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Prevalence of Zoonotic Parasites in Drinking Water of Three Districts of Khyber Pakhtunkhwa Province, Pakistan

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Abstract

A total of 450 water samples collected from three different sources (Tap water, ponds and drain water) in three districts (Karak, Kohat and Hangu) of Khyber Pakhtunkhwa Province Pakistan. In all the three sources, water was contaminated with eggs, cysts or oocysts of the parasite. The results indicates overall prevalence of 65.5% (295/450) of protozoa, including *Giardia* spp. 14.1% (63/450), *Cryptosporidium* spp 19.5% (88/450), *T. gondii* 2.8% (13/450), *F. heptica* 4.8% (22/450), *B. coli* 5.78% (26/450) and *Entamoeba* spp. 14.4% (65/450). The result of the study presents a need of an appropriate source of drinking water to identify the threshold of water sources contamination that requires treatment. Preventing waterborne disease and the health effects of water contamination is vital to our nation's public health due to the fact that access to safe drinking water is required cornerstone of public health.

Key words: Zoonotic Parasites, Drinking water, Pakistan

Introduction

Water is considered as one of the nutrients, although it yields no calories, yet it enters into structural composition of cell and is an essential component of diet (Baloch, et al., 2000). According to WHO more than 80 disease of human are waterborne. In developing countries, 60 percent population has no access to pure drinking water (Khan, et al., 2000).

Waterborne diseases occur worldwide, and outbreaks caused by the contamination of community water systems have the potential to cause disease in large number of consumers (Barwick, et al., 2000) A number of outbreaks have been associated with drinking and recreational water worldwide including USA (Barwick, et al., 2000). Water borne parasites are ubiquitous protozoan parasites that affect humans, domestic animals and wildlife throughout the world. At least 325 water associated outbreaks of parasitic protozoan diseases have been reported worldwide (Kramer, et al., 2001).

In industrialized countries, *Giardia* spp and *Cryptosporidium* spp. are of major concern as waterborne parasites. Infective cysts are environmentally robust, sufficiently small to penetrate the physical barriers of water treatment and insensitive to disinfectants used in the water industry (Smith and Grimason, 2003). Cryptosporidium is the most frequent etiologic agent identified in recreational waters in the United States (Dubey et al., 2005). Contamination from sewage discharges and wild or domestic animals is important source for untreated water (Dubey, et al., 2005). It is estimated that up to 30% of the human population, *i.e.* every third person in the world, has been exposed to *T. gondii* (Jackson and Hutchison, 1989; Wong and Remington, 1993). Human fascioliasis has been an underestimated and under-explored disease but is now considered an emerging/reemerging disease (Mass, et al., 2005)

Keeping in view of the of the above circumstances, the present study was design to carry out prevalence and level of contamination of the zoonotic parasites in different sources of the drinking water in Khyber Pakhtunkhwa province of Pakistan.

Materials and Methods

The study was conducted for prevalence of the zoonotic parasites in the different water sources *i.e.* Tap, pond and drain water, in three districts namely Kohat, Karak and Hangu of Khyber Pakhtunkhwa Pakistan.

Collection of water samples

A total of 450 water samples were collected from tap, pond and drain water in clean and sterilized bottles. The samples were labeled with date of collection, nature or source of water, the site of collection and were transported to the laboratory of Department of Zoology Kohat University of Science and Technology, Kohat for further process.

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Processing of water samples

Samples were filtered through Filta-Max filters (IDEXX , USA) with a pump on the inlet side of the filter according to the recommendation of the manufacturer. The filter was taken out and processed with the aid of a Filta-Max Manual for further elution and concentration process which consisted of decompression of the filter, passing the sample through a membrane, and centrifugation. A sample pellet was obtained and mixed with 1ml buffer solution and kept at -20^{0}C for further process.

Parasites Detection and Prevalence Rate

Slides were prepared, stained and examined under microscope (Olympus Japan) at 10X, 40X and 100X magnification. The prevalence rate of parasites in water samples was determined with the following formula

Prevalence Rate = (No. of parasite detected in water sample/Total no. of water samples examined) ×100

Statistical analysis

Data were analyzed using the SPSS 16.0 software. P values less than 0.05 were considered to be statistically significant.

Result and Discussion

A total of 450 water samples were collected from tap water, pond water and drain water located at Kohat, Karak and Hangu. The prevalence (%) of *Giardia, Cryptosporidium, T. gondi, Balantidium coli, Fasciola hepatica and Entamoeba histolytica* in each categories of water samples were determined.

In the present study, *Giardia* Spp and *Cryptosporidium* Spp were found in tap, pond and drain water in Karak, Kohat and Hangu districts of Khyber Pakhtunkhwa province Pakistan (Table 1). Of all the samples, 65.5% (295/450) contained protozoa. Amongst these *Giardia and cryptosporidium* was 18.5% (61/450) and 19.5 % (88/450) respectively.

The results of the study confirm the findings of clinical studies conducted that had shown the presence of these two parasites in the human population (Guerrant, 1997). Both *Giardias* and *Cryptosporidium* was known to cause gastroenteritis and were considered two of the leading causes of waterborne diseases in the United States as reported by (Guerrant, 1997; Furness et al*.,* 2000).

Similar studies conducted in Sri Lanka also showed the levels and concentrations of *Giardia* and *Cryptosporidium* species although these were higher than the result of the present studies from other countries (WHO, 2004; Solo et al*.,* 1998 and Quintero et al., 2000). This could be due to the different environmental and geographical distribution of the country and locality.

In the present study, *T. gondii* and *Balantidium coli* oocysts were found in all the water sources and were most numerous in pond and drain water. According to the recent report that water borne transmission of *T. gondii* is uncommon but a large human outbreak linked to contamination of a municipal water reservoir in Canada by wild felids and the widespread infection by marine mammals in the USA (Dubey, 2005).

In the current study, *Fasciola* eggs and *Entamoeba* trophozoites cysts were also recovered from all the water sources. The recent longitudinal studies reported the finding of these parasites in the water sources throughout the year (Wallis et al., 1996). According to the recent report which had shown *Entamoeba histolytica*, *Giardia lamblia*, and *Cryptosporidium parvum* are three of the major causes of protozoan-induced diarrheal disease (Black, et al., 1977; Walsh, 1986; Chapman, 1988). *E. histolytica* is responsible for approximately 100,000 deaths worldwide each year, making it second only to malaria as a cause of mortality due to a protozoan parasite (Walsh, 1986). In other studies, *E. histolytic*a and *E. coli* was recovered from the sewage waters and stool (Hernandez-Chavarria and Avendano, 2001).

Possible sources of water contamination including both human and animal sources are known to be important in the introduction of protozoa to a water system (WHO, 2004).

Table 1 Prevalence of zoonotic parasites in drinking water from different sources

Parasites	Kohat (n=150)			Karak (n=150)			Hangu (n=150)			Total
	Tap water	Pond water	Drain water	Tap water	Pond water	Drain water	Tap water	Pond water	drain water	
Giardia	6	8	11	7	2	8	3	9	7	61 (18.5%)
Crypto.	5	17	16	7	13	10	4	7	9	88 (19.5%)
T. gondi	1	2	1	1	3	3	1	0	1	13 (2.8%)
Fasciola	1	4	10	1	3	0	1	2	0	22 (4.8%)
B. coli	1	4	3	0	3	5	0	3	7	26 (5.78%)
Entamoeba.	7	16	11	7	4	13	8	10	9	85 (18.8%)

Statistical analysis; Tukey's test and one way ANOVA, (P>0.05) non significant.

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