from January 2016 to April 2016; which include tube well, well and tap water. All samples were analyzed in Public Health Laboratory, Khyber Medical College for presence of E.coli. Presumptive coliform test was done on all sample according to WHO criteria.

Results: The study showed that maximum Coliform values were >80MPN/100ml and minimum total coliform values were <20MPN/100ml while most of the samples have values in between 30MPN/100ml - 60MPN/100ml....Note; Two samples were collected from filtered water source in order to check the quality of filtration and chlorination of drinking water which gave disappointing results i.e. 20 MPN/100ml.

Conclusion: It is reported that quality of drinking water in Peshawar City is far from satisfactory, showing high percentage (99.9%) of coliform bacteria which is a sign of fecal contamination.

Key Words: Coli forms, MPN (Most Probable Number of Coli forms).

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INTRODUCTION

Water is a basic necessity of life. Water makes up to two-thirds of our body weight. The brain and heart are composed of 73% water, and the lungs are about 83% water. The skin contains 64% water, muscles and kidneys are 79%, and even the bones are watery: 31%¹. The body cannot work without water, just as a car cannot run without gas and oil. A drop in water supply can initiate various symptoms, such as: thirst, headache, general discomfort, loss of appetite, dry skin, decreased urine volume, confusion, unexplained tiredness, and irritability². A mere drop in 2 % body weight can impair work ability. Losses in excess of 5% of body weight can decrease the capacity for work by about 30%³. Where

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this water is a necessity for living, un-safe water has been found responsible for the deaths also. According to the WHO, Water-borne diseases account for an estimated 4.1% of the total global burden of disease, and cause about 1.8 million human deaths annually. WHO estimates that 88% of that burden is attributable to unsafe water supply, sanitation and hygiene⁴

If we turn towards Pakistan's data, it has been reported that an estimated 62% of Pakistan urban and 84% of rural population do not treat their water and resultantly 100 million cases of diarrheal diseases are registered in hospitals and 40% deaths are caused by polluted water. A study conducted by UNICEF found that 20-40% of the hospital beds in Pakistan are occupied by patients suffering from water-related diseases, such as typhoid, cholera, dysentery and hepatitis, which are responsible for one-third of all deaths. Poor water sanitation and a lack of safe drinking water take a greater human toll than war, terrorism and weapons of mass destruction combined^{5,6,7,8}

Pathogens responsible for water born diseases include, Protozoal organisms include: Entamoeba-histolytica, cryptosporidium parvum, cyclosporacay-

entriases, giardiasis, microsporidiosis which causes amebiasis, cryptosporidiosis, cyclosporiasis, giardiasis, and microsporidiosis respectively. These all have diarrhea, vomiting and nausea like symptoms in common, parasitic organisms include: schistosoma, dracunculus medinensis, taenia, Fasciolopsis, buski, hymenolepis nana, echinococcus granulosus, ascaris lumbricoides, enterobius vermicularis, which causes schistosomiasis, dracunculiasis, teniasis, fascioliasis, hymenolepiasis, coenurosis, ascariasis, and enterobiasis respectively. These diseases are responsible for intestinal disturbances, Bacteria include: clostridium botulinum, campylobacter jejuni, vibrio cholera, E.coli, mycobacterium marinum, shigella, salmonella, legionella, leptospirae, and salmonella typhi, vibrio which causes botulism, campylobacteriosis, cholera, E.coli infections, M. Marinum infections, dysentery, legionellosis, typhoid fever, and vibrio illness. All of them are notorious for diarrhea and nausea along with other complications, Viruses include: coronavirus, hepatitis A virus, poliovirus, which cause Severe Acute Respiratory Syndrome, hepatitis A, and poliomyelitis respectively.^{9,10,11,12}

MATERIAL AND METHODS

This cross sectional study was conducted in urban areas of Peshawar. A total of 29 different samples were collected in sterile bottle from January 2016 to April 2016 from different houses situated in Saddar, Tehkal and Warsak Road. All samples collected were analyzed for E.coli in the public health laboratory Khyber Medical College Peshawar. Presumptive coliform test was applied to detect MPN (most Probable number) of E.coliform in drinking water supplies.

RESULTS

The study shows that (99.99%) of water is polluted which contain maximum values of Coli form (≥ 80 MPN/100ml) and minimum values of coli form bacteria (≤ 20 MPN/100ml) while most of samples showed values in the range of (30MPN/100ml – 60MPN/100ml). The samples collected from Warsak Colony showed comparatively better results than the other two areas i.e. Saddar and Tehkal which showed equally high coli form contamination. It is important to mention that two samples were collected from filtered water to evaluate quality of filtration and chlorination of drinking water in the area under study but showed poor results i.e. ≤ 25 MPN/100ml which is beyond WHO permissible limits. Comparing with the WHO standard, no water sample is considered fit for drinking.

DISCUSSION

It was observed that samples collected from shallow tubewells, wells nearer to gutters and wells constructed in areas having no proper sewerage system,

have high MPN of Coli form bacteria. The Study also showed that samples collected from those areas where water supply lines criss-cross with sewerage lines, have high MPN of Coli form bacteria which is a sign of fecal contamination. Abid et al who had mentioned 12000 CFU/ml in drinking water of Peshawar¹³. Later on, Alizai et al showed high bacterial count (33000 CFU/ml) in drinking water of Peshawar. Total coli form bacteria minimum (< 1.1 MPN/100ml) to maximum (> 23 MPN/100ml), which is higher than the limit of WHO drinking water standard. Most of tap and hand pump coli form results were within the permissible limit of WHO drinking water standard¹⁴. Cheema et al concluded that 60% water samples were unfit for drinking purposes because of coliform bacteria. Total 23.3% water was contaminated with fecal coli form and 8.7% was contaminated with E.coli.¹⁵ Similar studies were carried out by Schets F.M et al analyzed the quality of drinking water from private water supplies in Netherlands [Total 144 samples were collected for bacteriological analysis. Their results showed that 10.9% samples were contaminated due to E.coli and Enterococci presence¹⁶. Hasan et al studied that the drinking water from different sources such as river, ground and well water showed that 67% of total water samples were found contaminated with Coli forms and fecal coliforms¹⁷.

This study shows that almost 99% of water samples are contaminated with coli forms and fecal coli form bacteria i.e. grossly polluted. Prasai et al conducted a study to evaluate the quality of drinking water in Kathmandu valley. During the study, 238 isolates of enteric bacteria were identified, Out of which 26.4% were Escherichia coli, 6.3% were Pseudomonas aeruginosa, 5.4% were Klebsiella spp, 4.0% were Shigella spp, 3.0% were Salmonella typhi, 1.0% were Vibrio cholera and other bacteria¹⁸. Ahmed et al analyzed drinking surface water from different dams in Rawalpindi/Islamabad region (Pakistan). Water samples contain different pathogenic bacteria like Staphylococcus aureus, E.coli, Salmonella spp and Shigella spp¹⁹. S. Haydar et al carried out a study on drinking water in southern Lahore in which they showed that bacteriological quality of about 50 – 65% house connection was miserable before monsoon and the percentage rose to 75% after the monsoon. They concluded that main causes of bacteriological contamination included old and rusted water mains, laying of water supply pipes close to sewerage lines and inadequate storm drainage in the study area²⁰. Khan et al found that more than 50% samples of Peshawar, Nowshera and Charsadda were highly contaminated and were considered unfit for human consumption²¹. Zubair and Rippy found high level of contamination of ground water with fecal coli form bacteria in urban areas of Karachi and suggested that ground water quality was most likely affected by waste water infiltration²².

CONCLUSION

The water samples were not free of parasites in District Peshawar.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Naeem M:	Contributed to concept, design, acquisition of data final approval
Khalil KUR:	Drafting of manuscript
Danish Z:	Data Analysis
Sufian M:	Bibliography
Saleem W:	Proof Reading

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.