Journal of Scientific Research & Reports
3(24): 3080-3095, 2014; Article no. JSRR.2014.24.004
ISSN: 2320–0227

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Quantity and Quality of Water in the Salfit District and the Role of the Salfit Primary Health Care Center in Monitoring and Supervising Drinking Water

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Author's contribution

This work was carried out by author himself. Designed the study, wrote the protocol, and wrote the first draft of the manuscript. Managed the literature searches, analyses of the study performed the spectroscopy analysis and MM managed the experimental process and MA identified the species of plant. Author read and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2014/10626
Editor(s):
(1) Masum A Patwary, Geography and Environmental Science, Begum Rokeya University Rangpur 5400, Bangladesh.
Reviewers:
(1) Pavlina Simeonova, Laboratory of Environmental Physics, Institute of Solid State Physics, Bulgarian Academy of Sciences, Bulgaria.
(2) Vasil Simeonov, Faculty of Chemistry and Pharmacy, University of Sofia, Bulgaria.
Complete Peer review History: http://www.sciencedomain.org/review-history.php?iid=678&id=22&aid=6174

Original Research Article

Received 1st April 2014
Accepted 12th May 2014
Published 22nd September 2014

ABSTRACT

Aims: To determine and give an overview about the bacteriological, physicochemical, quality, and quantity of public drinking water sources in Salfit District, and also to demonstrate the role of Salfit Primary Health Care Center (SPHCC) in monitoring and saving drinking water resources from pollution.
Study Design: Water samples were collected from the main sources (springs, Mekorot)

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and water networks in Salfit District. Additionally, Salfit Primary Health Care Center and Palestinian Water Authority reports were used in this study.
Methodology: During the year of 2013, 346 samples were taken randomly and tested (336 underwent microbial testing and ten samples underwent physiochemical testing). The sample was selected by dividing the Salfit District to four clusters, which are geographically similar. Then, the percentages of polluted water samples with microbial infections were calculated and the physiochemical parameters were assessed according to PSI and WHO standards. The quantity of water available for domestic use was assessed as well the role of the SPHCC in saving water from pollution and infection, different parameters were used.
Results: The percentages of infected drinking water samples in Salfit District were 9.2% with more prevalence in the water networks (8.9 %) and the most infection were with Total Coliform (9.2%). The results show that the physiochemical parameters met the standards of PSI and WHO, Also, the results show that the quantity of water available for domestic use in Salfit District was 2.8 million m3/year, which doesn't meet the demand for water, which is 3.7 million m3/year. The average daily allocation of water in Salfit is 86 liters/capita/day. This average is much below that recommended by the WHO, which is 100 liters/capita/day and finally from the results tables we see that the SPHCC is making great efforts in saving water from pollution and infection.
Conclusion: This study shows that in spite of the small quantity of water available for the community of Salfit District, the quality of the main sources of water meets the standards of PSI and WHO, and is safe for use. The SPHCC has made great efforts to monitor and maintain water quality and quantity to avoid possible associated health risks.

Keywords: Drinking water; water resourses; water quantity; water quality; pollution; wter related disease.

1. INTRODUCTION

Water is a key determinant of health, recognized as an important vector of transmission for many of the most widespread and debilitating diseases that afflict humanity [1-3]. Contaminated water serves as a mechanism to transmit communicable diseases such as diarrhea, cholera, dysentery, typhoid and other bacterial or viral diseases [4-6,2].

WHO estimates that in 2008 diarrheal disease claimed the lives of 2.5 million children under five [7]. This burden is greater than the combined burden of HIV/AIDS and malaria [7]. The most affected are the populations in developing countries [7]. Living in extreme conditions of poverty, normally peri-urban dwellers or rural inhabitants. A total of 58 countries from all continents reported a cumulative total of 589,854 cholera cases in 2011, representing an increase of 85% from 2010 [8].

By the end of 2010, 783 million people still lack access to improved water sources and over 2.5 billion people did not have access to basic sanitation [9]. Among the main problems that are responsible for this situation are: lack of priority given to the sector, lack of financial resources, lack of sustainability of water supply and sanitation services, and poor hygiene behaviors [9].

Water quality is a concept that includes taste, odor, color, appearance, softness, temperature, as well as bacteriological and chemical properties [10] Millions of people are exposed to dangerous levels of biological contaminants and chemical pollutants in their

drinking-water due to inadequate management of urban, industrial or agricultural wastewater [11]. In addition, dangerously high concentrations of chemical hazards, such as arsenic and fluoride, originating from natural sources affect millions and cause conditions such as cancer and fluorosis. Inorganic arsenic is present at high levels in the groundwater of a number of countries, including Argentina, Chile, China, and India (West Bengal) [11]. Where 20 million and 45 million people are at risk of being exposed to arsenic concentrations that are greater than the national standard of 50 µg/L and the WHO guideline value of 10 µg/L respectively [11]. Global driving forces, including climate change, increasing water scarcity [12]. Population growth, demographic changes and urbanization are expected to affect the resilience of water supply and sanitation systems and services [12]. As climate change scenarios become increasingly reliable, existing infrastructure will need to be adapted and planning of new systems and services will need to be updated [12]. Monitoring and sanitary inspection is an on-site inspection of a water supply to identify actual and potential sources of contamination, while the physical structure and operation of system and external environmental factors are also evaluated. This information plays an important role in selecting appropriate remedial actions to improve or protect water supply [13].

In addition to the above-mentioned reasons for the increased demand for water, Palestine has its own geopolitical barriers in access to adequate quantity and quality of water. In Palestine, the ground water is the main sources for Palestinians and provides more than 90% of all water supplies, while 10% is from surface and rain water [14,15]. In the West Bank, the resources of water are especially limited and drinking water is one of the challenges. The insufficient quantity of water available for Palestinians is a chronic problem, because of apolitical issue found in West Bank and Gaza strip describe by practices based on discrimination, deprivation and the exploitation of Palestinian water resources [14]. This is reflected in the flagrant disparity in the quantity of water obtained by the Palestinians and that obtained by the Israelis. The average consumption rate of water by the individual Palestinian in Palestine is 72 liters per day [14,15]. This average is much below that recommended by the WHO, which is 100 liters per individual per day [2]. The average Israeli consumption of water is 300 liters per person per day, which is more than 4 times that of the Palestinians [14]. Furthermore, some Palestinian village communities live on even less than an average of 72 liters per individual per day and in some cases it does not exceed 20 liters per person per day [14], which is only the minimum average recommended by the WHO for responding to emergency situations. Consequently, all these reasons yield a negative impact on the quality of water, making it more susceptible to contamination and more likely to become the source of infectious diseases. For these reasons, the Palestinian Ministry of Health makes a great effort to protect water from pollution thorough permanent supervision and monitoring of the sources of water to prevent transmission disease [9].

In the Salfit District in spite of the importance of the location of Salfit District on the western aquifer basin, which is one of the largest aquifers in the West Bank [14]. And also because of political issues found in the West Bank. Thus, the only resources of water used to supply the inhabitants for different activities are two springs (used to supply only one locality), cistern wells to collect rain water during the winter season, and purchased water (mekorot: water purchased from the Israeli authority) [14]. Despite the existence of these resources, the quantity of water available is not enough for the residents of the Salfit District to use in different activities (drinking, agriculture, industry, etc.). The water network covers all localities in the Salfit District, but 85% of the households in the Salfit District are not connected to a wastewater collection system. They mainly depend on collecting holes to collect the wastewater, which makes the possibility of water contamination high [14].

This study was done to give an overview about the water quantity and quality (physical, chemical and microbiological) in Salfit District, to assess the situation of networks used and the possibility of contamination and infection, and also to show the role and the extensive efforts of the Primary Health Care Center in the Salfit District in maintaining the integrity of the water from contamination and to be safe, especially for household use.

2. MATERIALS AND METHODS

2.1 Study Area

Salfit district is located at 32º 7′ 5.5″ N, 35º 5′ 25″ E Fig. 1, with a total area of almost 202 sq. km. It is one of 17 districts of the Palestinian National Authority, and is located in the northwestern West Bank, bordered by the District of Ramallah and al-Bireh to the south, Nablus to the east, and Qalqilya to the north, as well as Israel to the West. According to the Palestinian Central Bureau of Statistics (PCBS), in 2011, the governorate had a population of 67499 inhabitants, most of who work in agriculture and trade. Economic activity depends on agriculture, where olives, almonds, figs, grapes, and apples are the main crops. It has a hot climate, dry summers and rainy winters, and has the average maximum temperature of 29 degrees Celsius, while the average minimum temperature is 6 degrees Celsius. The average humidity in the region is 62%, which may rise up to 67%. Rainfall is concentrated in the winter and the average rainfall is 660 mm per year. In some years, the rainfall reached 1,000 mm, as reported in 1981.

2.2 Methods

2.2.1 Sample collection

346 water samples were collected during the year of 2013 from the Salfit District by using 250 milliliter sterile bottles for microbial examination, and one liter plastic bottles for physiochemical examination. The samples were placed in refrigerator cooling at 4 degrees Celsius. The district was divided by geographic location into four clusters, as shown in Fig. 2 and Table 2. 336 samples of chlorinated water were collected from these clusters from different resources for microbial tests and ten samples of water were collected for physiochemical analysis, using the WHO standard and manual for water sampling (depending on the number of the population), [16] as shown in Table 1. The chlorinated water samples were collected from the main resources in the Salfit District: springs (12 samples), purchased water (mekorot) (84 samples). Where180 samples were collected randomly from the networks and 60 samples were collected from an artificial cement tank, which is used to distribute water for households and other sectors in the Salfit District.

2.2.2 Water quality and quantity assessment

To assess the water quantity consumed in the Salfit District by different sectors (domestic use, agricultural use, etc.). This study depends on the annual reported data of the Palestinian Water Authority and the Palestinian Central Bureau of Statistics (2012). And also to assess water quality, all samples of collected water were sent to the Central Public Health Laboratory at the Ministry of Health for determination of physicochemical and microbial parameters. The determination of water quality parameters were carried out by standard techniques such as the membrane-filtration method (APHA, AWWA and WEF, 2005) [17]. and important parameters that have an important role in human health were considered

(Palestinian Standard Institute (PSI), 2005 and WHO 2011standards were used in analysis) [16,18]. The main indicators used for microbial testing were Total Coliforms, Fecal Coliforms, Hetrotrophic Plate, Entrococci, Salmonella and Sulfit Reducing Bacteria.

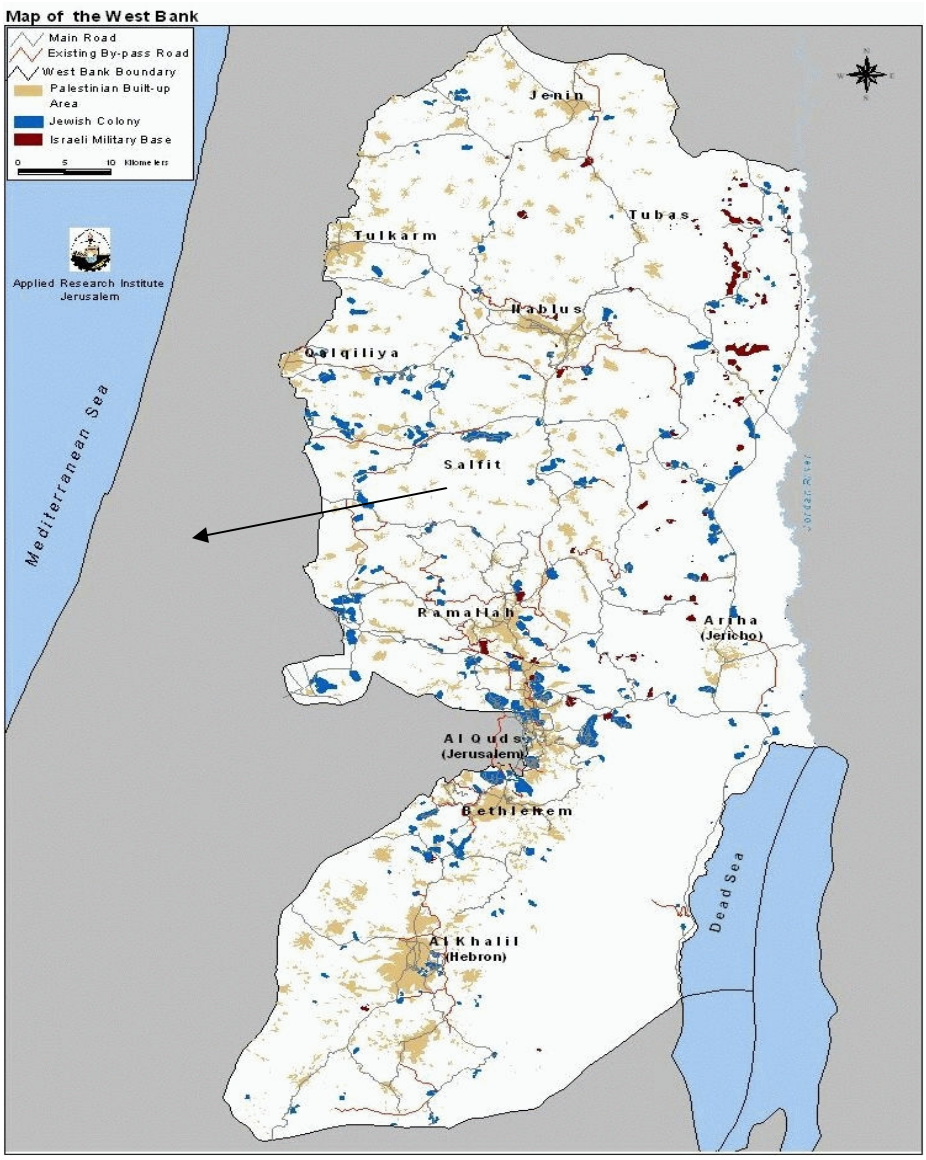

Fig. 1. The location of Salfit district in the west bank (Palestine Central Bureau of Statistics, 2007)

2.2.3 Assessing the role of the salfit primary health care center in saving water from contamination

To demonstrate and assess the role of staff at the SPHCC and their efforts in saving water in the Salfit District, we used this indicator:

1. Laws and regulations that give powers to the Ministry of Health to maintain the safety and quality of water.
2. Number of inspections to water resources to ensure the availability of healthy environmental conditions surrounding the resources.
3. Number of residual chlorine tests recorded for water in networks and in water taps.
4. Number of water samples that were taken from the resources, networks and taps.
5. Health education (number of workshops held and literature developed for the local community and local organizations about water safety).
6. Number of cases reported in the annual report of the Salfit Primary Health Care Center suffering from diseases related to water infections
7. Quantity weight of chlorine tablets distributed to local communities for chlorinated drinking water in cistern well found in houses
8. Average number of awareness posters and brochures distributed to the local community, local organizations and government institutions about the safety and quality of water.

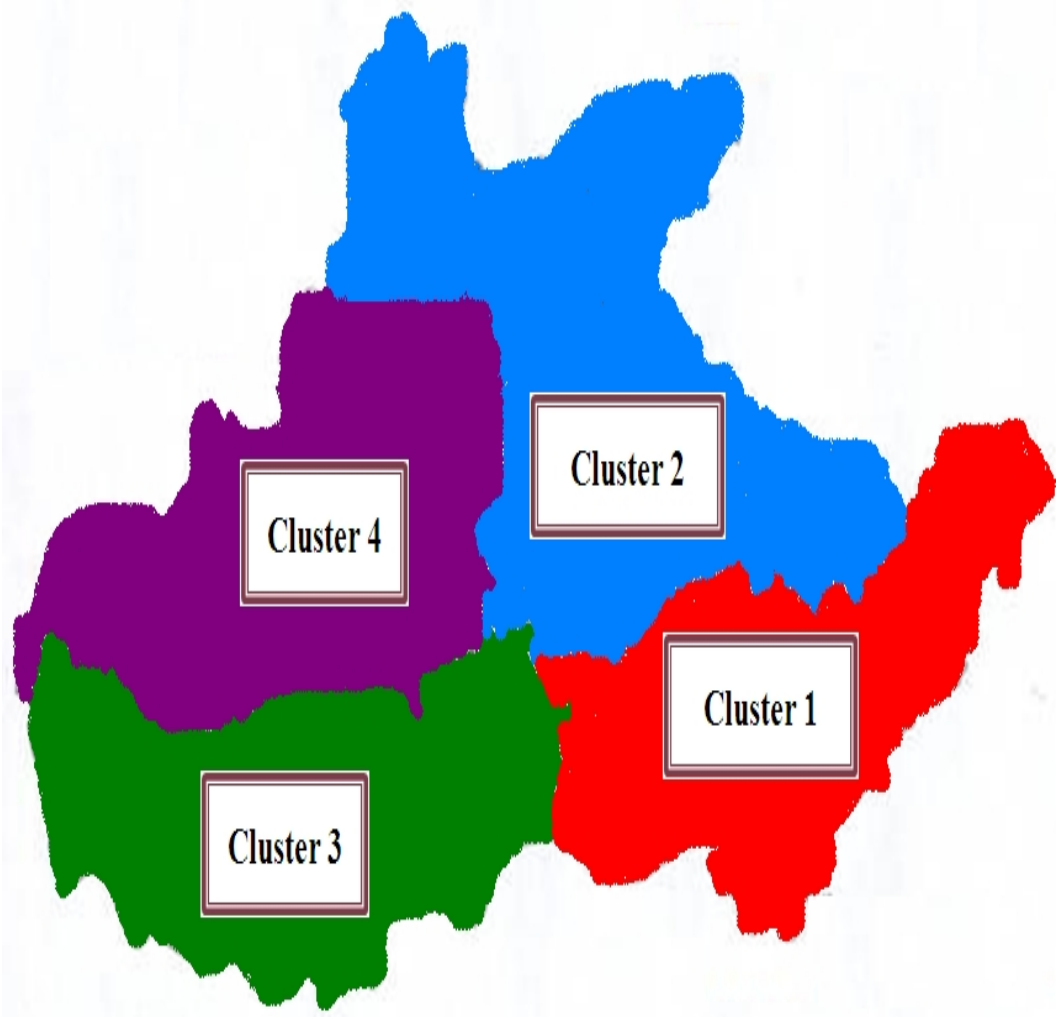

Fig. 2. demonstrate the distribution of clusters at Salfit district

* *(Palestine Central Bureau of statistic, 20012)*

Table 1. Minimum sample numbers for piped drinking water in the distribution system

Population served	No. of monthly samples
<5000	1
5000–100000	1 per 5000 people
>100000	1 per 10000 people, plus 10 additional samples

Table 2. Number of villages per cluster, number of inhabitants and number of water samples were taken from each cluster in salfit district

Cluster Number	Number of villages per cluster	Number of inhabitants	Number of samples taking from springs	Number of samples taking from mekerot	Number of samples taking from network	Number of samples taking from cement Artificial well 300mc	Total Number of samples during the year 2013
1	5	13380	12	12	36	12	72
2	5	14659	0	24	36	12	72
3	4	14896	0	24	36	12	72
4	5	24564	0	24	72	24	120
Total	19	67499	12	84	180	60	336

**MC: meter cubic*

2.2.4 Data management and analysis

Data were entered in SPSS software version 16, and analyzed using simple descriptive statistics, frequencies, main, and percentage and standard deviations.

3. RESULTS

3.1 Water Quantity Available for Use in Salfit District

according to the Palestinian water institute (PWI), 2012 the quantity of water available for only domestic use in the Salfit district were 2.8 MCM per year where as the quantity needed were 3.7 MCM per year and the Daily Allocation were 86 (liter/capita/day) as shown in Table 3.

3.2 Water Quality Assessments

3.2.1 Microbial test

336 chlorinated drinking water samples were taken from different sources in salfit district and tested for the main examination test (Total coliforms, Fecal coliforms, Hetrotrophic plat, Entrococci, Sulfit Reducing and salmonella). The results show that the percentage of contamination was 9.2% and the contamination caused mainly by total Coliform (TC) (9.2%) and fecal Choliform (FC) (4.4%). Also the results show that main contaminations were in water networks (8.9%) as shown in Tables 4 and 5.

Table 3. Water-needed supply and consumed quantities, deficit in domestic supply and daily allocation in Salfit district by 2012

Distric	Population Number	Needed Quantities of Water (million m3)	Water Supply for Domestic Sector(MCM)	Deficit Domestic Supply	Water Consumed for Domestic Sector	Actual Deficit for Domestic Needs	Daily Allocation Per Capita (liter/capita/day
Salfit	67499	3.7	2.8	0.9	2.1	1.6	86

**Unit: million m3/year * MCM: million Cubic Meter*

Table 4. Shows the number of collected samples and percentages of contaminated and non contaminated sample fore the main water recourses in the Salfit district during the year 2013

			Contaminated sample	Non contaminated sample	Total number of collected sample
Source of water	Spring	Count	0	12	12
		% within source of water	.0%	100.0%	100.0%
		% within contaminated sample	.0%	3.9%	3.6%
		% of total	.0%	3.6%	3.6%
	Mekorot	Count	0	84	84
		% within source of water	.0%	100.0%	100.0%
		% within contaminated	.0%	27.5%	25.0%
		% of total	.0%	25.0%	25.0%
	Network	Count	30	150	180
		% within source of water	16.7%	83.3%	100.0%
		% within contaminated	96.8%	49.2%	53.6%
		% of total	8.9%	44.6%	53.6%
	Artificial tank	Count	1	59	60
		% within source of water	1.7%	98.3%	100.0%
		% within contaminated	3.2%	19.3%	17.9%
		% of total	.3%	17.6%	17.9%
Total		Count	31	305	336
		% within source of water	9.2%	90.8%	100.0%
		% within contaminated	100.0%	100.0%	100.0%
		% of total	9.2%	90.8%	100.0%

Table 5. Shows the type of infections and percentage of contaminated drinking water samples in Salfit district during the year 2013

Type of infection	Infection	Number	Valid percent
FC	YES	15	4.5
	NO	321	95.5
	Total	336	100.0
TC	YES	31	9.2
	NO	305	90.8
	Total	336	100.0
HT	NO	336	100.0
ENT	NO	336	100.0
SAL	NO	336	100.0
SULF	NO	336	100.0

**Yes: contaminated * NO: None contaminated; TC: Total Coliforms, FC: Fecal Coliforms, HT: Hetrotrophic Plat, ENT: Entrococci, SULF: Sulfit Reducing and SAI: salmonella*

3.2.2 Chemical test

Ten samples of water were taken from the main resources in the Salfit district and tested for physiochemica parameters included heavy metals. The result show that the physiochemical parameters meet the standards of PSI and WHO as shown in Table 6 [17,18].

3.3 The Role of Salfit Primary Health Care Center in Saving Water from Contamination during the Year 2013

3.3.1 The palestinian laws and regulations give powers to the ministry of health to maintain the safety and quality of water through different articles as shown in public health law NO (20) for the year 2004

The main articles discussed the role of ministry of health in saving water as shown in chapter one article 2, 11, 16: For the purpose of implementing the provisions of this law, and with the coordination with the concerned institutions, the Ministry of Health must perform the regular inspection for drinking water, with respect to its adequacy for human consumption and health supervision over all sewage systems and waste water.

3.3.2 The results show the role of SPHCC staff in saving water from pollution through different indicators as show in Table (7-9)

From the annual report of SPHCC the result shows that the SPHCC staff visiting the water resources for environmental inspection around 30 visiting per month and taking 35 samples per month for microbial and physiochemical test and also recording around 30 reading for free chlorine in drinking water Table 7 and the result show that the Average concentration of residual chlorine in water after distributed from the main resources (spring and artificial tank) were 1.5 (mg/l), Average concentration of residual chlorine in water networks 0.3 (mg/l), average concentration of residual chlorine in tap water0.2 (mg/l). And Average concentration of residual chlorine in Mekorot 0.25 (mg/l) Table 8 and the average number of workshops about water safety per month were10 workshop, Average number of literature per month were 20 literature, Average number of posters distributed were 300 poster, Average number of Brochures were 700 and average Kilo gram of Chlorine tablets distributed were 21kg per month and average Number of Cisterns well chlorinated during the month were 8 Table 9. And finally the results show that the most infected cases were in Intestinal Parasitic diseases 92.2% Table 10.

Table 6. Physiochemical analysis for water resources in salfit district during the year 2013

TEST	Mean±Std. Deviation	UNIT	Test reference	PSI	WHO
Conductivity	858.5±4.9	Micro.S\cm	SMFEWW, 1992		
Fluoride	.17±.01	PPM	SMFEWW, 1992	1.5	1.5
Nitrate in water	49.59±1.17	PPM	SMFEWW, 1992	70	50
PH of water	7.2±.36		SMFEWW, 1992	6.5-8.5	6.5-8.5
Salinity of water	.34±.03	%	SMFEWW, 1992		
Sulfate in water	48.70±1.90	PPM	SMFEWW, 1992	200	250
Total dissolved solid (TDS) in water	545.9±15.5	PPM	SMFEWW, 1992	1000	1000
Total hardness in water	348.4±1.14	PPM	SMFEWW, 1992	500	500
Ammonia in water	.02±.008	PPM	SMFEWW, 1992		1.5
Chloride	57.81±4.51	PPM	SMFEWW, 1992	250	250
Calcium	59.40±2.87	PPM	SMFEWW, 1992	100	
Magnesium	25.4±1.54	PPM	SMFEWW, 1992	100	
Sodium	26.14±.51	PPM	SMFEWW, 1992	200	
Potassium	6.60±.18	PPM	SMFEWW, 1992	10	
Aluminum	4.35±.10	ppb	SMFEWW, 1992	200	
Iron	18.27±.44	Ppb	SMFEWW, 1992	300	
Manganese	.73±.02	ppb	SMFEWW, 1992	100	
Cupper	4.97±.28	ppb	SMFEWW, 1992	1000	2000
Zinc	63.39±2.46	ppb	SMFEWW, 1992	5000	
Barium	29.66±2.51	ppb	SMFEWW, 1992		700
Silver (Ag)	N.D	ppb	SMFEWW, 1992	10	
Total chromium (Cr)	N.D	ppb	SMFEWW, 1992	50	50
Cadmium (Cd)	ND	ppb	SMFEWW, 1992	5	3
Nickel (Ni)	N.D	ppb	SMFEWW, 1992	50	70
Molybdenum (Mo)	N.D	ppb	SMFEWW, 1992		70
Cobalt (Co)	N.D	ppb	SMFEWW, 1992		

**ND: not detected, the result less than LOQ*

Table 7. Average number of visiting to water recourses, average number of water samples tested for residual chlorine and average number of water samples taken for microbial and chemical testing during the year 2013

	Minimum	Maximum	Sum	Mean±Std
Average number of visiting inspection to water recourses per month during the year 2013	10	42	359	29.92±9.94
Average number of drinking water samples tested for residual chlorine per month	20.00	39.00	364.00	30.33±4.92
Average number of drinking water samples taken per month	29.00	44.00	417.00	34.75±4.53

Table 8. Shows average concentration of residual chlorine in water recourses , networks and tap water recorded by the staff of salfit primary health care center during the year of 2103

	Minimum	Maximum	Sum	Mean±Std. deviation
Average concentration of residual chlorine in drinking water resources (spring and artificial tank) (mg/l)	1.00	2.00	17.55	1.46±.28
Average concentration of residual chlorine in water networks (mg/l)	.10	.60	3.45	.28±.20
Average concentration of residual chlorine in tap water (mg/l)	.12	.19	1.79	.14±.02
Average concentration of residual chlorine in mekorot water (mg/l)	.10	.60	3.51	.29±.16

Table 9. Shows average number of workshops, literatures, average number of posters and Brochures distributed, KG of chlorine tablets distributed and average number of cisterns well chlorinated during the year 2013

	Minimum	Maximum	Sum	Mean±Std. deviation
Average number of workshops per month	5.00	15.00	122.00	10.16±3.12
Average number of literature per month	13.00	25.00	239.00	19.91±3.82
Average number of posters	200.00	500.00	3600.00	300±84.31
Average number of Brochures	400.00	900.00	8400.00	700±165.03
Average KG of chlorine tablets distributed	10.00	40.00	250.00	20.83±9.96
Average number of cisterns well chlorinated	5.00	20.00	100.00	8.33±5.77

Table 10. Shows the common water related disease recorded at SPHCS during the year 2013

Disease name	Number of cases	% of infection
1.Typhoid and paratyphoid	0	0
2. Cholera.	0	0
3. Hepatitis A	14	3.29
4. Salmonella	0	0
5. Shigellosis	0	0
6. Food and water poisoning	0	0
7. Chemical poisoning	0	0
8. Malaria	0	0
Total intestinal parasitic diseases	392	92.2
9.1. Ascariasis (round worm)	359	
9.2. Taeniasis	1	
Amebiasis	32	
Toxoplasmosis	0	
Scabies	19	4.47
Total of cases	425	

3.3.3 Number of cases suffering from water-related diseases as recorded at SPHCC during the year 2013

The results show that 425 cases of water related disease were recorded at SPHCC reports and the cases were more prevalence in Intestinal Parasitic diseases (92.2.1%) as shown in Table 10.

4. DISCUSSION

The quantity and quality of water are the main challenges of the world in the future. Inadequate drinking water supply and quality and poor sanitation are among the world's major causes of preventable morbidity and mortality [16,19]. In this research the results show that the quantity of water supply to the community in the Salfit District did not meet the water demand for different sectors, where as the quantity available also didn't meet the demand for domestic use, as shown in Table 3. The same results were found in different studies done around the world, especially in developing countries [20,21]. This study also agrees with many studies done in Palestine that discuss the availability and shortages of drinking water for the community [18,22,23].

The results show that the water quality in the Salfit District (physiochemical parameters) meet the standards of PSI and the WHO standards, as shown in Table 6. These results agree with similar studies done in other localities in the West Bank, which found that the quality of drinking water (physiochemical parameters) meet the standard of PSI and the WHO standards [20-25]. The results show that the percentage of microbial infection for drinking water in the Salfit District was (9.2%), where the infection was mainly with total coliform bacteria. This result agrees with other studies done in neighboring localities [14,24-27]. The results also agree with the results that were recorded in the Salfit Primary Health Care Center annual report for the year 2013 [28].

In the Salfit District the results show that the main contamination was in water networks (8.9%), which may be because of the old age of the networks in some localities, cross

connection, ineffective chlorination, resistance of microbe or a lack of chlorination system in some villages, and depending on the Israeli authority in chlorination of the water which is sold to Palestinian people, as well as mistakes in taking samples maintenance of networks done during collection samples and uncertain operational and environmental conditions. This result agrees with different studies [29-31]. Which discussed the factors causing water pollution in distribution networks.

Water quality and quantity are important aspects in human health, as the majority of infectious diseases that cause morbidity and mortality in populations are water-related. The results show that the communicable disease related to water were recorded in the Salfit Primary Health Care Center, as shown in Table 10. This result agrees with different studies, which found that the quality and quantity of water has significance on the prevalence these diseases. Also, the study showed that the main infected cases were those with Intestinal Parasitic diseases (92.2%). This result is similar to that of many studies [33-37,32], which found that the Intestinal Parasitic disease was the main kind of infection in water-related disease.

In this study, to demonstrate the role of the SPHCC in saving drinking water from pollution, the main issues stipulated and applied by the SPHCC to save water from pollution were discussed in addition to laws and other indicators.

In Palestine, different ministries have laws to protect the quantity and quality of water such as the Ministry of Agriculture [37]. The Palestinian Water Authority [38] the Palestinian Environmental Authority [39] and other local and international organizations concerned with the right of Palestinian people to water. However, despite of the role of these ministries and organizations, the biggest responsibility rests with the Ministry of Health because of its active role in reducing the prevalence of disease and protecting the community from disease infection, according to the Public Health Law No. (20) For the year 2004. Many other articles discuss the role of the Ministry of Health in protection of water, as shown in Chapter One, article numbers 2, 11, and 16. “For the purpose of implementing the provisions of this law, and with the coordination with the concerned institutions, the Ministry of Health must perform the regular inspection for drinking water, with respect to its adequacy for human consumption and health supervision over all sewage systems and waste water.”

Also, from the results we see that the Ministry of Health made great efforts to save drinking water from pollution through different ways such as inspections to water resources, residual chlorine tests of drinking water, collecting water samples for microbial and physiochemical tests, health education, distribution of chlorine tablets to local communities for chlorinated drinking water in cistern wells found in their houses, and the distribution of awareness posters and brochures about the safety of water quantity and quality, and finally, inter-sectoral and intra-sectoral collaboration with other ministries, local and international organization. These indicators play an important role in protecting water quality and quantity and preventing disease and contributing to a healthy community. Different studies discussed the important role of governmental ministries, local and private organizations, and international organizations in monitoring and protecting drinking water from pollution [40,41,42,43]. Which found that the effect of these parameters in protecting water quality and quantity and its roles in protecting the community from serious diseases.

5. CONCLUSION

This study shows that in spite of the small quantity of water available for the community of Salfit District, the quality of the main sources of water meets the standards of PSI and WHO,

and is safe for use. The SPHCC has made great efforts to monitor and maintain water quality and quantity to avoid possible associated health risks.

CONSENT

No consent was needed because this research was done by the author himself.

ETHICAL APPROVAL

The approval was taken from the Salfit primary health care center for the use of the laboratory and all materials needed for the research. Another approval was taken from the volunteer who is incharge of collecting water samples.

ACKNOWLEDGEMENTS

I am grateful to the Director of primary healthcare center in Salfit district Dr. Yasser Buzzia. For his support, comments and encouragement during this work. I also gratefully thank the head of environmental health department Mr. Abed Al –Kareem Bolad and his staff for their efforts. Finally, I am also grateful to my sister for here assistance in analytical statistics.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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