

ASSESSMENT OF DRINKING WATER QUALITY DISTRIBUTED BY WATER VENDORS IN EI-OBEID, NORTH KORDOFAN STATE, SUDAN

**Dr. Mohammed Ismail Humaida*¹, Dr. Mirghani Elnager Ahmed¹, Dr. Ahmed Subahi Ahmed¹,
Hafez Adam Musa², Abdalla Adam Omer³ and Abdalla Mohammed Adam¹**

¹Department of Public and Environmental Health, Faculty of Medicine and Health Sciences, University of Kordofan, Sudan.

²West Kordofan State Ministry of Health.

³South Darfur State Ministry of Health.

***Corresponding Author: Dr. Mohammed Ismail Humaida**

Department of Public and Environmental Health, Faculty of Medicine and Health Sciences, University of Kordofan, Sudan.

Article Received on 15/10/2017

Article Revised on 06/11/2017

Article Accepted on 27/11/2017

ABSTRACT

Background: Water is fundamental to sustenance of life and safe drinking water is so essential that it is recognized as a basic human right. **Objective:** This study aimed to assess drinking water quality distributed by water vendors in El-Obied, North Kordofan State. **Methodology:** This community based cross-sectional study comprised of 50 water samples and vendors. Data were collected via questionnaire as well as observation checklist and tests of water (chemical, physical and biological). The data were analyzed by SPSS software, version 11.5. **Results:** The study revealed that vendors obtained water from the following sources; piped connections 55% tanker 22.5%, canteen 17.5%, and hand pump 5%. In this study, 28% of vendors know human excreta as a pollutant of water and 90% of them clean their tank frequently. Whereas the mean value of turbidity of studied samples of water is 2.58 NTU, mean value of pH is 7.54, the mean value of residual chlorine is 0.01 mg/l, and about 62% of studied samples of water were containing coliform organism. **Conclusion:** Water of vendors need more surveillance and treatment and there is scope of health education for vendors regarding knowledge and practice towards water quality.

KEYWORDS: Drinking Water Quality, Vendors, El-Obied, Sudan.

INTRODUCTION

Water is vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities.^[1] Safe water is a precondition for health and development and a basic human right, yet it is still denied to hundreds of millions of people throughout the developing world. Water related diseases caused by insufficient safe water supplies coupled with poor sanitation and hygiene cause 3.4 million deaths a year, mostly among children. Despite continuing efforts by governments, civil society and the international community, over a billion people still do not have access to improved water sources.^[2]

In 1981, the 34th World Health Assembly in a resolution emphasized that safe drinking water is a basic element of "primary health care" which is the key to the attainment of "Health for All by the year 2000 AD". More recently, Millennium Development Goals included safe water and sanitation in the attainable goals.^[3]

Vendors selling water to households or at collection points are common in many parts of the world where

scarcity of water or faults in or lack of infrastructure limits access to suitable quantities of drinking-water. Water vendors use a range of modes of transport to carry drinking-water for sale directly to the consumer, including tanker trucks and wheelbarrows/trolleys. There are a number of health concerns associated with water supplied to consumers by water vendors. These include inadequate treatment or transport in inappropriate containers, which can result in contamination.^[4,5] According to Kjellen and Mc Granahan (2006), those who buy water from vendors are classified as not having reasonable access to an improved water supply.^[6]

MATERIALS AND METHODS

Study design: Community based descriptive cross sectional study

Study area: El-Obeid is the capital of North Kordofan State. Its area have been estimated by 81 km² and the distance from Khartoum is about 560 km. The population of the City estimated by 390993 person. Housing in the municipality is divided into four classes based on plot size. Buildings in the first and second classes are of good quality with water provided by house connections from

the public supply. The medium-density third class is subdivided into three groups: class 3A has piped water to the compounds, class 3B has mixed supplies, and class 3C relies on public standpipes. The fourth class areas are congested areas with the majority of the houses of sub-standard or temporary structure, mostly with mud walls. Their inhabitants rely on public standpipes, unprotected local sources, or water vendors. Donkey cart operators play an effective role in the provision of water to households.^[7]

Drinking water supply in El-Obied has two main sources

- a. Water collected from heavy rainfall in hafir through large area and then passed to the water treatment plant in El-Obied.
- b. Ground water from wells.

Sanitation

Sanitation provision in El-Obied is deficient, most people do not have access to hygienic toilets, and the large amounts of fecal waste discharged to the environment without treatment because there is no sewerage system in El-Obied this may assist in spread of infectious diseases.^[7]

Study population

Water distributed by vendors, which use donkey cart with tank.

Water vendors

Sample size

The calculation of sample size determined according to WHO guideline, which specify one sample per 10000 population, plus 10 additional samples if population > 100000.^[8]

The population of ElObied estimated by 390993 persons, accordingly we need $39.099 \approx 40$ samples, plus 10 additional sample thus, the total sample size is 50 samples.

Sampling technique

Cluster sample used through dividing El-Obied in to four clusters and then we select a sample within selected clusters using the simple random sample technique (SRS).

Data collection methods and tools

Questionnaires, observation checklist and laboratory tests of water.

Tests of water

Chemical and physical parameters of water were tested using palintest photometer 7100 for water analysis (direct reading), and biological parameter were tested via POTATEST WAG-WE10005 using membrane filtration technique.

Data processing and analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) version (11.5).

Ethical consideration

Approval obtain from North Kordofan State Ministry of health.

Water vendors provided informed consent.

RESULTS AND DISCUSSION

The study revealed that 55% of vendors their water source is public network (piped) (table.1), which is better than other sources, this percentage is high when compared with 54% their water source is piped in the study conducted in Urban Slum Settings.^[9] The main system of water distribution, in El-Obeid is the intermittent supply, which, water is delivered only during fixed hours. The disadvantages of the intermittent system are; the pipes may be empty during times of emergency and the people need to store water in containers which may not be dean always. The safe water is likely to be rendered unsafe through improper storage when the pipes are empty, there is negative pressure and by what is known as back-siphoning, bacteria and foul gases may be sucked in through leaky joints.^[10] Also 22.5% of vendors their source of water is tanker (table.1), which they take water from hafir, contains water harvesting from heavy rain fall which, sometimes contaminated with dust, animal manure, human excreta and other contaminants.^[11]

This study revealed that about 74% of vendors did not excute medical examination and 62.5% of them did not excute vetrinary examination for their donkeys that drag water cart (table. 2). This negative practice may cause water borne outbreak through contaminating of water during handling specially when handwashing is inappropriate.

This study showed that the mean value of turbidity of water distributed by vendors is 2.58 NTU and standard deviation is 1.57 (table.2) this turbidity value not exceed the maximum gideline value of WHO and SSMO standards, which equal 5 NTU for both.^[12,13] This value of turbidity is preferable because high turbidity interferes with disinfection and microbiological determination.^[10]

The pH mean value is 7.54, which indicate alkaline nature of water studied (table.3). The SSMO (2002) and WHO (1993) range for pH level in drinking water is 6.5-8.5. None of the pH levels of the drinking water samples studies was below or above this level. The mean value of pH in this study is near the pH mean value (7.8) in similar study conducted in Al-Butana Region of Sudan.^[14]

In this study, the taste and odour were acceptable in all water sample studied (table.3). The ordinary consumer judges the water quality by it is physical characteristics,

the provision of drinking water that is not only safe but also pleasing in appearance taste and odour is a matter of high priority.^[10] This study showed that residual chlorine mean value is 0.01 mg/l (table.3), that is less than recommended value of WHO guideline and SSMO standards, which is equal 0.5mg/l in both.^[12,13] That make water more vulnerable to contamination because the free residual chlorine provides a margin of safety against subsequent microbial contamination such as may occur during storage and distribution of water.^[10]

The study showed that about 62% samples of drinking water from vendors were containing coliform organism (fig.1). This result in contradicting with WHO guidelines for drinking water, which reflect that total coliform bacteria, must not be detectable in any 100-ml sample.^[8] This bacteriological pollution may be due to failure to provide adequate protection, effective treatment and disinfection of drinking water that may expose the community to the risk of outbreaks of intestinal and other infectious diseases.^[10]

Table 1: Sources of water among water vendors.

Sources of water	Frequency	Percentage
Public network of water	27	55%
Tanker (Hafir)	11	22.5%
Canteen	9	17.5%
Hand pumps	3	5%

Vendors in El-Obeid

Table 2: Knowledge and practice of water vendors towards water quality.

Knowledge towards water pollutants	frequency	Percentage
Human excreta	14	28%
Dust	17	34%
Leafs	8	16%
Others	11	22%
Uses of drinking water tank to take polluted water		
Yes	2	4.30%
No	48	95.70%
Cleaning of tank frequently		
Yes	45	90%
No	5	10%
Medical examination for vendors		
Yes	13	26%
No	37	74%
Vetrinary examination for donkeys		
Yes	19	37.50%
No	31	62.50%

Table 3: Physico-chemical quality of sampled water from water vendors.

Parameter	Mean	Standard deviation	SSMO standards (2002)	WHO standards (1993)
Turbidity	2.58	1.57	5	5
Temperature	30.16	3.17	NS	NS
PH	7.54	0.41	6.5 - 8.5	6.5 - 8.5
Residual chlorine	0.01	0.03	0.5	0.5
Taste and odour	Acceptable		NS	NS

N. S. No standard

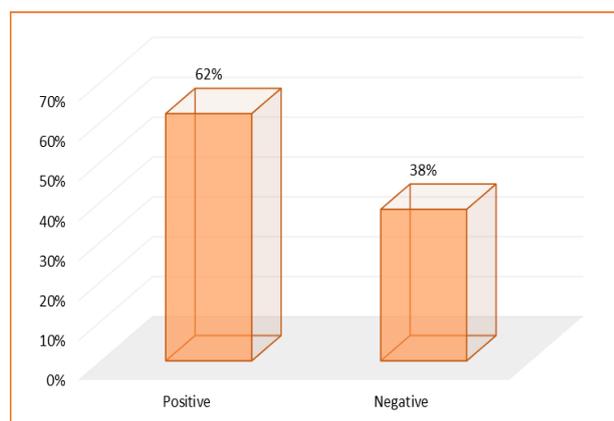


Figure 1: Bacteriological quality of sampled water from water vendors.

CONCLUSION

The majority of vendors have safe water source (piped), inspite of that more than half of sampled water were polluted and the residual chlorine was below the

recommended range. Therefore, water of vendors need more surveillance and treatment and there is scope of health education for vendors regarding knowledge and practice towards water quality.

ACKNOWLEDGEMENTS

Our, thanks to administration of environmental health North Kordofan, water laboratory staff for their great help.

REFERENCES

1. UN GEMS/Water Programme. Water Quality for Ecosystem and Human Health, 2nd ed. Burlington; UN GEMS/Water Programme, 2008.
2. UNICEF. UNICEF Handbook on Water Quality. New York; UNICEF, 2008.
3. Prak, K. Parks Textbook of Preventive and Social Medicine. 23rd ed. Jabalpur; Banarsidas. Bhanot, 2015.
4. WHO. Guidelines for drinking-water quality (3rd ed) Vol (1): Recommendations. Geneva; WHO, 2008.

5. Kjellen. M and McGranahan. G. Informal water vendors and the urban poor. London; International Institute for Environment and Development, 2006.
6. Mc Granahan, G., Njiru, C., Albu, M., Smith, M., Mitlin, D. How Small Water Enterprises can contribute to the Millennium Development Goals. Evidence from Dar es Salaam, Khartoum and Accra. WEDC, Uk; Loughborough University, 2006.
7. Sheikan locality. Administration of health affairs. North Kordofan State. El-Obied, 2015.
8. WHO. Guidelines for drinking-water quality, 2nd ed. Vol (3): Surveillance and control of community supplies. Geneva; WHO, 1997.
9. Joshi, A. et-al. (Water and Sanitation Hygiene Knowledge Attitude Practice in Urban Slum Settings). Global Journal of Health Science, 2014; 6(2): 23-34.
10. Prak, K. Parks Textbook of Preventive and Social Medicine (20th ed). Jabalpur; Banarsidas. Bhanot, 2009.
11. WHO. Environmental Health in Emergencies and Disasters: A practical Guide. Geneva; World Health Organization, 2002.
12. WHO. Guidelines of drinking water quality recommendations, Geneva; WHO, 1993.
13. SSMO. Unbottled drinking water: Standard NO. 044 1st ed. Khartoum; Sudanese Standards and Metrology Organization, 2002.
14. Abdelmonem M. Abdellah, Hago M. Abdel-Magid and Nadia A. Yahi. (Assessment of Groundwater Quality in the Al-Butana Region of Sudan). Journal of Applied Sciences, 2014; 12(1): 64-70.