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Original Research Article

How Water Sanitation Affect Water Born Diseases

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Abstract: Water borne diseases are caused by pathogenic microorganism that most commonly are transmitted in contaminated fresh water. Various forms of waterborne diarrheal diseases (Hepatitis A and Diarrhea) probably are the most prominent examples, and affect mainly children in developing countries. Diarrheal diseases and hepatitis are a major cause of hospitalization & child's death globally**.** This study was designed to see the effect of water sanitation and socio-economic status on common feco-oral transmitted diseases. A total of 116 children, fulfilling inclusion criteria were recruited in the study after taking written informed consent from parents or guardians of children. Detailed data including general information, age, sex, environment, education level, socio-economic status, source of water supply, type of toilet, sewage disposal and any method of water treatment at home were taken. History of diarrheal illness in last month of enrolment was also taken to find out incidence of diarrhea. Results showed significant higher incidence of diarrhea and hepatitis A among children with lower socio-economic classes and poor sanitation practices. Study concluded that improving access to safe drinking water and adequate sanitation, as well as promoting good hygiene, are key components in preventing diarrhea and hepatitis A.
Keywords: Diarrhea, Hepatitis A, Socio-economic class and Water sanitation.

INTRODUCTION:

Water borne diseases are caused by pathogenic microorganism that most commonly are transmitted in contaminated fresh water. Infection commonly results during bathing, washing, drinking, in preparation of food, or the consumption of food thus infected. Various forms of waterborne diarrheal diseases probably are the most prominent examples, and affect mainly children in developing countries. The world health organization estimates that 58% of that burden, or 842,000 deaths per year, are attributable to unsafe water supply, sanitation and hygiene [1].

Diarrheal diseases and hepatitis are a major cause of hospitalization & child's death globally. Together they account for approximately one in six deaths among children younger than five year's (WHO). In India more than 2.3 million annual deaths among children about 334000 are attributable to diarrheal diseases. Major risk for diarrhea and hepatitis includes environment contamination & increased exposure to enter pathogens. Viral hepatitis continues to be a major public health problem in India as well as in other part of the world. Eight different types of viruses have been found to be associated with viral hepatitis. However in India hepatitis A and E continues to be the major etiological agent both for epidemic and sporadic cases [2]. Hepatitis A virus (HAV) is a major cause of disease throughout the world, with an estimated 1.5 million cases annually [3].

This study was designed to see the effect of water sanitation and socio-economic status on common feco-oral transmitted diseases that is diarrhea and hepatitis.

METHODS:

This was a cross- sectional and observational study conducted in Out-patient department (OPD), Department of pediatrics, at a Medical College hospital, Gwalior with due approval from ethical committee for a period of one year (August 2012 to September 2013). Participants were children belonging to Gwalior district from both urban and rural areas, between 1 to 5 years, attending pediatric outpatient department with minor

problems. Children who received HAV vaccination were excluded from study.

A total of 116 children, fulfilling inclusion criteria were recruited in the study after taking written informed consent from parents or guardians of children. Detailed data including general information, age, sex, environment, education level, source of water supply, type of toilet, sewage disposal and any method of water treatment at home were taken. Data regarding education level, occupation and income were taken in to consideration and was classified according to socioeconomic class (assessed by modified KUPPU SWAMI SCALE). Histories of diarrheal episode in last month of enrolment were also taken to find out incidence of diarrhea.

Competitive ELISA test was done for detection of total anti HAV antibody using commercial available kit "DIA.PRO". The statistical analysis was performed by chi-squared test using Epi Info software 3.5.4. Version 2012.

RESULTS:

A total of 116 children were studied, categorized into 5 groups according to their socioeconomic class by modified Kuppuswamy scale. Out of 116 subjects, 10 subjects were in Upper class, 12 subjects were in upper middle class, 36 subjects were in lower middle class, 32 subjects were in upper lower class and 26 subjects were in lower class.

Table 1: Socioeconomic status distribution in study population and its relation to HAV seropositivity and incidence of diarrhea

Socioeconomic class	Total no.	Anti-HAV positive		Incidence of Diarrhea	
		No.(%)	P value	No.(%)	P value
Upper [I & II]	22	12(54.5%)	0.00075	3(13.6%)	<.005
Lower [III,IV & V]	94	82(87.2%)		32(34.04%)	

Out of total 116 children 94 (81.03%) belongs to lower socioeconomic class and 22 (18.96%) belongs to upper socioeconomic class. Among a total of 22 children belonging to upper socioeconomic class 12 (54.50%) were seropositive for anti-HAV antibody compared to 82 (87.2%) out of 94 children belonging to lower socioeconomic class. In this study difference of positivity for anti-HAV antibody with children having a lower (class III, IV, V) SEC and upper (class I, II) SEC was statistically significant with P value 0.00075.

Among a total of 22 children belonging to upper socioeconomic class 3 (13.6%) were positive for diarrheal episode compared to 32 (34.04%) out of 94 children belonging to lower socioeconomic class, and this difference was significant.

Table 2: Correlation of method of water treatment at home with seropositivity of HAV ab and incidence of diarrhea

Method of water treatment	No. of cases 116 (100%)	Anti HAV Ab +ve No. (%)	p value	Incidence of diarrhoea in last month (n=35)	P value
No treatment at home	98 (84.48%)	84 (85.71%)	0.0036	33(33.6%)	<0.005
Boiling	04 (3.44%)	02(50.00%)		0	
Chlorine treatment	00 (00%)	00 (00%)		0	
Mechanical filtration	06 (5.17%)	05 (83.33%)		1(16.6%)	
Filtration + UV treatment	8 (6.89%)	03 (37.50%)		1(12.5%)	

Out of total 116 children only 18 children were using any method of water treatment at home either by boiling (4 children), mechanical filtration (6 children) or mechanical filtration combined with UV treatment (8children) and no one had chlorine treatment of water at home. Seropositivity was 50.0% (2 out of 4 children) when children had boiling of water at home, 83.33% (5 out of 6 children) when children had mechanical filtration of water at home and 37.5% (3 out of 8children) when children were using filtration combined with UV treatment of water at home.

Among total 116 children, 98 were not having any treatment of water at home out of them 84 (85.71%) were seropositive for anti-HAV antibody. In our study difference of seropositivity for anti-HAV antibody with children having any method of water treatment at home and without any treatment was statistically significant with p value 0.0036.

We also take history of diarrheal episode in last month of enrollment among study cases and we found that out of 98 study subject, those were not treating drinking water, 33 had history of diarrhea while only 2

study case had diarrheal episode in last month of enrollment among 18 children those were using any method of water treatment at home. This difference was statistically significant.

Table 3: Correlation of source of water supply with seropositivity of anti-HAV antibodies and incidence of diarrhea

Source of water supply	Total no.	Anti-HAV positive			Incidence of Diarrhea		
		No.	%	P value	No.	%	P value
Municipal bore well	54	49	88.88	0.026	19	(35.1%)	0.0034
Municipal Tighra dam supply	24	19	79.16		11	(45.8%)	
Personal bore well in home	38	26	68.16		5	(13.15%)	

In our study 116 study subjects were categorized in to 3 groups according to their source of water supply. Among them 54 (46.55%) were having water supply from municipal bore well, 24 (20.68) were having water supply from municipal tighra dam and 38 (38.75%) were having an inside house source of water from personal bore well. Out of 54 children with municipal bore well water supply, 49 (88.88%) were seropositive for total anti-HAV antibody and out of 24 children with municipal Tighra dam supply 19 (79.16%) were seropositive compared to 26 (68.16%) out of 38 children with an inside house source of water.

The difference of positivity for total anti-HAV antibody with children having outside house water supply either from municipal bore well or dam and inside house water supply was statistically significant with P value 0.026. Similarly incidence of diarrhea is more with children having outside house water supply either from municipal bore well or dam then inside house water supply, which was statistically significant with P value 0.0034.

DISCUSSION;

Several previous studies showed a clear inverse correlation between exposure to HAV and socioeconomic level. It is well known that HAV infection is strongly correlated with poverty and inadequate sanitation. In present study difference of positivity for hepatitis A IgM/IgG antibody with children having a lower [class I, II, III] class and higher [class IV, V] class was statistically significant with p value 0.00075. This result was in the line of study by C P Rath *et al.;* [6], Dhawan *et al.;* [5] and Das K *et al.;* [7] Showing a statistically significant difference. Similar to this study, some studies have shown that the association between socio-economic factors, such as poor housing, crowded condition, low income and higher rate of diarrhea was statistically significant. The results are the reflection of the fact that higher socio-economic groups have better access and affordability to food hygiene and water sanitation.

In this study seropositivity was significantly lower in children living in family having source of water in their own house by personal bore well (68.16) in compared to those children with family having pipe line supply either from public bore well (88.88%) or dam supply(79.16%) suggesting probably a contamination while carrying water from outside in to the house. Similar results were observed by C P Rath *et al.;* [6] showed that people using piped water had significantly low hepatitis A IgG prevalence compared to people using well water. Amiel *et al.;* [9] did not find any statistically significant difference between people using municipality water supply and other water supply. I .I. Salama *et al.;* [8] concluded that the risk of infection with HAV was 3 times higher among children using a public water supply compared to those with piped water inside the home.

As diarrhea is acquired via contaminated water and foods, water-related factors are very important determinants of diarrhea occurrence. Increasing distance from water sources 22, 28, poor storage of drinking water [10, 12, 14, 15]. (E.g. obtaining water from storage containers by dipping, no drinking water storage facility), use of unsafe water sources (such as rivers, pools, dams, lakes, streams, wells and other surface water sources) [11, 13, 16-20]. Water storage in wide mouthed containers [2, 20], low per capita water used [17, 18] have been found to be risk factors for more diarrhea occurrence among children less than five. The present study also showed higher incidence of diarrhea among children using a public water supply compared to those with piped water inside the home.

In this study difference of seropositivity for anti-HAV antibody with children having any method of water treatment at home and without any treatment was statistically significant with p value 0.0036. This is the only study of its type in which impact of water treatment at home on seropositivity of anti HAV IgM/IgG antibody and incidence of diarrhea was observed. The present study showing that filtration combined with UV treatment of water at home can

significantly reduce the incidence of infection in population.

CONCLUSSION:

Improving access to safe drinking water and adequate sanitation, as well as promoting good hygiene, are key components in preventing diarrhea and hepatitis A and other waterborne diseases as well.

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