
WATER SUPPLY AND BASIC SANITATION IN PRIMARY SCHOOLS IN KHARTOUM, SUDAN

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Abstract

School sanitation is necessary for the safeguard, secure the healthy environment for students' health. WHO suggests that the provision of sustainable safe drinking water and sanitation services to all, there would reduce morbidity and mortality rate regarding food and water borne diseases. Poor sanitation has led to the infestation of nearly a billion people - largely children - with a variety of worm infections, with its corresponding costs of health and energy. The study aimed to assess water and sanitation facilities in primary schools in Khartoum, Sudan.

A cross-sectional, descriptive study was conducted among 409 randomly selected schools. Data were collected using structured questionnaires, interviews, observation checklist, focus group discussions and microbiologically and physically analysis of water samples, from sources and storage reservoirs. The data were analyzed using (SPSS) and chi-square test with 95% confidence level.

The results showed that 6.8% of schools were without excreta disposal facilities, 46.7% had no collection program for solid waste. Regarding water supply, the Coliform, Thermo tolerant, E. Coli bacteria appeared in the samples taken from the taps, clay pots, plastic barrels, and coolers. The correlation between the coverage of water storage vessels and pollution was not significant, ($p > 0.05$).

The primary schools in Khartoum have a different forms of sanitation facilities, but these are generally inadequate. The schools have a variety of water sources, but there is generally inadequate coverage, insufficient potable water supply or non-existent at all in some schools. Water storage vessels were found open and without cover and dirty. The majority used water storage source is clay pots which is mainly contaminated.

Keywords:

Sanitation-Solid waste-Schools, Water supply.

Introduction

Water quality and sanitation improvement, in association with hygiene behavior change, can have significant effects on population and health by reducing a variety of disease conditions such as diarrhea, intestinal helminths, guinea worm, and skin diseases⁽¹⁾. Sanitation is the efficient disposal of excreta, urine, refuse, and sullage⁽¹⁾.

WHO, suggests that if sustainable safe drinking water and sanitation services were provided to all, each year there would be 200 million fewer diarrheal episodes, 2.1 million fewer deaths caused by diarrhea, 76,000 fewer dracunculiasis cases, 150 million fewer schistosomiasis cases and 75 million fewer trachoma cases⁽²⁾. Diseases

related to poor sanitation and water availability cause many people to fall ill or even die. Children are the most vulnerable to health hazards and consequently are the most affected. In 1998, 2.2 million people died because of diarrheal diseases, of which the vast majorities were children. In addition, poor sanitation has led to the infestation of nearly a billion people - largely children - with a variety of worm infections, with its corresponding costs of health and energy⁽³⁾. The World Health Organization, estimated in 1996 that every eight seconds a child died from a water-related disease and that each year more than five million people died from illnesses linked to unsafe drinking water or inadequate sanitation⁽⁴⁾.

School sanitation is necessary for safeguard, secure and healthy environment for children to learn better and face the challenges of future life⁽⁵⁾. Schools are stimulating learning environment for children and stimulate or initiate change⁽⁶⁾. Really schools are often more than just places for learning and behavior change they have to become safe places where diseases are prevented. Schools can pollute the natural environment in such a way that it causes health hazards in the community at large; therefore, it must have proper facilities. However, improved facilities in themselves are not sufficient. In order to reduce the incidence of sanitation and hygiene related diseases, and to protect the natural environment, the behavioral change leading to proper use of the facilities are needed⁽³⁾.

Most of the diseases among the school children are the food and water borne disease that caused by the poor sanitation which becomes the breeding site for all the Pathogenic bacteria. Improving sanitation can prevent diseases and reduce the mortality rate among the students. Thus, this study aimed to assess water and sanitation facilities in primary schools in terms of availability, access and behavior in Khartoum, Sudan.

Material and methods

This cross sectional, descriptive study was conducted in Khartoum, Sudan at governmental and private primary schools. The total number of the primary schools in Khartoum is 2335 with the 862,170 pupils. The randomly selected schools were 400 schools. The selected schools were distributed proportionally over the seven localities based on the types; 271 governmental schools, and 129 private schools.

Samples of water were taken according to the WHO water quality guidelines, (The recommended minimum sample numbers for fecal indicator of population more than 500.000 is 1 sample per 10.000 head of population plus an additional 10 samples). The total of students is to be divided over 10000 people. Samples of water for analysis are collected from the taps (distribution system in the schools), water from the tanks, water from the clay pots and barrels and water from the coolers.

The ethical clearance was obtained from the ethical committee of the Bahri University, Sudan.

The collected data were statistically analyzed by using (SPSS), version 20. The results were presented in tables and graphs.

Result

This study was conducted to assess water and sanitation facilities in primary schools in Khartoum, Sudan. 400 schools were used as study area and the result revealed that 96% of the schools in the urban areas have latrines compared to 86% in the rural areas, (**figure 1**). The cleaning of the latrines varies from daily cleaning 36% to not cleaning 21%, (**figure 2**). Nearly one third of the latrine in the primary schools is less than 10 meters from the water sources, see figure3. 65% of the students are badly using the latrines where only 14% using them properly, (**figure 3**). There is only 33.2% of schools have existence of garbage collection points within the school, (**figure 4**). Nearly all the schools burn the solid waste as a means of a solid waste disposal, (**figure 5**). 65% of schools using traditional water containers (clay pots) and only 18% using coolers and refrigerators, (**figure 6**). The result revealed that there is insignificant relationship between the existence of health education program and the cleanliness of latrines, (**table 1**). There is also insignificant relationship between the coverage of water storage and water pollution, (**table 2**). The bacteriological analysis of the water samples according to the source of water provision,

showed that the availability of Coliform Bacteria is 44% in the tape, 81% in clay pots, and 7% in tanks, thermo bacteria is found to be 9% in the tape, 32% in the clay pots and 1 % in the tank where the E-coli bacteria if found to be 6% in the tape 25% in the zeers and 9% in the tanks, (table 3). The Physical analysis of the water samples according to the source of water provision showed that the turbidity is found to be 73% of the tape samples, 72% of the clay pots samples and 7 of the tanks samples, (table 4).

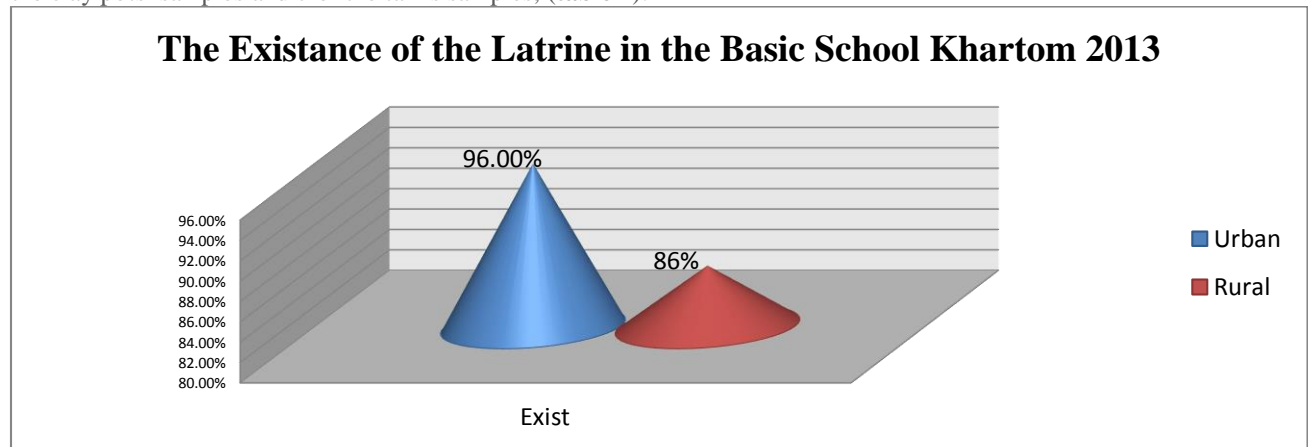


Figure (1): The existence of Latrines in the primary schools

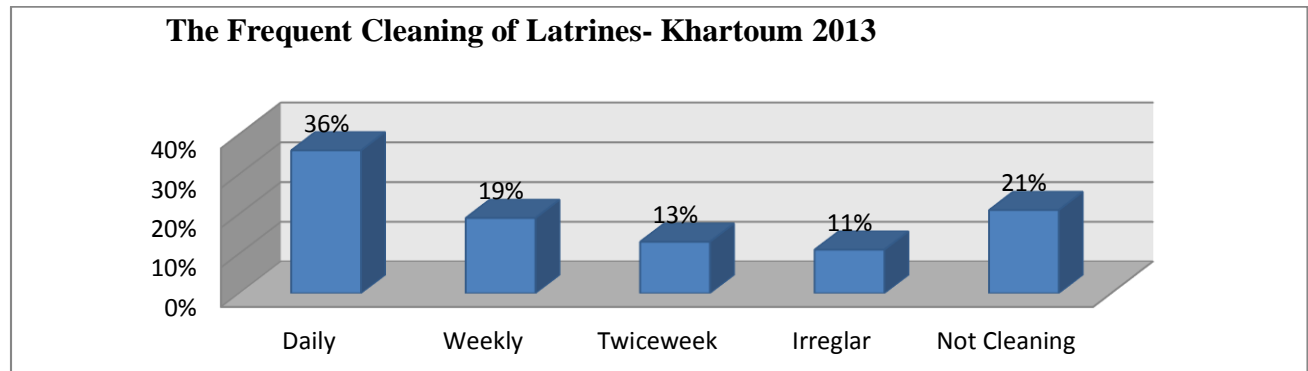


Figure (2): The cleaning frequency of latrines in the selected primary schools, Khartoum state -2013.

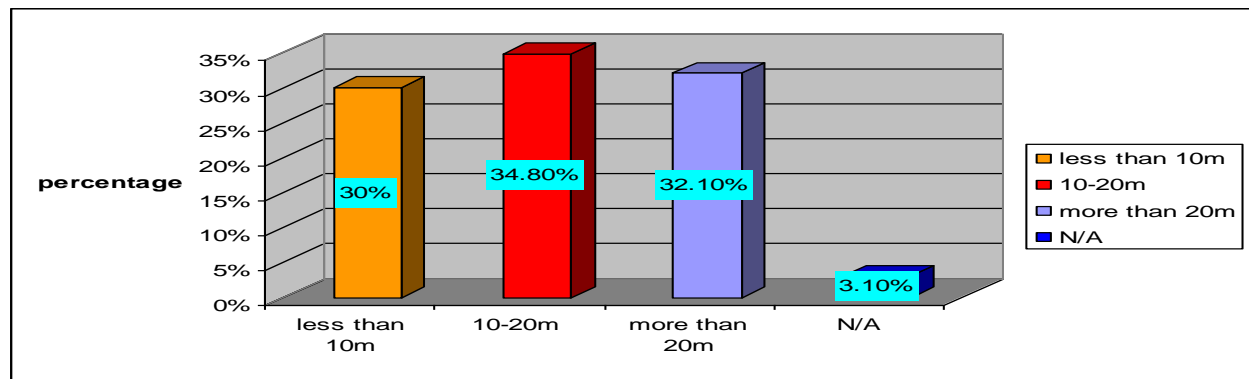


Figure (3): Latrines distance from drinking water site in the school in the primary schools – Khartoum state -2013.



Figure (4): The Pupils behavior towards usage of latrines in primary schools, Khartoum state - 2013.

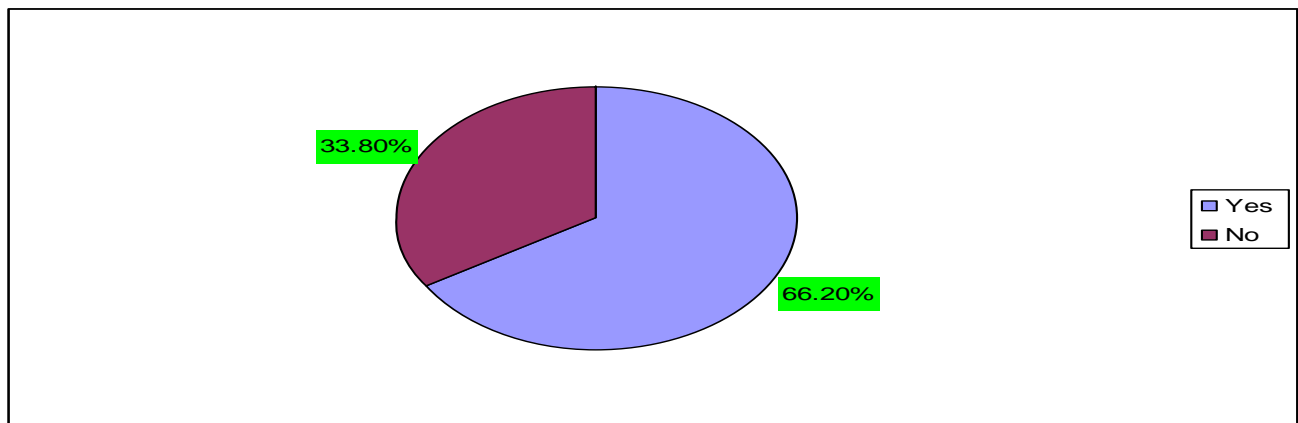


Figure (5): The existence of garbage collection points within the school in primary schools, Khartoum state -2013.

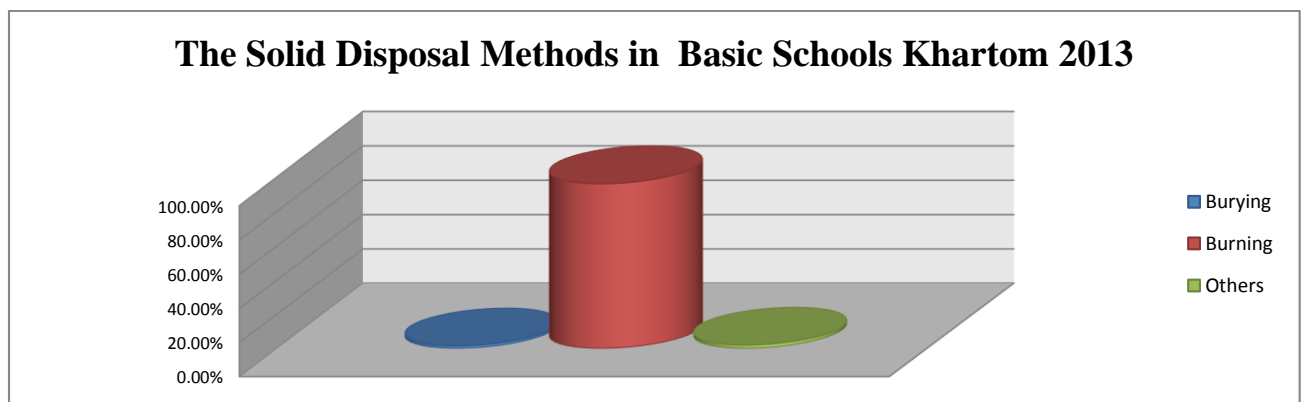


Figure (6): The disposal methods of solid waste in primary schools – Khartoum State -2013.

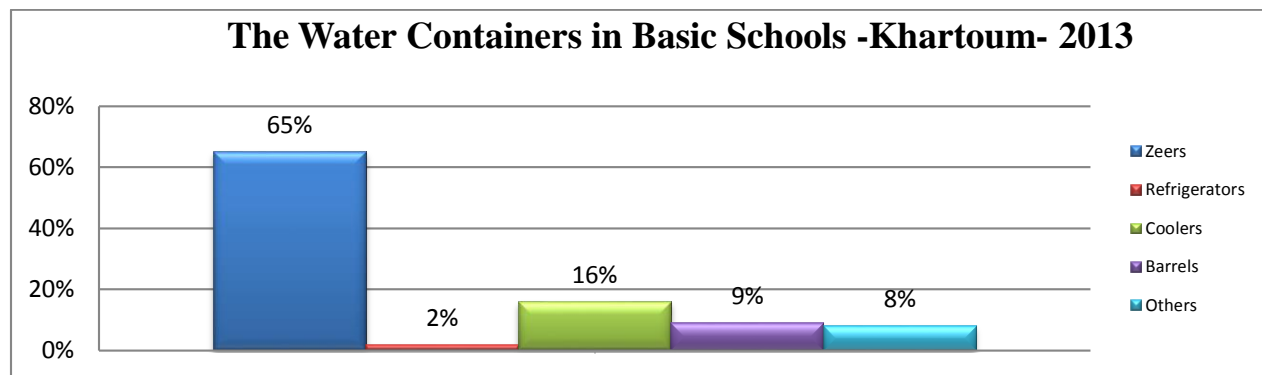


Figure (7): The storage equipment in primary schools – Khartoum state -2013.

Table (1): The relationship between the existence of health education program and the cleanliness of latrines – in the primary schools – Khartoum state -2013.

		Existence of health education	
		Yes	No
Latrines clean	Yes Clean	62.5%	37.5%
	Not Clean	85%	15%
Total	Clean	78.6%	21.4%

Chi- square = 1.718

p value = 0.190

Table (2): The relationship between the coverage of water storage and water pollution - in primary schools – Khartoum state -2013.

		Water pollution results	
		Polluted	Not polluted
Storage covered	Covered	33.3%	7.7%
	Not Covered	66.7%	92.3%
Total	Covered	66.2%	33.8%

Chi- square = 0.014

p value = 6.091

Table No (3): The bacteriological analysis of the water samples according to the source of water provision.

Sources	Coliform	Thermo	E.coli
			http://www.ijmprs.com/

	No of sample	+ve	%	-ve	%	No of sample	+ve	%	-ve	%	No of sample	+ve	%	-ve	%
Tap	75	33	44	42	66	75	9	16	66	88	75	6	8	69	92
Zeer	74	60	81	14	19	74	32	43	42	57	74	25	34	49	66
Tank	20	14	70	6	30	20	10	50	10	50	20	9	45	11	55
Barrel	7	4	57	3	43	7	3	43	4	57	7	3	43	4	57
Cooler	13	9	69	4	31	13	8	61.5	5	38.5	13	6	46	7	54
Total	189	120	63	69	37	189	62	33	127	67	189	49	26	140	74

Table (4): The Physical analysis of the water samples according to the source of water provision.

Sources	Turbidity					Taste				Odor			
	No of sample	Within range	%	More	%	Acceptable	%	Not acceptable	%	Acceptable	%	Not acceptable	%
Tap	75	55	73	20	27	75	100			75	100		
Zeer	74	53	72	21	28	74	100			74	100		
Tank	20	14	70	6	30	20	100			20	100		
Barrel	7	5	71	2	29	6	100			5	100		
Cooler	13	9	69	4	31	13	100			13	100		
Total	189	136	72	53	28	189	100			189	100		

Discussion

This study was conducted to assess water and sanitation facilities in primary schools at Khartoum, Sudan. The sanitation regarding the presence of latrines indicate that 93.2% of schools had some forms of latrine, the majority of schools had traditional latrine in 62.1% and only 5.5 % of schools had VIP latrine and some sort of flush latrine in about 32.4%.

Since 6.8% of the schools had no access to excreta disposal, some pupils used open defecation around the schools or in the street. The study also showed that 6.5% of girls schools and 10.2% of mixed schools have no toilets. The age of girls pupils in schools is between (6-15) years who are beginning to menstruate which can be difficult time for girls in schools. The latrines in 54.5% of the schools were not sufficient for the number of pupils this affect the latrines function and lead to defecation around latrines buildings. This situation may lead to many health problems which affect directly children health. This does not agree with WHO guidance (Excreta disposal facilities in schools need to be sufficient for the number of pupils and staff members, separate block for male and female students should be provided. Separate facilities are also commonly built for male and female staff⁽⁷⁾. This situation is better than the situation that has been reflected by a study conducted in Malawi in 2008 by UNICEF, which revealed that 35% of schools do not have toilets. Among the school toilets that exist, many are not functional or unusable⁽⁸⁾. Another study carried out in India showed that 45.9% of schools in India were without toilets⁽⁵⁾. Also assessment conducted in Bangladesh, explained that 6% of schools have no latrines⁽⁹⁾.

Pupils' behavior observed about the use of latrines; 65.1% of the school's pupils are not using latrines properly so the latrines were not clean and very dirty, due to that 80% of the pupils do not use latrines in schools; but the students in the private schools had better behavior than the students in the public sector.

The study explained that the relationship between pupil's behavior and existence of health education program is statistically insignificant, because the health education program was not focused on the latrines usage and personal hygiene, this does not agree with guidance of UNISCO which stipulated on that (Hygiene education should be part of the school's comprehensive health education programme to ensure students' awareness towards the risks of poor sanitation and hygiene, and to help them develop good hygiene practices⁽¹⁰⁾.

The study pointed out that 83.4% of schools have collected points of the solid waste inside the schools and only 28.2% of these schools had covered the containers. This lead to the release of bad odor in case of fermented waste and act as breeding sites for insects and redistributed solid waste in school's yard or in the classrooms. This disagrees with the standards of UNISCO, Refuse must be disposed safely. Bins with well-fitting lids or sacks are the most appropriate containers to prevent flies and vermin from being attracted to refuse ⁽¹⁰⁾.

The study revealed that the schools have different types of water sources, 89.7% were from the public net, 7.1% from vendors, some schools had no water sources and some schools had hand pumps inside the schools. As the findings indicate, taps from the public net were the most common type of water sources used by schools, followed by vendors, and hand pumps in few cases. Water storage containers in schools: 65.4% of the schools use clay pots as direct drinking sources, refrigerators, coolers and barrels and (Thermess) in 65.4%, 7.4%, 26.3% 18.2% and 18.8% respectively.

General condition of water containers in schools, 80% of clay pots and barrels were not covered to avoid pollution of water in contrast. The study revealed that there were statistically insignificant relationship between the coverage of water storage vessels and the water pollution, because the uncovered storage and other factors exposed vessels to the pollutants such as microorganisms, dust, pupils handling.

Water samples were subjected to microbial analysis, which showed that *The Coliform* appeared in 44% of sample taken from the taps, 81% of samples taken from the clay pots, 57% of samples taken from the plastic barrels and 69% of samples taken from the coolers. On the other hand *The Thermotolerant* bacteria found in 8% of samples taken from the taps, 43% of samples taken from the clay pots, 50% of samples taken from the tanks, 43% of samples taken from the barrels and in 61% of samples taken from the coolers. The most dangerous bacteria *E.Coli* was found in 8% of samples taken from the taps, in 34% of samples taken from the clay pots, in 45% of samples taken from the tanks, in 43% of samples taken from the Barrels and in 46% of samples taken from the coolers. The physical examinations included the taste, odor, color and turbidity. The results were compared with international and national drinking water guidelines.

Conclusion

The primary schools in Khartoum have a different forms of sanitation facilities, but these are generally inadequate. Toilets were not adapted to the needs of the children in particular girls especially in mixed schools. There is poor disposal of solid waste as they just practiced burning inside or around schools and cleanliness of the available sanitation facilities were not at its best, this causes many diseases related to poor sanitation and hygiene. The schools have a variety of water sources, but there is generally inadequate coverage, insufficient potable water supply or non-existent at all in some schools. Water storage vessels were found open and without cover and dirty. The majority used water storage source is clay pots which is mainly contaminated. There were no or irrelevant health education and hygiene promotion programs regarding water and sanitation at schools. The Ministry of Education should provide all schools with safe drinking water and activate the role of the teachers and students to take care about the drinking water facilities. Regular program shall be organized for cleaning and maintenance of toilets, hand washing facilities and drinking water storage facilities by all children.

Acknowledgements

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