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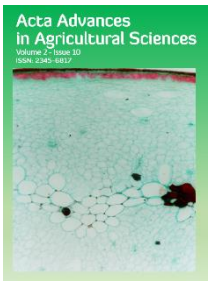

Research Article

Comparison of Bio-Contamination Level of Source and Sink Water in Hyderabad and Tando Allahyar, Sindh Pakistan

Muhammad Saleem Kalhoro, Dildar Hussain Kalhoro*, Mansoor Ayoob, Mazhar Hussain Mangi, Muhammad Faisal Ayoob and Syed Kamran Gilani

Department of Veterinary Microbiology, Sindh Agriculture University Tandojam, Pakistan.

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* Corresponding Author;
E. Mail:
drdildarkalhoro@gmail.com
Tel:+923003059164

ABSTRACT

This study was carried out to compare the level of bio-contamination between source and sink water from 11 different water supply schemes of Hyderabad and Tando Allahyar. 3 samples from each scheme were collected (untreated source water, treated source water and sink water). The average water contamination in source water (untreated) was 91.81 (n=26), source water (treated) 52.27 (n=10) and sink water (home) was 74.54 (n=20) against the microbial growth of 15 (n=03) in the control water samples (Nestle). Percentage of microbial agents that was *E. coli*, *fecal streptococci* and *Salmonella* were 100 (n=11),, 73 (n=08) and 64 (n=07) in untreated source water respectively. After treatment, the level of contamination was reduced to 45 (n=05), 18 (n=02), and 27 (n=03) of *E. coli*, F*ecal streptococci* and *Salmonella* respectively. However microbial growth was increased at end users (sink water) as 100 (n=11), 45(n=05) and 36 (n=04) of *E. coli*, *fecal streptococci* and *Salmonella* respectively. Water supply schemes under investigation were found to be highly contaminated with microbial organisms (*E. coli* 82 (n=27), *fecal streptococci* 45 (n=15) and *Salmonella* 42 (n=14). We conclude from our studies that rare treatment of source water does not provide clean water supply to the end users therefore it is recommended that the drinking water must be subjected to various techniques (chlorination, fluorination, aeration and boiling of water).

Contaminated drinking-water contributes to the death of millions of the poor people of the world from preventable diseases. Globally, it is estimated that 88% of diarrheal disease cases are attributable to contaminated water. In fact, the World Health Organization (WHO) estimates that about 1.1 billion people globally, drink contaminated water (WHO 2007).

Water can be contaminated by human or animal feces that causes risk to the human and animal health. Contaminated drinking-water may result in waterborne

diseases, such as cholera, dysentery, and other diseases that may cause diarrheas (Tumwine et al., 2002). The availability of safe drinking water is an increasing major concern for the interventional community, especially in the light of climate change biodiversity.

Access to safe drinking-water for domestic use has become a major challenge for contemporary societies with its increased demand. Farooqui et al., (2009) investigated an outbreak of typhoid fever associated with drinking water in Karachi Pakistan which claimed three human lives and left more than 300 people suffered within one week. A total of 250 suspected cases of typhoid fever were interviewed. Lab investigations confirmed the presence of multidrug resistant strain of *Salmonella enterica serovar Typhi* in 100% well water, 65% household water samples and 2% food items. 22% of clinical stool samples were tested positive with *Salmonella enterica* serover Typhi.

Nogueira et al, (2010) analyzed 21630 water samples for microbiological analysis in northwestern Portugal between 1996 and 2005 and reported that the percentage of treated and non-treated waters analyzed were similar, but the fraction of conforming samples were higher for treated (74.2%) than for non-treated (37.8%) water. Zaman et al, (2012) reported water tanks and drinkers were contaminated with *Escherichia coli* and *Salmonella typhi* and considered to be main source of bacterial transmission to animals, humans as well as birds. Raju et al, (2010) evaluated the quality of drinking water of Mysore city. Among all the samples collected 20% of tap water samples were contaminated, followed by bore well water 11% and stored household water 73% contaminated with enteric bacteria. During the study 232 isolates of enteric bacteria were identified, of which 61 were *Escherichia coli*, 76 *Klebsiella* and 21 *Salmonella* isolates.

In Pakistan, 64% of the population lives in rural area (WHO, 2012) and most of them have access to good quality water causing diseases in human population (Ilyas et al., 2008). Khan et al., (2014) Collected 22 samples form Hingol River Pakistan and analyzed physical, chemical and microbiological quality of the water and concluded that the faecal coliforms are commonly found in Hingol River and its water is not safe for human consumption. No any worker, to our knowledge has conducted research on comparing Source and Sink Water contamination in sindh province so present study was planned to find out the bio-contamination level in drinking water from various areas of Hyderabad, TandoAllahyar.

Materials and Methods

During present study 33 samples were collected from 11 different water supply schemes of Hyderabad and Tando Allahyar i.e. Channel water plant hyd, Water Treatment Plant Jamshoro road hyd, Latifabad Water Plant hyd, Hala Naka plant hyd, Jamshoro Water Treatment Plant Jamshoro, Usman Shah hyd, Drip Colony Tandojam, Sindh Agriculture University Boys Hostel Tandojam, Sindh Agriculture University Residential Colony Tandojam, Amzi Water Plant Rashidabad and Water Treatment Plant TandoAllahyar. Water samples were collected in one litter sterilized glass bottles and preserved in an ice box and brought to the laboratory of Molecular parasitology laboratory, faculty of animal husbandry & veterinary sciences, Sindh Agriculture University, tandojam. The study was conducted over a period of 3 weeks. Microrganisms were identified by

Table 1. *Microbial Growth in Petri Dishes (%)*

S. No:	Samples	Source Water (Untreated)%	Source Water (Treated)%	Sink Water (Home)%
1	Channel Water Plant, Hyd	95	40	80
2	Water Treatment Plant, Jamshoro Road Hyd	90	50	60
3	Latifabad Water Plant, Hyd	90	40	75
4	Hala Naka water Plant, Hyd	95	55	80
5	Jamshoro Water Treatment Plant, Jamshoro	95	60	75
6	Usman Shah, Hyd	90	60	80
7	Drip Colony, Tandojam	95	70	80
8	Sindh Agriculture University, Boys Hostel, Tandojam	95	50	75
9	Sindh Agriculture University, Residential Colony, Tandojam	80	60	80
10	Amzi Water Plant, Rashidabad	95	40	60
11	Water Treatment Plant, Tando Allah Yar	90	50	75
Mean %		91.81	52.27	74.54

Control water sample (Nestle): 15% microbial growth.

employing ISO standard 7402 (1993) by plate count method. Organisms were identified by morphological and culture characteristics. Nutrient agar media was used for the growth of microorganisms in the petri dishes. Nutrient agar was prepared, sterilized and poured into sterilized petri dishes. Streaking of water samples were done over the solidified agar media in air flow cabinet under the flame of burner. For growth of microorganisms, petri dishes were placed in incubator for 24 hours at 37°C. The comparison between source water sample and sink water sample was done by noting the percentage of microbial growth in petri dishes (APHA 2005).

Results and Discussion

Drinking water has significant importance towards human health. The assessment of the microbiological quality of drinking water protects consumers from illness due to consumption of water that may contain pathogens harmful for the human health and thus to prevent water borne diseases. (Figueras & Borrego, 2010).Biotic and a-biotic aquatic contaminations of drinking water are known to cause health problems both in animals and human beings. Town planning schemes have further deteriorated the concentration of problems because the outbreak of city sewerage system are conveyed to running water which is supply to human population for drinking. Though there have been implantations of water treatment schemes. Yet the drinking water still was and still is a burning human and veterinary problem. With this in mind a small scale pilot study was conducted to establish data on bio-status of drinking water at three time points. That is quality analysis of drinking water before treatment, during treatment and after treatment.

Table 2. *Percentage of microbial agents in Untreated, Treated and Sink water.*

S. No.	Water Samples	Number of Samples	*E. coli*	*Fecal Streptococci*	*Salmonella*
1	Untreated Source Water	11	11 (100%)	08 (73%)	07 (64%)
2	Treated Source Water	11	05 (45%)	02 (18%)	03 (27%)
3	Sink Water	11	11 (100%)	05 (45%)	04 (36%)
4	Total	33	27 (82%)	15 (45%)	14 (42%)

Table 3. *Presence of different microorganisms in Untreated, Treated and Sink water in various areas of Hyderabad and Tando Allahyar region*

SL	Area of Sampling	Untreated Source Water			Treated Source Water			Sink Water		
		E. coli	*F. Strep*	*Salmonella*	*E. coli*	*F. Strep*	*Salmonella*	*E. coli*	*F. Strep*	*Salmonella*
1	Channel Water Plant, Hyd	+	+	+	+	+	+	+	+	+
2	Water treatment plant, Hyd	+	–	–	–	–	–	+	–	–
3	Latifabad water plant, Hyd	+	–	–	–	–	–	+	–	–
4	Hala naka water plant, Hyd	+	+	–	+	–	–	+	–	–
5	Jamshoro water treatment plant, Jamshoro	+	+	–	–	–	–	+	–	–
6	Usman shah, Hyd	+	+	+	+	+	+	+	+	+
7	Drip Colony, Tandojam	+	+	+	–	–	–	+	+	+
8	SAU, Boys Hostel, Tandojam	+	+	+	+	–	+	+	+	+
9	SAU, Residential Colony, Tandojam	+	+	+	+	–	–	+	+	–
10	Amzi Water Plant, Rashidabad	+	–	+	–	–	–	+	–	–
11	Water Treatment Plant, Tando Allah Yar	+	-	+	–	–	–	+	–	–

Hyd= Hyderabad

Percentages of microbial growth in petri dishes in untreated source water of different areas of Hyderabad and Tando Allahyar regions viz: channel water plant Hyderabad, water treatment plant jamshoro road Hyderabad, Latifabad water plant Hyderabad, Hala naka water plant Hyderabad, Jamshoro water treatment plant jamshoro, Usman shah, drip colony Tandojam, SAU boys hostel Tandojam, SAU residential colony Tandojam, Amzi water plant rashidabad and water treatment plant Tando Allahyar were 95, 90, 90, 95, 95,

90, 95, 95, 80, 95, and 90 % respectively. Whereas the percentages of microbial growth in petri dishes in treated source water of 11 different areas of Hyderabad and Tando Allahyar regions were 40, 50, 40, 55, 60, 60, 70, 50, 60, 40, and 50 % respectively. However the percentages of microbial growth in petri dishes in sink water were 80, 60, 75, 80, 75, 80, 80, 75, 80, 60, and 75 % respectively. The average percentages of microbial growth in petri dishes were 91.81 (n=26), 52.27 (n=10) and 74.54 (n=20) for the untreated source water, treated source water and sink water respectively. This showed that there was non-significant decrease in the bio-contamination level between untreated source water and sink water after treatment. (Table 1). Our results reveal that the source water is highly contaminated. The level of contamination was found to reduce at significant level after treatment. However when treated water reached to end users the level of contamination significantly found to be increased. This explained that the treatment of water has very little potential to kill the microbial organisms for longer duration. There have been many studies of same nature. A study by Rufener et al., (2010) confirm our observations. They studied 81 household where from 347 water samples were analyzed. The quality of water was assessed using *Escherichia coli* as an indicator of fecal contamination. They found significant increase in *E. coli* population in source water and non-significant reduction in drinking water. Nogueira et al., (2010) not agreed with our results. They performed 21630 microbiological analysis and found that the percentage of treated and non-treated water samples were similar. Raju et al., (2010) also confirmed our observations. They evaluated the quality of drinking water of Mysore city and suggested that the stored household water and tape waters both were highly contaminated with microorganisms.

In untreated source water mixed microbial growth was found. Percentage of microbial agents that is *E. coli*, *fecal streptococci* and *salmonella*. 100(n=11), 73(n=08) and 64(n=07) respectively. After treatment the concentration of infection reduce to 45(n=05), 18(n=02), and 27(n=03) of *E. coli*, *fecal streptococci* and *salmonella* respectively. However the growth of *E. coli*, *fecal streptococci* and *salmonella* was increased in sink water (end user level) to 100 (n=11), 45(n=05) and 36 (n= 04) respectively (Table 2). Whereas the lowest level of infection was observed in Water treatment plant Hyderabad, Latifabad water plant Hyderabad and Amzi water plant Rashidabad (Table 1). Copeland et al., (2009) also agreed with us that the source water had highest level of contamination. The results of present study agreed with the study of Obire et al., (2009). They studied the bacteriological quality of various drinking water samples using the standard plate count method. They found increased in microbial population in well water and reduced in treated tape water.

Kaoruko et al., (2008) also confirmed our results that the source water stored in containers by boat households used for drinking were contain significantly high bacterial contamination, because no treatment procedure was applied to reduce the microbial level from drinking water before storing in containers. Shar et al. (2010) reported that for the public health surface water quality is poor as compared to groundwater. Aziz (2005) also reported that most of the water supplies for drinking is faecally polluted causing water borne diseases in Pakistan. Smolders et al (2014) conducted a survey to measure *E. coli* concentrations in water in Australia. 3.9×10^{14} *E. coli* were produced/day. Oswald et al., (2007) assessed fecal contamination of drinking water by measuring the *E. coli* counts in municipal source water, stored water and water in a serving cup with in

households. They found source water microbiologically clean but contamination increased successively to the point of consumption. Whereas, our results showed high microbial contamination in both source and drinking water.

Wright et al., (2004) going against our observations and analyzed that the source water contained less microbial counts as compared to stored water in home. Donald et al., (2003) analyzed the quality of private water supplies within aberdeenshire. Water samples collected from source water were compared with tap water and suggested that source ground water contributes much microbial contamination rather than storage and supply line contamination mechanism.

Conclusions

It is concluded that the drinking water in Hyderabad city and Tando Allahyar town, Sindh, Pakistan, is highly contaminated with micro-organisms. The level of contamination is very high at source as well as during storage and supply of treated water to the consumers. The contamination of water increases when it is supplied to remote areas where the water supply lines are conjugated with sewerage pipe lines. It is assumed that due to old and rusty sewerage and water pipe lines, the leakage of sewerage into water supply lines results into contamination of treated water as it reaches to the end users.

Recommendations

It is suggested that the treatment procedures for eliminating bio-contamination from drinking water may be revised and more efficient and modern methods may be adopted. Old sewerage and water supply pipe lines should be replaced and be properly laid down to prevent leakage and contamination. A broad scale water screening for microbial growth may be conducted for better understanding of the severity of the problem. Mass education of people for use of domestic methods of treatment of drinking water and importance of safe drinking water are also emphasized.

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