Research Article

Quality of Drinking Water, in Basic Schools at Almatama Locality, River Nile State, Sudan.

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Abstract

A descriptive cross-sectional school-based study was performed to evaluate the drinking water quality in basic schoolsat Almatamma locality. A questionnaire was used as a baseline survey of all basic school in the locality which is 117 in terms of school information, water quantity, quality and, sanitation facilities, sixty drinking water samples were collected from selected schools for physiochemical and bacteriological examination. Each school represent of s a group of schools that were supplied with the same water source. Conductivity, PH, TDS, Ca, Mg, Na, F, Cl, SO4, K, No3, No2, and other physiochemical parameters of water samples werewithin the permissible limits. Total iron concentration, total hardness, and degree of turbidity were above the permissible limit. The bacteriological quality of 81 % of the water samples was above the WHO and Sudanese drinking water standards. The study concluded that water, sanitation, and hygiene was poor in the basic schools at Almatama Locality, and recommended to establish rules and methods for the school WASH program's follow-up, monitoring, and evaluation, as well as encouraging community and civilian organizations to support WASH activities in basic schools.

Keywords: ***Drinking water quality, WASH, Basic schools, Almatamma***

Introduction

Access to clean and inexpensive drinking water for all is one of the first targets of the Sustainable Development Goal 6 (SDG6), which was adopted in 2015(1). Access to healthy drinking water is essential to one's health (2). Unfortunately, in some parts of developing countries, where this critical resource is subject to contamination, the supply of safe drinking water has been compromised due to a lack of suitable sanitary infrastructure. Groundwater sources are being contaminated by hazardous microbiological agents and chemicals derived from a variety of social, economic, and urban activities; thus,

governmental agencies must protect groundwater sources (3, 4). Microbiological pollution has been linked to the closeness of septic tanks to artesian wells in nations with shaky basic sanitation systems, according to some studies(5,6). As a result, an estimated 2.3 billion individuals suffer from water-related illnesses around the world [7]. Drinking water contaminated with harmful microorganisms can cause major health problems related to waterborne infections [8,9]. In developing countries, drinking water is regarded as one of the most important reservoirs of bacteria. Each year, four billion instances of diarrhea are reported, with 2.2 million of them resulting in death, with children under the age of five being the most vulnerable. Furthermore, the developing world is responsible for more than 90% of the illness burden [10,11]. Each bout of diarrhea weakens the immune system, resulting in the deaths of millions more people each year [12]. The availability of improved drinking water. Adequate sanitation and a hygienic environment within schools are essential in order to provide a suitable environment to encourage school enrolment and support retention and learning achievement for children (13).Many Sudanese live in an environment characterized by poor access to improved drinking water and sanitation services. The access to improve sanitation facilities is 24% and the use of improved water sources is 55%. The situation in schools is also alarming, only 37% of the schools in Sudan have access to water, sanitation, and hygiene facilities and most of the schools with WASH facilities are in urban areas. (14).For assessing industrial, irrigation, and domestic water quality, physicochemical and microbiological characteristics are significant determinants. pH, TDS, turbidity, hardness, nitrate, EC, chloride, phosphate, and other physicochemical qualities of drinking water are among the common criteria used to present drinking water quality. If their levels are above the Sudanese drinking water standards and World Health Organization's (WHO) guideline limits. (15, 16) According to The United Nations Children's Fund, only 51% of schools in low-income settings have access to water, and 45% have adequate sanitation facilities(17). Diseases primarily transmitted through the fecal-oral route may occur through a variety of mechanisms, including consumption of contaminated water and food as well as through person-person contact (18). Flukes are one of the parasites that affected schools age group children, causing various health problems (19). Many Sudanese live in an environment characterized by poor access to improved drinking water and sanitation services.

Material and Methods

A descriptive cross sectional study was designed to assess the drinking water quality in basic school at Almatamma locality during 2018-2020 The consent for the study was obtained from the health and education authority The total population of the study was 117 basic schools .From data of the baseline survey the schools that have the same water sources were identified. One school was selected as represented for the group of schools of the same water source for water sample collection, hence 60 water samples were collected from the selected schools. .according to steps that set by WHO. The methods used for physicochemical parameterincluded turbidity meter for turbidity, conduct meter for conductivity. Atomic spectrophotometer for, Fe+2, titration method hardness, SO4-2, NO3-1, and F-1,The bacteriological examination included bacteriological analysis(the presence or absence of coliform, thermo tolerant coliformand E. coli . Data, were analyzed using (SPSS), and the, results were organized in tables and figures.

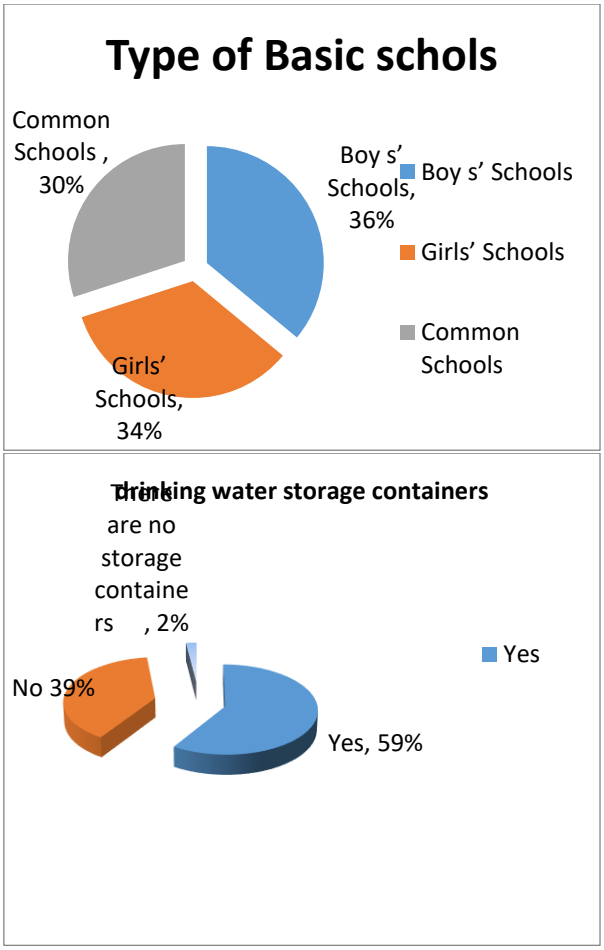


Figure (1) Drinking water storage containers properly coveredin basic schools at Almatama Locality during 2020. {n=117}

Results

Table (1) Physiochemical quality of the drinking water in basic schools at Almatmma Locality 2020. {n=60}.

Parameters	Explain	Frequency	Percent
Appearance	Clear	26	43.3%
	Turbid	34	56.7%
Remarks	Unfit	27	45.0%
	Fit	33	55.0%
Turbidity	Within the Standard permissible limit	33	55.0%
	Above the Standard permissible limit	27	45.0%
Iron	Within the Standard permissible limit	32	53.3%
	Above the Standard permissible limit	28	46.7%
Hardness	Moderate	27	45.0%
	Hard	31	51.7%
	Very hard	2	3.3%
Conductivity	within the Standard permissible limit	59	98.3%
	Above the Standard permissible limit	1	1.7%
Total alkalinity	Within the Standard permissible limit	34	56.7%
	Out of the Standard permissible limit	26	43.3%
Calcium	Within the Standard permissible limit	59	98.3%
	Out of the Standard permissible limit	1	1.7%
Magnesium	Within the Standard permissible limit	25	41.7%
	Out of the Standard permissible limit	35	58.3%
Nitrate	Within the Standard permissible limit	59	98.3%
	Out of the Standard permissible limit	1	1.7%
Nitrite	Within the Standard permissible limit	59	98.3%
	Out of the Standard permissible limit	1	1.7%

Cont. Table (1): Physiochemical quality of the drinking water in basic schools at Almatmma 2020. {n=60}.

Parameters	Explain	Frequency	Percent
Potassium	Within the Standard permissible limit	53	88.3%
	Out of the Standard permissible limit	7	11.7%
Fluoride	Within the Standard permissible limit	60	100.0 %
Ammonia	Within the Standard permissible limit	60	100.0 %
Sodium	Within the Standard permissible limit	60	100.0 %
PH	within the Standard permissible limit	60	100.0 %
TDS	Within the Standard permissible limit	60	100.0 %
Chloride	Within the Standard permissible limit	60	100.0 %
	e limit		
Sulfate	Within the Standard permissible limit	60	100.0 %

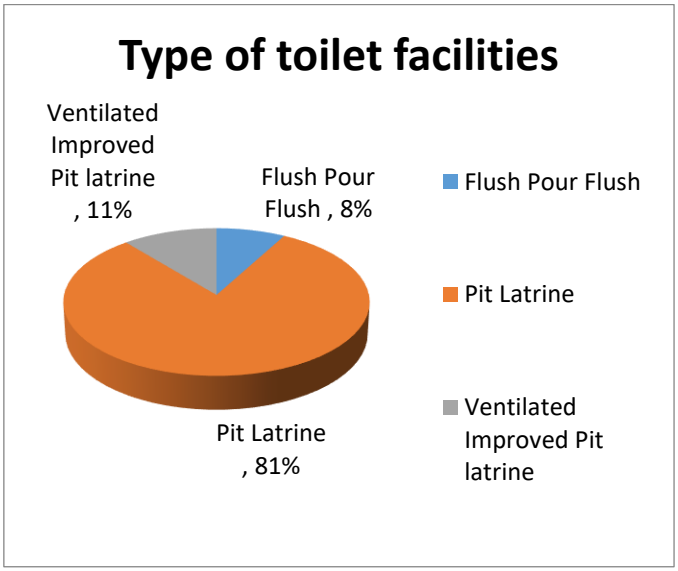


Table (2) One Sample T test of Physiochemical analysis results of the drinking water in basic schools at Almatmma Locality 2020. {N=60}

Parameter	Mean	Standard deviation	T test	Sig	Test Value
Calcium	41	19	-43.2	0.000	150
Calcium	41	19	-3.54	0.001	50
Magnesium	19	11	-20	0.000	50
Chloride	12	15	-116	0.000	250
Sulfate	18	18	-96	0.000	250
Nitrate	7	10	-18	0.000	33
Nitrite	0.17	1.2	-10	0.000	2
Fluoride	0.23	0.12	-77	0.000	1.5
Ammonia	0.07	0.24	-44	0.000	1.5
Sodium	22	18	-94	0.000	250
Potassium	5	4	-9	0.000	10
Total Iron	11	24	3	0.001	0.3

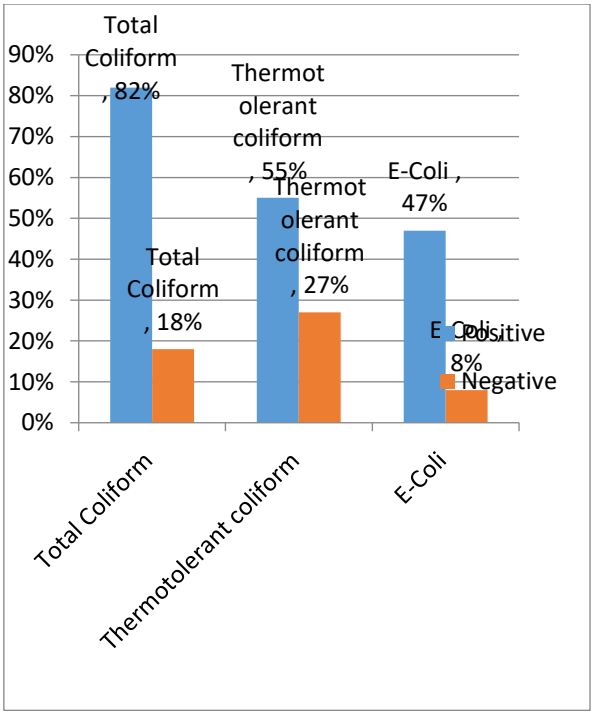


Figure (2) Bacteriological quality of the drinking water in basic schools at Almatmma Locality 2020{n=60}

Table (3) Correlation between the turbidity and Coliform test result of the drinking water in basic schools at Almatmma Locality 2020. {n=60}.

Turbidity	Coliform test		Total
	Negative	Positive	
Within Standard range	18.3%	36.7%	55.0%
Above the Standard range	0.0%	45.0%	45.0%
Total Count	18.3%	81.7%	100.0%
X2 = 11.020 PV=0.001 significant			

Table (4)Association between the turbidity and total Iron results of the drinking water in basic schools at Almatmma Locality 2020. {n=60}

Turbidity	Total Iron		Total
	Within the standard range	Above the standard range	
Within the standard range %	There are no sources in the current document.48.3%	6.7%	55.0%
Within the standard range %	5.0%	40.0%	45.0%
Total % of	53.3%	46.7%	100.0 %
X2 = 35.162 PV=0.000 significant			

Discussion

The study revealed that storage containers for drinking water were present in 115(98%) of schools but in 46(39%) of schools, water containers had no proper covered, hence increased risk of contamination and spread of water-borne diseases among the student (Figure1).

The study revealed 81.7% of the water samples contaminated by coliform bacteria, 55% thermotolerant, and 46.7% of the water samples contaminated by fecal coliform E-coli (Figure2). Such findings were not incompatible with the guidelines of WHO and SSMO.Water intended for human consumption should be both safe, wholesome, and free from pathogenic agents (16). According to these results the drinking water in half basic schools were not suitable for drinking without appropriate treatment process because pupils can be exposed to the risk of the fecal-oral diseases that cause diarrhea and lead to malnutrition eventually affect the performance of the student. For the results of the physic-chemical analysis of drinking water samples, the study indicated that 45% of drinking water samples were remarked as unfit for human consumption..The results of the physic-chemical analysis of drinking water samples indicated that 45% of drinking water samples were remarked as unfit for human consumption.

Also, there are statistical differences between the standard value of WHO and SSMO (20) and analysis of the mean of Calcium, Magnesium, Chloride, Sulfate, and Potassium. The T-test value is negative which means significantvalue of the standard WHO and SSMO (PV=0,000) (Table2). For the results of the physic-chemical analysis of drinking water samples, the study indicated that 45% of drinking water samples remarked as unfit for human consumption.

There was a statistically significant relationship between the water turbidity

and coliform test (X2=11 PV=0.000), (Table 3). The turbidity can promote the growth of pathogens in the distribution system and lead to water-borne diseases. Turbidity can be indicator of a microbiological problem., There was a significant relationship between the turbidity and the result of total Iron concentration in drinking water (X2=35 and PV=0.000), (Table4).The concentration of Iron and Turbidity is high in 46%, 45% of water samples respectively(Table4) , There was a significant statistical difference between the mean of the of results(Iron and Turbidity) and values of the standard WHO, SSMO. The positive value of the T-test means the result was above the permissible limit and indicated there was a problems of the excessive total Iron concentration in water at the point of student consumption (mean= 11 T test=3 PV=0.001 test value 0.3mg/l) (Turbidity mean= 894 T-test = 4 PV= 0.000 Test value 5 NTU) (Table 1).

Conclusion:

School'sdrinking water quality status is poor and doesn't fulfill the required standard of WHO and Sudanese Standards and Metrology Organization. The results suggest there is the problem of microbiological contamination, and schools can be a focal point for disease transmission.

Recommendations: Encourage the effort of the community and civilian organizations in support of the WASH activities in the basic schools. Public illumination and backing through broad communications, workshops, and courses on the significance and requirement for fitting financing of water sanitation and hygiene training in schools, and its importance in communicable disease control. To establish guidelines and systems to follow-up, monitoring, and evolution of the school WASH program.

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