Assessment of Drinking water Facility and its Quality in Government Schoolsof Visakhapatnam

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Abstract:

Background:*Globally poor sanitation contributes to approximately 7,60,000 children deaths every year from diarrhoeal diseases Most schools in developing countries lack even basic water and sanitation facilities. Lack of water and sanitation facilities can prevent students from attending school. Access to safe water and sanitation facilities, can reduce illness and have impact on socioeconomic development.*

Objective: *1) To assessthe drinking water facilities in Government schools of Visakhapatnam city. 2) To study the quality of drinking water.*

Materials and Methods: *A descriptive cross sectional study was conducted between Octoberto November 2015 in a sample of 30 randomly selected Governmentschools in Visakhapatnam City. Information on the availability of safe water source, sanitation and hand-washingetc was obtained using a questionnairefrom teachers and students. Quality of water samples were analysed forphysical, chemical andbiological,parameters at Regional Laboratory, Visakhapatnam. The data was analysed using Microsoft excel.*

Results: *Protected drinking water source was available in all the schools. In 47% and 53% of schools,bore water and municipal water was the water source respectively. Lab reports of physical, chemical and microbiological parameters are within normal limits except 1 school, where the microbiological parameters were found to be abnormal.*

Conclusion: *Study shows that majority of schools were getting water from community water facility. Water quality parameters were complying with standards. However basic hand washing practices among students were poor.*

Key words:*Drinking water quality, Governmentschools, Visakhapatnam.*

I. Introduction

Access to safe water and sanitation facilities, can reduce illness and have an impact on socioeconomic development. Poor sanitation contributes to approximately 7,60,000 children deaths[1] every year from diarrhoeal diseases which can have a negative effect on child development (both physical and cognitive)[2].The UNO's Millennium Development Goal-7 included the target (no 10) to reduce by half the number of people without access to safe drinking water by the year 2015.[3] On an average school children on an average spend eight hours, in and around school facilities, and take in more air, water, and food per unit of body weight per day[4] than adultsthus close attention must be paid to their microenvironment.Therefore assessment and prevention of waterborne diseases are crucial for primary prevention, especially for the children.[2] Most schools in developing countries lack even basic water and sanitation facilities. Lack of water and sanitation facilities can prevent students from attending school,especially girls and increase their drop-out rate and diminish productivity.

Therefore this study was undertaken with an objective to assess the drinking water facility in Government schools of Visakhapatnam city and to study the quality of drinking water.

II. Materials And Methods

A descriptive cross sectional study was conducted in government schools of Visakhapatnam city between October to November 2015. Out of 250 Government schools, a sample of 30schools was selected using simple random method. From each school 2 staff members and 10 students were selected randomly to obtain information on the facilities available and hygiene practices. A total of 60 teaching staff and 300 students were included in the study. Information on the availability and accessibility to safe water source, sanitation around the facility and hand washing practice was obtained using a Semi-structured questionnaire.Two sterile bottles (1 bottle each of capacity 1 litre and 100 ml) were used for collection of drinking water for quality analysis. Water samples were collected from all the 30 government schools and sent to Regional laboratory, Visakhapatnam, for laboratory analysis (biological, chemical and physical analysis).Important tests done among physical parameters includes turbidity, colour, odour, pH at 29.5℃ and Conductivity $(\mu\Omega)$-1. Important tests done in chemical

parameters includes carbonate hardness as CaCo3, chlorides   as Cl,Fluorides as F, Sulphates as SO4, Iron as Fe, Carbonate hardness as   CaCo3, Calcium as Ca, Magnesium as Mg, Free Residual Chlorine   and Bacteriological parameters include MPN count, and test for coliform bacteria , Salmonella, Shigella.The data was entered into Microsoft excel 2013 and interpreted in form of percentages.

Ethical consideration:
Purpose of the study was explained to the school authorities & participants and confidentiality was assured.

III.   Results

Drinking water facility was available in all schools. As shown in fig.1, 16 (53%) schools had municipal water supply and 14 (47%)hadbore well as the source. All the 14 schools with bore water facility, were using the same source for both general use and drinking purpose, however of them, 12schools had RO system of purificationfrom which outlets/taps were connected for drinking. The remaining two had hand pumps and students would fetch water through handpump whenever needed. (table 1)

For, those receiving municipal water (16 schools), the GVMC (Greater Visakhapatnam Municipal Corporation) was supplying treated water cans with dispensers for 11 schools for drinking purpose. In these schools, bore water was available but only for general use. Other 5 schools had municipal piped water supply. These schools depend on this sourcefor both drinking and general use. Of these, 3 schools have provided RO purification system at the consumer level for drinking purpose.

Fig 2 shows that in 96% of the schools, drinking water facility available within the school premises. Regarding the time taken to reach the water outlet from the class room, in 80% of schools it was within 5 min distance (fig-3), in rest 20% of schools, the water outlets were beyond 5 min distance. In 40% of schools there was one outlet / tap for > 50 students, and rest 60 % schools, there are more than one outlet for ≤ 50 students at the drinking water facility.

Cleanliness around the drinking water facility, whether it was bore well or municipal water as source, was maintained in 96 % of the schools, asno water logging was seen around the place. (fig5)

Regarding basic hygiene practices such ashand washing before eating and after going to toilet, fig -6 shows that 44% of students were not practicing hand washing before taking food, and fig- 7. shows 76% of students were not following the practice of hand washing after going to toilet.

Table -1: Source Of Water Supply In Schools

Name of the School	Drinking water source			
New primary school, bangarumetta ,allipuram			Bore water	R O water
Govt. high school, railway colony			Bore water	R O water
MGM high school, Bangarumetta, allipuram	Municipal water cans			
CBM UP School, Bangarumetta, Allipuram	Municipal water cans			
GVMC Primary School, Shivajipalem	Municipal water cans			
VisakhaSevaSadhan High School, Ramnagar			Bore water	R O water
KDPM high school, Chinnawaltair			Bore water	R O water
Omkar Lions School for Deaf, Chinnawaltair			Bore water	R O water
GVMC high school, Railway new colony	Municipal water cans			
GVMC high school, NGGO'S Colony, Akkayyapalem	Municipal water cans			
GVMC high school, R P peta, Kancharapalem	Municipal water cans			
GVMC primary school, R P peta, Kancharapalem	Municipal water cans			
GVMC high school, K colony, Burma Camp	Municipal water cans			
GVMC high school, Marripalem	Municipal water cans			
GVMC high school, Madhavadhara	Municipal water cans			
Mandala PradhamikaPatasala, Butchirajupalem		Municipal water tap		
Mandala PradhamikaPatasala, Yendada		Municipal water tap		R O water
Primary school, Kapuluppada		Municipal water tap		R O water
MPP School, Vadapalli			Bore water (HP)	

|				
ZPH School, Vadapalem		Municipal water tap		R O water
ZPH School, Chinnagadili			Bore water	R O water
MPP School, Peddagadili			Bore water	R O water
MPP School, Santhapalem, Chinnagadili			Bore water	R O water
MPP School, Arilova, Chinnagadili			Bore water	R O water
MPP School, Sagarnagar			Bore water	R O water
Primary School, Chinnawaltair			Bore water	R O water
MPP School, Dheenadayalapuram			Bore water(HP)	
A.P Residential School, Sri Krishnapuram, Chinnagadili			Bore water	R O water
Government School, Isukathota		Municipal water		
GVMC Old Primary School, Velampeta, 1 town	Municipal water cans			
Total	11	5	14	15
HP = Hand pump				
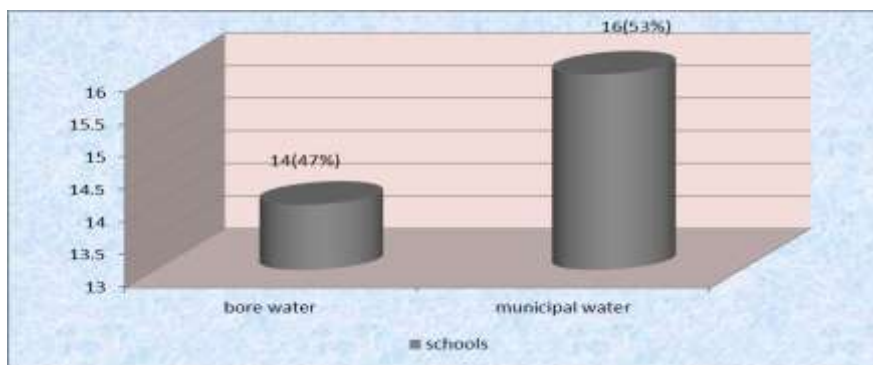
**Fig 1** Source of water supply in school (n= 30 schools)

- drinking water facility within school
- drinking water facility out side the school

Fig 2: Drinking water facility   (n = 30 schools)
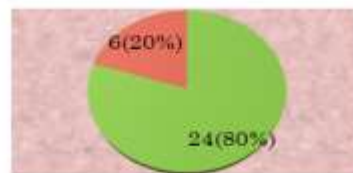
- drinking water facility within 5 min distance

Fig 3: Time taken to reach Drinking water facility in school% (n=30schools)
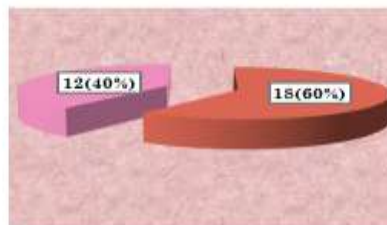
- schools having 1 outlet for ⩽/=50 students
- schools having 1 outlet for ⩾50 students

Fig 4: Drinking water outlets (n= 30 schools)
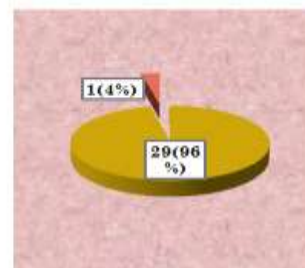
- no water logging
- water logging present

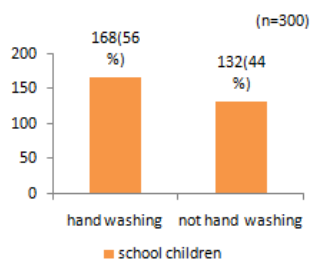Fig 5 : Water logging surrounding the drinking water facility (n= 30 schools)
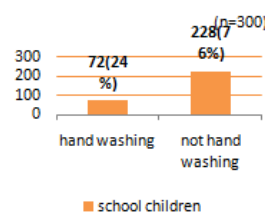
Fig 6:Hand washing before eating food
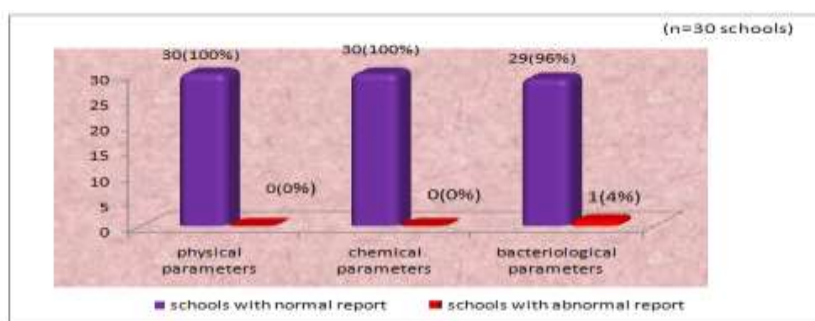
Fig 7:Hand washing after going to toilet

Fig 8 : Quality of water

Table 2: Bacteriological Parameters In The Water Samples

SCHOOLS	Acceptable levels	MPN	Coliform bacteria	Salmonella/ Shigella
1-29 schools	0/100ml	0/100ml	0/100ml	0/100ml
30th school (bore water from A.P Residential schools (BC-boys), srikrishnapuram, chinnagadili,Visakhapatnam)	0/100ml	23/100ml	0/100ml	0/100ml

Regarding the quality of drinking water, the water samples taken from all the 30 schools show no abnormality in physical and chemical parameters.The biological parameter was also found to be within normal limits in all schools except one. Sample from bore water in A.P Residential school (BC-boys), Srikrishnapuram, Chinnagadili, showed MPN 23/100ml which indicates presence of gas forming coliform organisms.

IV. Discussion

Young children are at the greatest risk of waterborne diseases, especially when living in unsanitary conditions[5]. The availability of a clean and sufficient water supply is a primary consideration while selecting a site for new school construction.The drinking water quality of 30 schools in Visakhapatnam was assessed with respect to the drinking water facility and its sources, the location of the facility and the different laboratory parameters.

In this study it was observed that majority (96%) of the schools had drinking water facility with in the school premises and within 5 min of distance(80%) from the classrooms. Out of the 30 schools, 16(53%)were obtaining water from a community water systemie., rely on the public water supplies to provide safe drinking water. This was being supplied in 20 L water cans with dispensers by the municipality to majority of municipal schools in the city, which is a good initiative by the authorities to solve the issue of safe drinking water in the schools. Remaining 14 (47%) schools were found to be using bore wateras the main source, however for drinking purpose, RO water purification system connected to the bore well was used in 12 schools. In only two school bore water was used directly for drinking purpose through hand pumps. Public water supply is always a preferable source as the water undergoes treatment however contamination can occur even at the consumer

level. Bore wells as underground water source is a safe alternative to it. Studies done by WATER AID in 9 states of India have reported that hand pumps were the primary source for water[6].Others studies by Kotingo E L et al [7]and Sidhu S et al[8] reported that submersible pumps, piped supply , and hand pumps / bore with electric pump were the main sources of water.

Contamination can occur at any point therefore it is advisable to use some method of purification at the consumer level also.The schools are also encouraged to test and flush drinking water outlets periodically. It was found that irrespective of the source, in 15 schoolsdrinking water outlets (taps)were connected through RO system of purification.As per Model Building Bye-laws, Govt. of India guidelines, the number of drinking water outlets/taps should be proportionate to the number of students using the facility, ie one tapfor ≤50students. In this study,60% of the schools had number of outlets as per the normsie (one tap for ≤ 50 students)[9].Study by Majra J.P et al [10]reported that 90% of schools had adequate drinking water points.

Drinking water outlets must be near to the class rooms and must be in adequate number to avoid inconvenience to the students. Regarding the time taken to reach the water outlet/tap from the class room, in 24 (80%) schools it was within 5 min distance (fig-3), in remaining 6(20%) schools, the water outlet/taps were beyond 5 min distance, which means even within the campus the drinking water taps were far from the classrooms and it takes more than 5 minutes for going there and coming back to their class. Kotingo E. Let al[7] reported that 72% of the schoolshad water supply inthe school compound but in 13.04% schools, students had to walk for > 5 minutes to the drinking water source.

Sanitation should be maintained in the area surrounding the water facility so as tokeep water free from further contamination and also for prevention of other water related diseases. In majority (96%) of the schoolsthere was no water logging around the water facility. Whereas in a study conducted by WATER AID stagnant pool of water around the hand pump was reported in 42.9% and open drains were seen in 57.1% of schools.[6]

Water facility in the school is essential not only for drinking but also for other purposes such as washing hands and feet and to maintain basic hygiene after going to toilet. Lack of such facilities contributes to an increase in the drop-out rates especially among girls. The school environment is important for interventions aimed at mitigating infectious diseases[11]. Therefore children should be encouraged and inculcated with the habit of hand washing before eating and after going to toilet. In this study it was observed that around half of the students were not practicing hand washing before taking food and two thirds(76%) were not following the practice of hand washing after going to toilet.In another study by WATER AID[6] it was found that 82% of students were not washing hands after toilet and 95% were not washing hands before eating.Most of the school do not have adequate hand washing facilities, Reasons may be,lack of funds, inadequate supervision leading toimproper maintenance of the water supply facility.

Regarding the quality of the drinking water, EnvironmentalProtectionAgency regulations and WHO Drinking Water Quality Guidelines require monitoring of substances such as coliform bacteria, organic and inorganic chemicals. Total coliforms should be absent after disinfection, because the presence of these organisms indicates inadequate treatment. [12,13]

Drinking water samples from majority (96%) of the schools were complying with the WHOstandards, in terms of physical, chemical and bacteriological parameters, except for one school where bacteriological parameter was abnormal[5] Sample from bore water inA.P Residential school (BC-BOYS), Srikrishnapuram, Chinnagadili,showedMPN 23/100ml which indicatesthe presence of gas forming coliform organisms.[MPN =Most probable number for coliform organisms,normal value = 0/100ml. Presence of coliforms in drinking water sources indicates inadequate treatment and sanitation which is necessary for drinking. The reaction may occasionally be due to the presence of some other organisms or combination of organisms, therefore should be followed by a confirmation test.

While testing for MPN, three sets of tubes with 5 tubes per dilution (in each set) are used. Each set has sample water of 10ml, 1ml and 0.1ml. As perMc CRADY'S table for 5 Tube test, using the Most Probable Number Method, MPN of 23/100ml reflects 5-0-0 combination of positive tubes.[13]However this test should be followed by confirmatory tests. In present study the confirmatory test did not showthe presence of E Coli. No microbiological reproduction was detected in the Community Water Supply or tanks of the primary schools.The potential health consequences of microbial contamination necessitate that the control of microbial contamination must be of paramount importance and must never be compromised.[5]

The World Health Organization has issued guidelines for water, sanitation, and hygiene implementation in schools in low cost settings and also recommends thateach country must review its needs and capacities when developing a regulatory framework[2]. WHO also recommends toestablish effective monitoring programmes for surveillance of drinking-water quality ieto monitor the levels of chemicals and bacteriological quality of water[5]**.**

V. Conclusion

Study shows that majority of schools had water facility with in the premises and were getting water from community water facility and bore water through hand pumps as well as taps. Sanitation around the facility was satisfactory.

Drinking water samples from all the schools were complying with the WHO [5]standards, in terms of physical, chemical and bacteriological parameters, except for one school where bacteriological parameter was abnormal. However confirmatory test revealed the absence of coliforms. In most of the schools, hand washing practices were not satisfactory.

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