Students' Corner
Original Article

Assessment of frequency of diarrhoea in relation to drinking water among residents of Nurpur Shahan, Pakistan

Zainab Masroor Kakakhel,[1] Somabia Ibrar,[2] Wasim Alam Khan,[3] Hajera Bibi,[4] Syed Ahmed Zamir,[5] Shafin Sohail Khan,[6] Shabaz Khan,[7] Sohrab Khan,[8] Wasif Tariq,[9] M Hassan Tahir,[10] Saima Iqbal[11]
Medical Students,[1-10] Community Health Sciences,[11] Shifa College of Medicine, Islamabad.

Abstract

Objectives: To determine the source of drinking water and to assess its relationship with the frequency of diarrhoea among households of Nurpur Shahan.

Methods: A cross-sectional descriptive study was carried out in January 2010 with a preformed questionnaire. Systematic random sampling was used to collect data. Participants' consent was obtained and confidentiality was maintained during the survey and during analysis. Households were evaluated for the frequency of diarrhoea in relation to their water source, its purification, and availability of sanitation facilities. All collected data was analyzed using SPSS 10.0.

Results: Of the107 households surveyed, 2.8% used wells, 63% used tap water and 32.7% used hand pumps, whereas only 0.9% consumed store-bought water as their major source of drinking water. The difference in the frequency of diarrhoea between those households who purified their water and those that did not was just 1%. The relationship between the source of drinking water and the frequency of diarrhoea was not statistically significant ($p = 0.319$). Surprisingly households with no disposal facilities only had a 20% frequency of diarrhoea; this was found to be statistically significant ($p = 0.023$).

Conclusions: This study contradicts the general conception that water supply is responsible for diarrhoea in the locality of Nurpur Shahan; it was found that the statistical difference between diarrhoea resulting from purified and non purified water was very small (p-value=0.587). Rather, improper sanitation and poor personal hygiene seem largely responsible for diarrhoea in this rural Islamabad community.

Keywords: Diarrhoea, Drinking water, Sanitation, Pakistan (JPMA 61:934; 2011).

Introduction

Diarrhoea, as defined by the World Health Organization (WHO), "is the passage of 3 or more loose or liquid stools per day, or more frequently than is normal for the individual".[1] Diarrhoea, unfortunately, is still responsible for morbidity and mortality in Pakistan. The WHO Statistical Information System for Pakistan found in 2000 that 14% of children below 5 years of age die because of diarrhoea; ranking second to pneumonia (19.3%).[2] More than 50 % of the general practitioner work load in the community is children with diarrhoea, especially in the summer season.[3] The complications of diarrhoea may be severe and include dehydration and electrolyte imbalances. A study conducted by the King Edward Medical College demonstrated that unsafe water, when given to infants, results in diarrhoea and also impairs short term growth.[4]

The risk factors for diarrhoea include availability of safe drinking water, proper disposal and correct methods of sanitation. Improved drinking water, as classified by the WHO, comes from facilities that are capable of providing safe drinking water. These include household connections, public stand pipes, and protected springs. Unimproved water sources include unprotected wells. Improved sanitation and disposal involves public sewers and toilets with connections to septic systems, and unimproved sanitation facilities are public latrines and open latrines.[2] The urban population of Pakistan in 2006 was found to both have better access to improved drinking water (95%) and better access to improved sanitation (90%) as compared to the rural population (87% and 40% respectively).[2]

As diarrhoea is transmitted through the faecal-oral route, consuming contaminated food or water may result in diarrhoea. Drinking water taken directly from a source may not be safe unless treated by boiling, filtering or water chlorination. A study preformed to assess the safety of water provided by fourteen hotels in 4 different countries determined that water taken directly from a source, such as tap water, was not safe enough to prevent traveller's diarrhoea unless heated to at least 65 degrees (Celsius).[5] Another study was conducted to determine how well selected water treatment methods reduced the prevalence of diarrhoea in a village setting. The study found that even simple interventions, such as diluted bleach and water or encouraging frequent hand-washing, each significantly lowered the prevalence of diarrhoea.[6]

Improving the quality of drinking water can also reduce diarrhoea. This was proved by a Pakistani study conducted in two villages.[7] One village had water supplied by Water and Sanitation Extension Programme (WASEP), which provided improved potable drinking water at the village and household levels. The other village was without WASEP supply. They found that, with WASEP intervention, there was a 25% reduction in the incidence of diarrhoea in children of that village.[7] Another study was conducted to prevent diarrhoea in a village in Kenya. The study found that "households in which drinking water was coliform bacteria-free increased from 10.7% to 43.1% after adoption of pasteurization practice."[8] These studies highlight the importance of purifying a direct water supply in order to prevent diarrhoea.

This study was conducted in a rural community near Islamabad, Pakistan, after considering that unsafe drinking water is a risk factor for diarrhoea and that rural communities have a larger percentage of unsafe water supply and unimproved sanitation facilities compared to urban communities. The objectives of this study were to determine the source of drinking water used in Nurpur Shahan and to assess its relationship with the frequency of diarrhoea in the community. This study also evaluates other risk factors for diarrhoea, such as the type of disposal facility available for residents within households and maintenance of personal hygiene among these residents.

Methods

A comparative cross-sectional study was carried out by the students of Shifa College of Medicine in January 2009 in Nurpur Shahan (rural Islamabad) village. A pre-designed questionnaire was used, and was translated into the local language and back again to English to ensure accurate results. A systematic randomized sampling technique was used where we questioned one member of every 4th household after obtaining their consent. If a household member refused to give consent we moved on to the next 4th house. Independent variables included age, gender, educational status, income, number of family members and source of drinking water. Dependent variables included occurrence or no occurrence of diarrhoea. A Sample size of 107 was calculated using EPI-info 6.0, for a 95% confidence interval, and a precision of ±5%. Inclusion criteria included houses with 2 or more people and within the vicinity of Nurpur Shahan. The information received in the questionnaires was analyzed using SPSS version 10.0. Frequencies were determined for the categorical variables (such as age, gender, income and educational status). Chi-Square test was used to evaluate the relation between source of water and incidence of diarrhoea and purification of water and occurrence of diarrhoea. The level of statistical significance was $p < 0.05$.

For this study, possible confounders included other risk factors for diarrhoea such as hand washing before cooking, eating and after using the toilet.

Approval was granted by the Ethics Committee of Shifa College of Medicine for this study. Furthermore, written informed consent was taken from all participants and confidentiality was assured.

Results

A sample size of 107 houses was taken, which accounted to a total of 741 individual people. The average number of members in each household was 7. Majority of the residents interviewed were females (65.4%) who spoke on behalf of themselves, and for the children in the house. The age distribution and the educational status of the participants are mentioned in Table-1.

Table-2 indicates the following: the source of water being consumed by the residents of Nurpur Shahan was as follows : 2.8% used wells to obtain drinking water, 63% of the people relied on tap water and 32.7% of the people used hand pumps that were installed in their houses, whereas only 0.9% consumed store-bought water. The table also mentions what type of disposal facilities are present in households, whether they purify their water supply individually, and other features of the study such as participants' opinion as to the causes of diarrhoea.

Table-1: Demographic Profile of Study Participants: (n=107).

Variable	Frequency #	Percentage %
Gender		
Male	37	34.6
Female	70	65.4
Family Members in Household		
Less than 5	13	12.1
10-May	82	76.6
More than 5	12	11.2
Educational Status		
None	44	41.1
Elementary	43	40.2
Middle	8	7.5
FSc	2	1.9
College or University	10	9.3
Monthly Income		
Less than 5,000	42	39.3
5,000-10,000	48	44.9
11,000-20,000	9	8.4
More than 21,000	8	7.5

Table-2: Household Data of Source of Water and Diarrhea: (n=107).

Variable	Frequency #	Percentage %
Source of water		
Community wells	3	2.8
Household tap water	68	63.6
Community hand pump	35	32.7
Store-bought	1	0.9
Consumed		
As is	91	85
Purified	16	15
Diarrhoea in past month		
Yes	44	41.1
No	43	40.2
Number of episodes in the past month		
0	66	61.6
3-Jan	25	23.3
7-Apr	13	12.1
10-Aug	3	2.8
Type of disposal facility		
Flush	45	42.1
Latrine	57	53.3
nothing	5	4.7
Participant opinion for cause of diarrhoea		
Water supply	41	38.3
Sanitation	26	24.3
Disposal facility	34	31.8

Table-3: Relation between source of water and prevalence of diarrhoea: (n=107).

Variables	Diarrhoea in Household	No Diarrhoea in Household	P-value
Source of Water			
Wells	-	3	
Tap Water	26	42	0.319
Hand Pump	14	21	
Store-bought	1	-	
Consumed			
As is	35	56	0.587
Purified	6	10	
Disposal Facility			
Flush	24	21	
Latrine	16	41	0.023
None	1	4	

The relation between the source of water and prevalence of diarrhoea is depicted in Table-3. We found that: 68 houses in Nurpur Shahan used tap water as their main source and out of those only 26 (38%) had any prevalence of diarrhoea reported in the past one month. Similarly 35 households consumed water extracted from hand pumps and a total of 14 (40%) of those had any episode of diarrhoea. A total of three households used wells and one household bought water from the store. The relation between the source of drinking water and occurrence of diarrhoea was not statistically significant (p=0.319). The difference in occurrences of diarrhoea between households that purified their water (39%) and those that did not purify (38%) was just 1%. Surprisingly, only 20% of those households with no disposal facility suffered diarrhoea within the last one month. This relation was found to be statistically significant (p=0.023).

Discussion

Among the risk factors for diarrhoea, proper hygienic practices and proper sanitation with safe disposal facilities are as important as the provision of safe drinking water. The water supply to Nurpur Shahan is derived from the Simly Dam. Studies performed to determine the quality of the dam's water found aesthetic and physical parameters of water samples to be ideal-ph 7.3, water was colourless, tasteless, odourless, had a low turbidity of 2.5 and no growth of micro-organisms.[9,10]

This study supports the findings obtained from samples

at Simly Dam. It has shown that purifying the water supply did not significantly reduce the frequency of diarrhoea in the community of Nurpur Shahan. Rather, the most significant factor that affected the frequency of diarrhoea was kind of disposal facility available for residents within their homes. The data collected in this study indicates that quality of water was not the major factor responsible for diarrhoea among residents of Nurpur Shahan. A study conducted to determine factors responsible for diarrhoea at a Pakistani village (Takkipur) had a similar finding. They found that among the most important factors was poor personal hygiene of mothers. A notable point is that Takkipur was also found to have an adequate water supply and therefore, water was not listed as one of the causative factors for diarrhoea in that village.[11]

A cross-sectional survey taken from parents in Saudi Arabia determined that major risk factors for diarrhoea among schoolchildren was sewage spillage near homes and the number of children under five year's of age living in one house.[12] These factors relate to the quality of sanitation and to the health practices of young children within homes.

Similarly, a review conducted by the London School of Hygiene and Tropical Medicine found that hand-washing with soap and excreta disposal as interventions against diarrhoea each had greater diarrhoeal risk reductions than improving the quality of water.[13] Also, a review from the same institution determined that "improvements in water quantity may have a greater impact on diarrhoea than improvements in quality alone through their effect on personal and domestic hygiene."[14] The Department of Epidemiology at the School of Public Health (University of Michigan, USA) found that if adequate sanitation is not maintained, households will not benefit from improved water quality.[15] These observations can readily be applied to communities which are supplied with safe water, such as Nurpur Shahan, but which do not utilize water sufficiently or do not maintain adequate sanitation and personal hygiene to prevent faecal-oral transmission of diarrhoea.

Educating mothers regarding the importance of sanitation, personal hygiene and purified water has shown to be both integral and successful in lowering the incidence of diarrhoea during a quasi-experimental study conducted at the Children Hospital Complex in Multan.[16] Adequate sanitation, proper disposal facilities, and correct personal hygiene should be emphasized along with the need for safe water supply in any preventive programme employed to reduce the incidence of diarrhoea in rural communities.

For this study, possible confounders included other risk factors for diarrhoea such as hand washing before cooking, eating and after using the toilet. Unfortunately, these confounders were not addressed in this study. However we presume that the results of this study are unlikely to be affected by these confounders.

Conclusion

This study has shown that the residents of Nurpur Shahan contract diarrhoea because of poor sanitation and the unavailability of safe disposal facilities. To reduce the prevalence of diarrhoea in Nurpur Shahan, any future improvement programmes carried out in the area should aim to improve the disposal and sanitation facilities available and raise awareness among the residents about good personal hygiene practices.

References

1. World Health Organization. Diarrhoea. (Online) 2009 Oct 6. (Cited 2009 Oct 6). Available from URL: http://www.who.int/topics/diarrhoea/en/.
2. World Health Organization Statistical Information System [Internet]. (Online) 2009 Feb 6. (Cited 2010 Jan 18). Available from URL: http://apps.who.int/whosis/database/core/core_select_process.cfm.
3. Malik BS, Hassan M. Acute bacterial diarrhoeas in children. J Pak Inst Med Sci 1997; 7: 395-7.
4. Ashraf RN, Jalil F, Hanson LA, Karlberg J. Giving water during Breastfeeding increases diarrhoeal incidence and impairs early short term growth in a Poor Country. Pak Paed J 2003; 27: 47-55.
5. Bandres JC, Mathewson JJ, Dupont HL. Heat Susceptibility of Bacterial Enteropathogens. Arch Intern Med 1988; 148: 2261-3.
6. Luby SP, Agboatwalla M, Painter J, Altaf A, Billhimer W, Keswick B, et al. Combining drinking water treatment and hand washing for diarrhoea prevention, a cluster randomised controlled trial. Trop Med Int Health. 2006; 11: 479-89.
7. Nanan D, White F, Azam I, Afsar H, Hozhabri S (2003) Evaluation of a water, sanitation, and hygiene education intervention on diarrhea in northern Pakistan. Bull World Health Organ 2003; 81: 160-5.
8. Iijima Y, Karama M, Oundo JO, Honda T. Prevention of Bacterial Diarrhea by Pasteurization of Drinking Water in Kenya. Microbiol Immunol 2001; 45: 413-6.
9. Physical and Aesthetic Parameters in Drinking Water of Islamabad. (Online) (Cited 2010 Jan 18) Available from URL: http://www.pcrwr.gov.pk/wq_phase3_report/Pdfs/pap_isb.pdf.
10. Ahmed T, Kanwal R, Tahir SS, Rauf N. Bacteriological analysis of water collected from different dams of Rawalpindi/Islamabad Region in Pakistan. Pak J Biol Sci. (Online) (Cited 2010 Jan 18). Available from URL: http://www.cababstractsplus.org/abstracts/Abstract.aspx?AcNo=20043083875.
11. Aziz N, Rauf S, Ashraf M. Determinants of childhood diarrhoea in a Pakistani village, Takkipur - where do we stand? J Fatima Jinnah Med Coll Lahore 2007; 1: 76-9.
12. Al-Ghamdi MA, Bentham G, Hunter PR. Environmental risk factors for diarrhoea among male schoolchildren in Jeddah City, Saudi Arabia. J Water Health 2009; 7: 380-91.
13. Cairncross S, Hunt C, Boisson S, Bostoen K, Curtis V, Fung IC, et al. Water, sanitation and hygiene for the prevention of diarrhoea. Int J Epidemiol 2010; 39 Suppl-1: i193-205.
14. Huttly SR, Morris SS, Pisani V. Prevention of diarrhoea in young children in developing countries. Bull World Health Organ 1997; 75: 163-74.
15. Eisenberg JN, Scott JC, Porco T. Integrating disease control strategies: balancing water sanitation and hygiene interventions to reduce diarrheal disease burden. Am J Public Health 2007; 97: 846-52.
16. Rabbani W, Quddusi AI, Mustafa S. Prevention of diarrhea; the role of health education. Professional Med J 2007; 14: 416-21.