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AVAILABILITY AND ACCESSIBILITY OF DRINKING WATER SUPPLY IN JABER AREA EAST MEDNI, JAZEERA STATE, SUDAN

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ABSTRACT

The study aimed to assess the accessibility and availability of drinking water and to determine the handling of water in households in Jaber area, Jazeera state.

A descriptive cross-sectional study was conducted in Jaber area , Jazeera state , where 150 households selected as sample size.

Data were collected using structured questionnaires and interviews with the heads of households.

Data were processed using the Statistical Package for Social Science (SPSS) version 16, and office excel 2007.

The study showed that 85% of households used piped water, 2% bought water from water vendors, and 10% shallow well and 3% from public tap

Majority of the households had access to water within a distance of up to 200 metres or less and had access to water within a time of 30 minutes or less.

The result showed that most households (80%) had covered their stored water and 25% of storage containers of drinking water were not clean, also the study appeared that 83% of Latrines distances from drinking water site in homes were less than 30 meter which may cause pollution of water.

The study concluded that the majority of households had access to an improved source of drinking water within reasonable time and distance, the handling of water in side households is not hygienic.

The study recommended conduction of awareness creation of households to handle water hygienically.

KEY WORDS: *Accessibility, Availability, Water, Households, streams, soil moisture, water vapor,*

INTRODUCTION

Water is essential to sustain life, and a satisfactory (adequate, safe and accessible) supply must be available to all. Improving access to safe drinking-water can result in tangible benefits to health. Every effort should be made to achieve a drinking-water quality as safe as practicable.(WHO, 2004)

Water covers 75% of our planet, yet, only a tiny fraction of this abundant water is available to us as fresh water. The majority of water (97%) is found in the oceans and is too salty for drinking, irrigation or industrial purposes except as a coolant. The remaining water (3%) is fresh. Ninety-nine point nine percent of this water is locked up in the poles, or is buried so deep underground that it is too costly to extract.

lakes, streams, soil moisture, water vapor, or exploitable groundwater. To understand this better, imagine that the earth's total water is 100 liters. Our useable fresh water would then, be only about 3 milliliters or one half teaspoon. 1

potable or " drinking" water can be defined as the water delivered to the consumer that can be safely used for drinking , cooking , and washing .

Access to water supply and is a fundamental need and a human right. It is vital for the dignity and health of all people. According to the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Joint Monitoring Programme for water supply and sanitation estimates that 1.1 billion people live without improved water sources, while over half of the developing world population (representing 2.6 billion people) lack access to improved sanitation (WHO and UNICEF 2000; Waddington et al. 2009).

One of the targets of Millennium Sustainable Development Goal (SDG) 6, which is concerned mainly with environmental sustainability, is to halve the number of people who do not have sustainable access to safe drinking-water and basic sanitation by 2030.

Sub-Saharan Africa represents about 11 per cent of the world population, but almost a third of all people live without access to safe drinking water (UNICEF, 2006)

SOURCES OF WATER

There are basically three categories of naturally occurring water resources: groundwater, rainwater and surface water.

Groundwater: occurs under most of the world's land surface, but there are great variations in the depths at which it is found, its mineral quality, the quantities present and the rates of infiltration (thus yield potential) and the nature of the ground above it (thus accessibility). In hilly areas it emerges from the ground in places as natural springs, otherwise wells have to be constructed and pumps or other lift mechanisms installed.

Dug wells: The open or poorly covered water shallow dug wells appose the greatest risk for contamination when inappropriate water-filling devices are used. Also faecal contamination from latrines, septic tanks, and from manure are common than for borehole wells. Concerning contamination originating from agriculture, pesticides and nitrates are increasing problems for small community wells (WHO, 2004).

Borehole wells: Drilling for water makes it possible to reach deep aquifers that are less likely to be affected by contamination from land or surface waters, but depending on the bedrock the water may have high contents of natural contaminants. Water from deep bore hole wells is normally free from microbiological contamination and the water may be used by small communities without treatment. (WHO, 2004).

Spring water:A spring used as drinking water source needs to be of adequate capacity in order to supply the dependent households on every day basis. Exposed springs are vulnerable to contamination from human and animal activities. The usual contamination sources are mainly barnyards. Sewers, septic tanks and cesspools, located higher than the spring (WHO, 2004).

Surface water: The use of surface water as drinking source is mostly dependent on pre-treatment before distribution. Surface water is often a recipient for sewage pipes, agricultural drainage. etc contributing to contamination. (WHO, 2004).

Surface Water, in streams, lakes and ponds is readily available in many populated areas, but it is almost always polluted, often grossly so. It should only be used if there are no other safe sources of water available. (UNICEF, 1999)

Rainwater:

Rainwater collection, from roofs or larger catchment areas, can be utilized as a

source of drinking water, particularly where there are no other safe water sources available (for example in areas where groundwater is polluted or too deep to economically tap). In extreme situations, small quantities of water can be condensed from the atmosphere (as dew) on screens or similar devices. Surface Water, in streams, lakes and ponds is readily available in many populated areas, but it is almost always polluted, often grossly so. It should only be used if there are no other safe sources of water available. (UNICEF, 1999)

Storing water:

Water is only available if it is at hand when needed. Unless the source is on the household plot, access to water is limited. This problem can be overcome by storing water on the plot.

Where the water supply is unreliable (e.g. harvesting rainwater, piped water with intermittent supply) storage improves availability when water is not accessible.

An additional advantage of storing water is that the water quality improves over time. If water is stored for one day over 50 per cent of the bacteria will die.

Suspended solids, which can contain pathogens, will often settle out during storage. By pouring the clear water out carefully, the settled solids can be separated from the water (Shaw, R.J, 1999).

Vessels that can be used to store water include local traditional clay pots, mortar jars, ferrocement tanks, and plastic or fibreglass vessels or tanks.

To avoid contamination vessels or reservoirs used for drinking-water should have

a small opening or tap to prevent people from dipping the water out. The vessel should be covered with a clean, tight lid to keep animals, insects, and contaminated material out. If the water is not used for drinking, the way it is extracted is less important, but as Aedes mosquitoes – vector of yellow fever, dengue fever, and several other arboviruses and filariasis – can breed in household reservoirs no matter what their size, all water reservoirs should be covered properly.

How much water should be stored will depend on the situation. In general the less reliable the supply, the more effort needed to obtain the water, and the higher the water need, the larger the storage capacity should be. If there is a reliable, continuous piped water supply with a house connection then storage will not usually be necessary; but if people rely on rainwater storage needs may be large.

Where there is a reliable source throughout the year, a storage capacity equivalent to the amount of water used in one to two days is probably adequate.

In addition to water storage vessels, households usually need vessels to transport water. These should be made so that carrying the water is as easy and comfortable as possible. The vessels should be covered with a clean cover or lid, and the water should be poured instead of dipped out. (46).

WATER TREATMENT AT HOUSE LEVEL

Boiling:

Apart from the use of chemicals such as chlorine, boiling is the only certain method of killing microorganisms in contaminated water. Despite this, it is not a good thing to rely totally on boiling for purification of water because of the amount of fuel that is needed (about 1 kg. of wood for each liter of water). In areas where wood and other fuels are in short supply, other methods for making water safe should be used, when possible.

Filtration:

The ancient Egyptians filtered water through earthenware pots. Similar methods are used throughout the world today. Two vessels are used. One is unglazed and porous.

It fits into the neck of the second, glazed vessel. This larger glazed vessel is fitted, with a clamped flexible tube about five centimeters above the bottom of the pot. Water is poured into the upper pot and gradually, passes through its small pores into the lower glazed container. Dirt, bacteria and parasitic eggs are filtered out, although viruses will pass through. However, if the cleaned water is left covered for two days before use, then most of the microorganisms will have died because of the cold or lack of food

Chlorination5

Chlorine is widely used as a disinfectant. It is commercially available as calcium hypochlorite powder, sodium hypochlorite (liquid), or as chlorine gas. Chlorine is very active and reacts quickly with organic and inorganic matter in water. For disinfection is to be achieved, due allowances must be made time-wise and quantity-wise for the chlorine to react with other compounds like ammonia, metal ions, and organic compounds. (WHO,2002)

Accessibility is defined as the proportion of the population with reliable improved drinking water supply. Improved sources include: piped water into dwelling or yard; public tap or standpipe; bore well; protected spring or dug well; and rainwater collection. Unimproved water sources are: unprotected spring and dug well; vendor supplying water via small tanks or tanker trucks; surface sources like rivers, dams, streams, irrigation canals; and bottled water from unimproved sources.

Affordability is a key issue to ensure that the least privileged population stratum can gain access to safe water supply. However, in informal settlements lacking piped infrastructure water is often provided by private water vendors. Then the poorest people usually have not only to pay more per water quantity but get water of poor quality, compared to the more fortunate in formally recognized neighborhoods with piped supply.

Continuity in water supply is particularly important to ensure good quality. All water networks have leakages, and with interruptions in water supply there is an immediate risk for in-pipe contamination. Polluted water carrying waterborne diseases can enter the pipe through cracks during low pressure, and eventually reach the consumer when water pressure is restored. Unreliable water supply also forces households to build up water storage, with stagnant water becoming a health risk. Lack of supply can also drive people to acquire water from inferior sources8.

WATER-RELATED DISEASES

The most common risk to human health is associated with water stems from the presence of disease-causing micro-organisms. Many of these microorganisms originate from water pollute with human excrement. Human faeces can contain a variety of intestinal pathogens which cause diseases ranging from mild gastro-enteritis to the serious, and possibly fatal, dysentery, cholera and typhoid. Depending on the prevalence of certain other diseases in a community, other viruses and parasites may also be present. Freshwaters also contain indigenous microorganisms, including bacteria, fungi, protozoa (single-celled organisms) and alg (microorganisms with photosynthetic pigments), a few of which are known to produce toxins and transmit, or cause, diseases. Intestinal bacterial pathogens are distributed world-wide, the most common water-borne bacterial pathogens being species of *genera Salmonella, Shigella, enterotoxigenic Escherichia coli, Campylobacter, Vibrio and Yersinia.* Other pathogens occasionally found include *Mycobacterium, Pasteurella, Leptospira and Legionella and the enteroviruses (poliovirus, echovirus and Coxsackie virus). Adenoviruses, reoviruses, rotaviruses* and *the hepatitis virus* may also occur in water bodies. All viruses are highly infectious. *Salmonella species*, responsible for typhoid, paratyphoid, gastro-enteritis and food poisoning, can be excreted by an apparently healthy person acting as a carrier and they can also be carried by some birds and animals. Therefore, contamination of water bodies by animal or human excrement introduces the risk of infection to those who use the water for drinking, food preparation, personal hygiene and even recreation.

Sewage, agricultural and urban run-off, and domestic wastewaters are widely discharged to water bodies, particularly rivers. Pathogens associated with these discharges subsequently become distributed through the water body presenting a risk to downstream water users.

Typical municipal raw sewage can contain 10 to 100 million *Coliform* bacteria (bacteria originating from the gut) per 100 ml, and one to 50 million *Escherichia coli* or faecal streptococci per 100 ml. Different levels of wastewater treatment may reduce this by a factor of 10 to 100 and concentrations are reduced further after dilution by the receiving waters.

The use of water bodies by domestic livestock and wildlife is also a potential source of pathogens (Chapman, 1996).

In the year 2000, the estimated global burden of disease associated with poor water supply equalled more than 2 billion cases of diarrhoea, with an annual death toll of 2.2 million. (WHO & UNICEF, 2005)

Since the work of John Snow in the UK in the 1850s, the importance of drinking water quality to public health has been recognised. Various diseases are associated with consumption of water containing the organisms that cause them, known as pathogens. Such diseases include cholera, typhoid, and gastro-enteritis (an illness of the digestive system with symptoms of diarrhoea and vomiting). Subsequent studies, Esrey et al. 1990, have indicated an association between improved water and sanitation and reduced levels of gastro-enteric disease in low income countries. A key component of this diarrhoea-transmission model is the control of water quality through a reduction in pathogenic microorganisms that include *viruses, bacteria, protozoa and helminths* (WHO,2004). Control of microbial water safety is of equal importance in high income countries. For example, 2,300 severe cases of gastro-enteritis illness and seven recorded deaths occurred in an epidemic due to microbial contaminated drinking water in Walkerton, Ontario, Canada in 2000 (National Institute, 2002) .

2.OBJECTIVES

- To assess the accessibility and availability of drinking water among Jaber area households in Jazeera state.
- To determine the handling of water in households.

3. MATERIALS AND METHODS

Study Design and Setting

This was a descriptive, cross-sectional study conducted among households of Jaber area.

Jaber area is located in East Medni in locality of Medni Elkobra which is boarded with Medani Elgdarif High way in the east and Eldindir River in south and in north and west residential areas.

The area has a population of more than 1500. Registered number of households of the area during the time of the research was 240.

Sampling Methods:

The sample of households was selected using simple random sampling techniques. The lists of registered households of the village were obtained from registration of health center and used for the selection of households. A number was assigned to each head of household name on the list, and then using a table of random numbers the households were selected from the registered list.

Sample Size:

The total numbers of households are 240 where 150 households were selected as sample size from the study population by using the following sample formula.

Confidence level=95%

Confidence interval= 5%

$n = \frac{N}{1+N(e)^2}$

Where:

n= sample size

N= Total

e= error allowable (0.05)

Confidence interval= 5%

$n = \frac{N}{1+N(e)^2} = \frac{240}{1+240(0.05)^2} = 150$

Data Collection: The data was collected by using a structured questionnaire designed in a close-ended questions. And it was divided to tow section, section one personal information data of the head of household, and section tow research problem data.

Data analysis: Data were analyzed by using SPSS version 16, and chi-square test was carried out with 95% confidence level to find associations between the different variables. P-values less than 0.05 were considered statistically significant.

RESULTS AND DISCUSSION

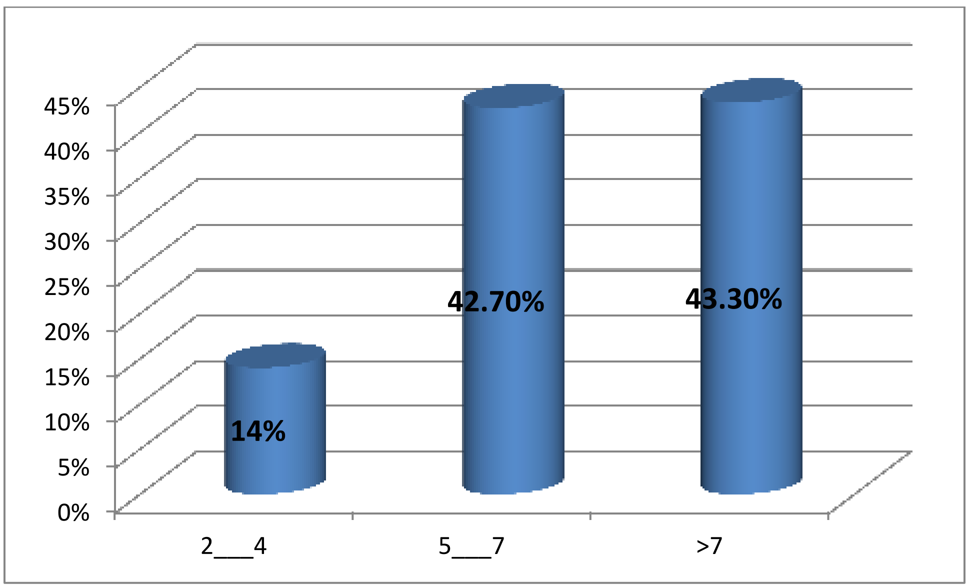

Figure (1) size of household's member, Jaber area, 2015.

Table (1) Type Job of the Heads of Households, Jaber area, 2015.

	Job	Frequency	Percent
	Farmer	49	33.0
	shopkeeper	11	7.3
	housewife	3	2.0
	worker	48	32.0
	student	1	.7
	employees	15	10.0
	non-working	6	4.0
	others	14	9.3
	1+2	3	2.0
Total		150	100.0

Table (2) Household's Monthly Income in SDG , Jaber area, 2015.

	Income / SDG	Frequency	Percent
	< 450	56	36.0
	451-600	33	20.7
	601-800	18	12.0
	801-1000	21	14.0
	>1000	22	14.7
	Total	150	100.0

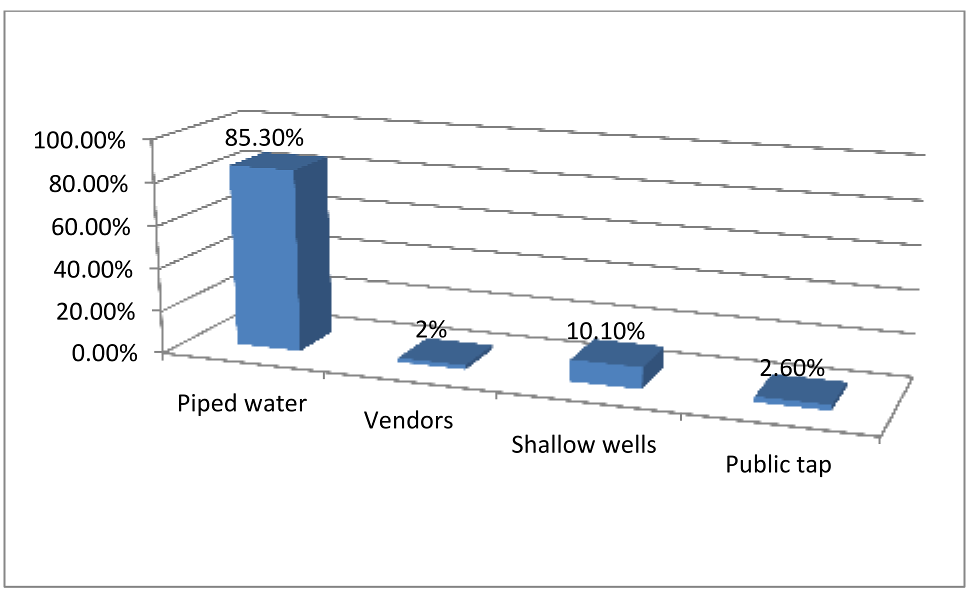

Figure (2): Households sources of drinking water in Jaber area, 2015.

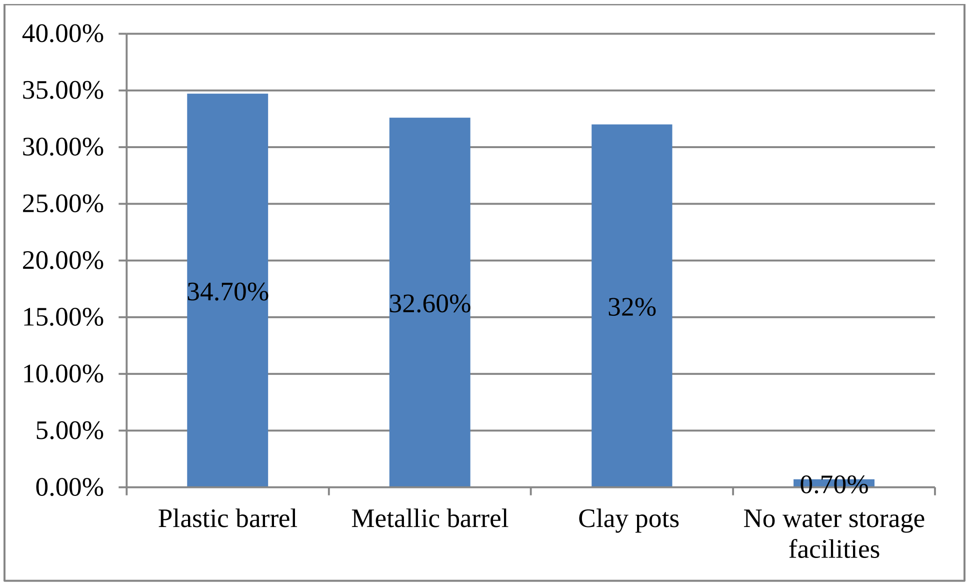

Figure (3): Patterns of the storage equipment for water in households in Jaber area, 2015.

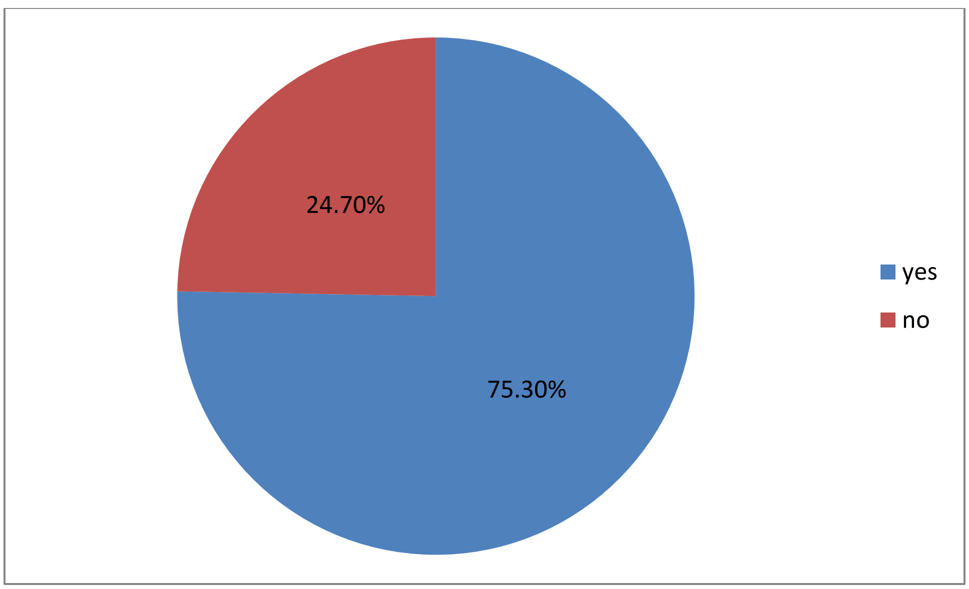

Figure (4): Cleanness of storage equipment in households, in Jaber area.

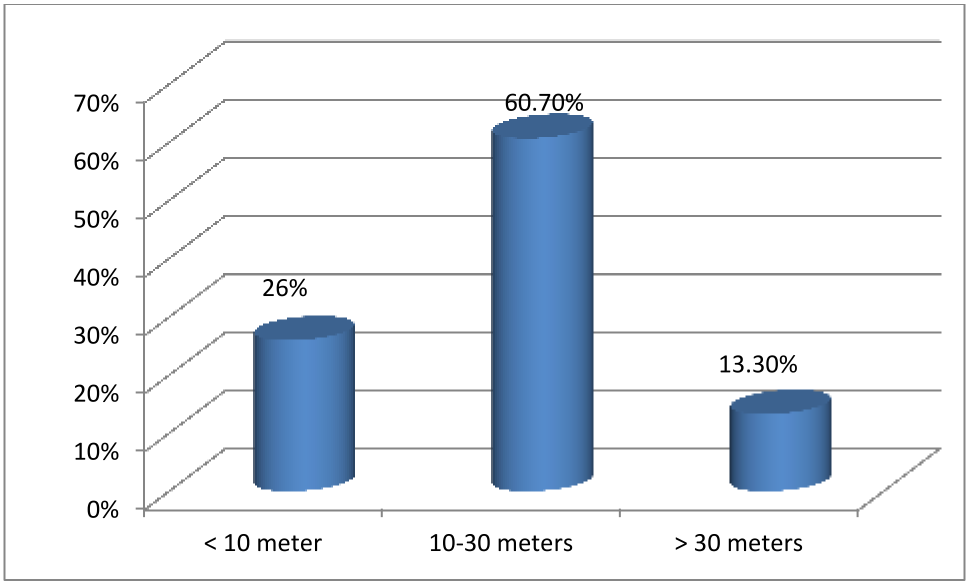

Figure (5) Latrines distance from drinking water site in homes, Jaber area, 2015.

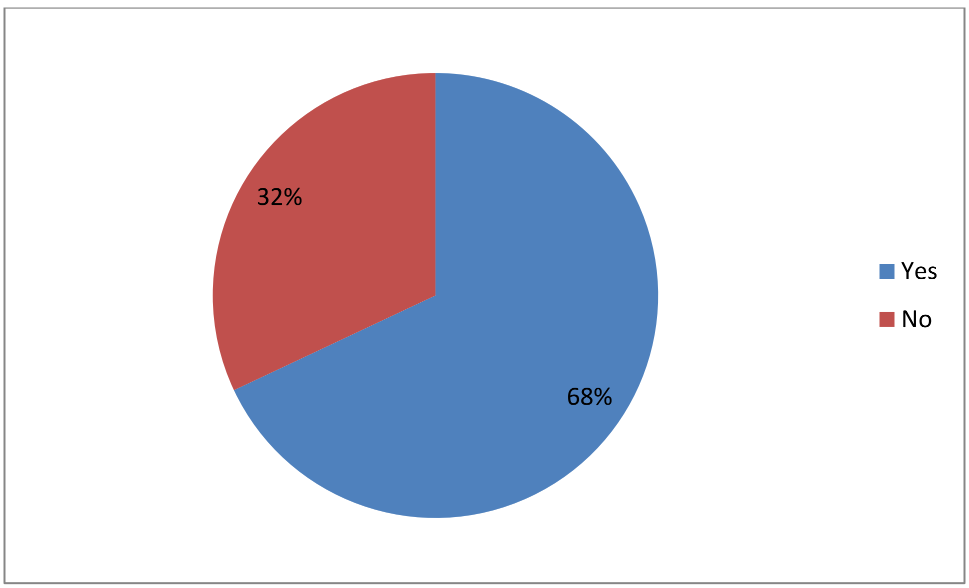

Figure (6): The existence of separate place for drinking water facilities in the households, Jaber area, 2015.

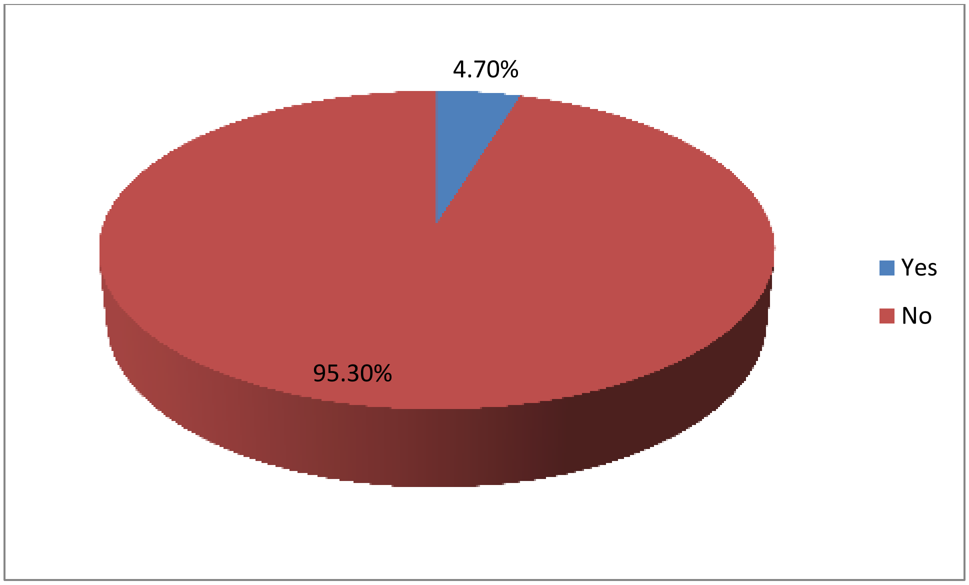

Figure (7): Treatment of water inside households, Jaber area, 2015.

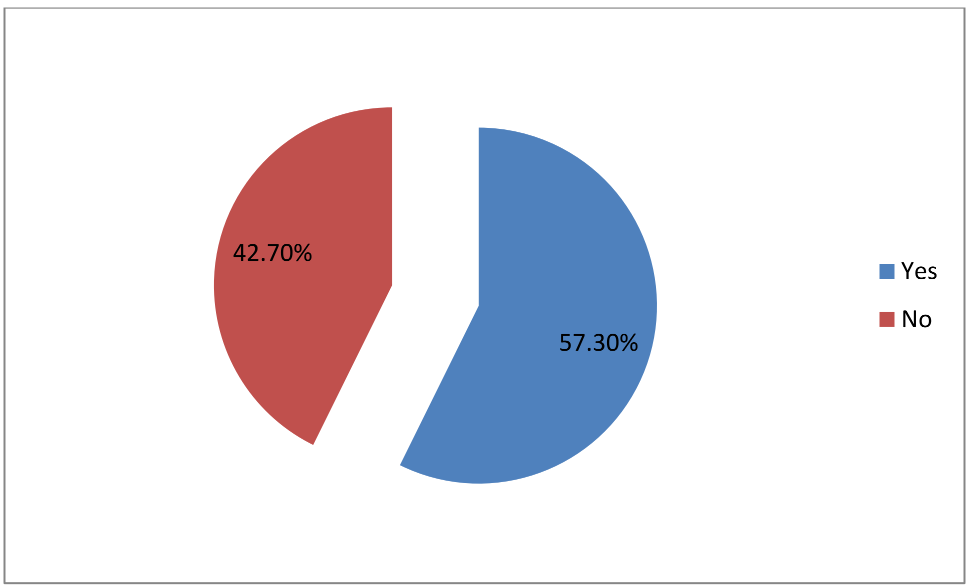

Figure (8) Family members infected with diarrhea, Jaber area,2015.

This study investigated accessibility and availability of water supply among households in in Jaber area east Medani.

The study that pointed out that the size of households member in the study area as (2-4), (5-7) and (>7) person as 14%, 43%, 43% respectively, 86% of households had members more than 5.

With respect to the type of job of the heads of households, 32% were farmers and the same percentage were workers free business followed by traders (10%),

More than three-quarters (83%) of the households had family monthly income of SDG 1000 or less.

The study found the Source of water supply in households in Jaber area, where 85% of households used piped water, 2% bought water from water vendors, and 10% shallow well and 3% from public tap. As the findings indicate, taps from the public net were the most common type of water sources used by households, followed by shallow well, and vendors and public tape in few cases.

This is similar to the SHHS More than three out of four household members in Khartoum State and about two thirds of household members in Northern, River Nile, and Gezira states use drinking water that is piped into their dwelling or into their yard or plot (SHHS) which is in matching with statement of UNICEF which stated Piped systems, especially with household connections, provide greater convenience and are thus preferred by people in most communities.

However, making large quantities of safe water readily accessible to all households is often not easily realizable (UNICEF 1999).

Regarding to improved sources of drinking water, almost all the households (98%) had access to improved sources of drinking water, which was high coverage because of reasonable access to public piped water connections.

This coverage was high as compared With the results of SHHS 2010 , in which national access to improved water is 61 %, national access to urban improved water is 58% and national access to urban piped water is 67%.

Ensuring access to water supply systems can greatly reduce the time women spend collecting water, allowing more time to care for young children and more time for income generating activities (Environmental Health Project 2004).

Regarding to distance of water source from homes, 83% of the households had access to water within a distance of up to 200 meter or less. This similar to the study of A.I. Mohammed, conducted in Ethiopia at Dukem Town where 83.9% of households had access to water within a distance of up to 200 meter or less. (A.I. Mohammed et al. 2010).

Also, all households had access to water within a time of 30 minutes or less.

This was agree with WHO guidelines Determining the proportion of a population with reliable access to drinking water is an important function of a drinking-water surveillance agency. This task can be facilitated by establishing a common definition for reasonable access, appropriate to a local context, which may describe a minimum quantity of water supplies per person per day together with a maximum tolerable distance/time to a source (e.g. 20 litres, and within 1 km/30 minutes, respectively, for basic access).

The result of the study indicated that all of the households had used more than 20 litres per capita per day. The finding was similar to the WHO and UNICEF's Joint Monitoring Programme (JMP) recommendations which describe reasonable access as being 'the availability of at least 20 litres per person per day from a source within one kilometre of the user's dwelling' (WHO and UNICEF 2000).

The study pointed out that Water storage containers in households: 32% of the households use clay pots which known as (zeer) as storage facilities and direct drinking sources, Plastic barrel 34.7% , Metallic barrel 32.6%

Data collectors observed whether the household water container was covered or not. The result showed that most households (80%) had covered their stored water

The study pointed out that Storage containers of drinking water were not clean in 25% which indicate the unsafe water supply. This situation does not agree with the guidelines of provision of safe water to households by UNISCO (If the water is stored, it is extremely important to protect it from contamination. The containers used for storing water should be kept clean and rinsed regularly with boiling water or washed out with a bleach solution (one part liquid bleach to five parts of water). The containers should be provided with a tap and a cover to prevent insects, dust and other possible contaminants from entering).

Also the study explained the relationship between the cleanness of water storage vessels and the educational level of the head of households the relation was statistically significant p values were < 0.05 (0.01).

The study appeared that 83% of Latrines distances from drinking water site in homes were less than 30 meter which may cause pollution of water this did not agree with WHO guidelines which stated the distance between latrines and water sources shall not be less than 30 meter.

The study pointed more than half of households (57%) suffered from diarrhea diseases

The study found 32% of households had no separate place for drinking water storage facilities

about 100% they were treated water inside home s for the water that need home treatment and varied between boiling and usage of ceramic filters.

This is similar to the results of the study conducted by

CONCLUSION

The majority of households had access to an improved source of drinking water within reasonable time and distance.

The handling of water in side households is not hygienic

The study recommended a conduction of awareness creation of households to handle water hygienically

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