

Asian University for Women

The Impacts of Water Pollution on the Health Situation in Syria

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Abstract:

Introduction: Water is the main source of life, but it can be harmful if it has been used without proper treatment and testing.

Background: The health situation in Syria before the war improved due to improvement in healthcare, but after the war, more water-borne disease arises among the Syrian in the conflict areas.

Methodology: This study was an observational cross-sectional study based on the opinions of experts. It used qualitative techniques for analysis.

Results: testing water samples from four main areas in Syria results and interviews analysis with doctors and health officers.

Discussion: A connection was created between the water testing results with the health situation in the nearby areas.

Conclusion: Concluding the report and giving the recommendation for future research.

Introduction:

The water is one the most important natural resource for living organisms but it can be very harmful to them as well. As water is considered one of the most suitable media for microorganisms to grow, it can cause harm to other organisms that are consuming the water. Also, it is a good dissolver for chemicals and other toxic substances. Water can be polluted by two main types of pollutants that can be dissolved or suspended in water (“Water Pollution Diseases”, 2017). Chemicals can be natural one or man-made chemicals that get into a water body and reaching concentration that can cause health issues to the consumers. The presence of

pollutants in the water can be very dangerous because it may not be obvious to the consumers that the water body is polluted without proper testing (“Water Pollution Diseases”, 2017). Some of the most common chemicals that could get into the water bodies are pesticides, petroleum chemicals, mercury, industrial chemicals and some other organic pollutants (“Water Pollution Diseases”, 2017). The second type of pollutants are the living organisms, some organisms can affect the human health if they consumed water that contains these organisms because it can get into their bodies and create issues in their biological system. Some of the living organisms that can pollute the water are the pathogens which can get into the water body in many ways. These pathogens can be viruses, bacteria, fungi, and intestinal worms. Those microorganisms can live in the water without being noticed by the consumers unless there is water testing (“Water Pollution Diseases”, 2017). Adding to the microorganisms, some kinds of Algae can be toxic and it can grow fast in the water resources due to the nitrates and other organic substances that can be found in the natural water bodies. There are many water-borne diseases that human beings suffer from such as Cholera, It can be caused by the ingestion of water or food contaminated by the bacterium *Vibrio cholera* which in some cases can lead to death. Schistosomiasis is water-growth snail that affects about 250 million individuals in many areas of the developing world and puts at risk about 700 million people in regions where the disease is endemic. There is wide-range of disease that caused by polluted water like Malaria, Dengue fever, etc (Mari et al., 2018). these type of diseases are cannot only be caused by drinking the contaminated water but also it can transfer to humans by eating plants that were watered by polluted water (Mari et al., 2018). Adding to the examples, diarrhea is commonly linked to water-borne diseases, is responsible for the death of about 525,000 children under five every year (out of around 1.7 billion cases globally) (Mari et al., 2018). It is one of the leading causes of death among children in poor

countries. Most of the cases of this disease are connected to unsafe water supply, lack of sanitation and poor hygienic practices (Mari et al., 2018).

During the war, the conflicts and attacks can destroy the water infrastructures in the country which will cause water scarcity and lack of access to safe drinking water. Many citizens in countries that are struggling with wars are suffering from water-related issues because of the destruction of water bodies and cause pollution. According to UNICEF, last year, Yemen had the biggest outbreak of cholera/acute watery diarrhea in the world because of the lack of access to safe drinking water. People who live in the areas which had attacks on their water infrastructure, they started using unsafe water resources, that increased water-borne diseases spread among the Yemenis (Swangin, 2018). Similarly, in Syria, the war started in 2011, and it is still going on. When the attacks started to increase, many infrastructures in the country were destructed due to the attacks and battles. Many of water infrastructures were destroyed, so the people started to use the water of the wells for their daily use, without testing this water, that leads to many diseases in the areas where the war has the severe impacts. The damage of the water supply facilities caused more than lack of access to safe drinking water, but it expanded to cause health issues.

Background:

Before the crisis: Baseline health status:

The health situation in Syria improved throughout the past three decades in term of diseases, healthcare and mortality rate. According to data from the Syrian Ministry of Health mortality dropped from 132 per 1000 live births in 1970 to 17.9 per 1000 in 2009 (Kherallah et al. 2012). The country has an epidemiological transformation from communicable diseases to non-communicable ones in the recent data before the war. Despite the low public investments in

the health sector, the access to health service achieved increased among the rural areas citizens and improvement in the health situation. Even though the capacity of the health system was improved, there was a number of challenges need to be addressed, the uneven distribution of the health care centers among the rural areas and urban one. Also, the increase of private hospitals created more inequality in the health access of the citizens. However, the health campaign and basic health centers distribution in the remote areas helped almost everybody to access basic healthcare (Kherallah et al. 2012). During the war, very few assessments were taken place to assess the health care services at the conflict areas. The report showed an urgent need for health support and facilities in some hospitals. One of the major obstacles that Syria faced during the war and related to health care is the long distance of the availability of hospitals in some areas (Kherallah et al. 2012). Also, the health assessment was limited due to security issues in different parts of the country which created more health issues in Syria. Adding to the war impacts on the people's health, the pollution of the water resources has a massive impact on the health situation in the country after the crisis (Kherallah et al. 2012). The water resources were affected by the conflicts because the attacks damaged the water infrastructure and the water supply networks that connect the households with the water center resource in the conflict areas. In comparing with a neighboring country, that has a similar situation in term of water issues and war, Iraq water situation is not improving. In 2011, UNICEF reported that 20% of the general Iraqi population and 40% of rural citizens did not have access to safe drinking water which affected the health situation in the country (Zolnikov, 2013). The life expectancy rates fell to below 60 years for both men and women due to the widespread communicable and non-communicable diseases. The conflicts of 2003 destroyed 12% of Iraq's hospitals. Collapsed sanitation and water

infrastructure led to an increased in the chances of cholera, dysentery, and typhoid fever (Zolnikov, 2013).

Methodology:

This study was an observational cross-sectional study based on the opinions of experts. It used qualitative techniques for analysis.

In Hospitals

The study sample included Doctors (Males and females) who were working in government hospitals and health units in three different states in Syria (Damascus, Latakia, and Hama). Recruitment was based on the experience and field of specification. Participants were chosen from different specialization like (General (internal) Medicine Gastroenterology, Pulmonology, Dermatology, Obstetrics and Gynecology and specializes in communicable diseases). Participants must have been working in the same area for the last five years and have direct contact with patients. Individuals were given a brief introduction about the research by the researchers and then they were given two sheets one is an informative document about the research and the other is consent form. Due to the type of sample required for such a project, there was no need to consider individuals who do not know how to read or have any special needs.

Interviews were conducted face-to-face by the two researchers each one for around 9-10 minutes; a topic guideline was used to direct the flow of the interview. The structure of the interviews was as follow: participants were asked about the effect of water pollution on spreading communicable diseases in the field of their experience, and then if they are facing those kinds of disease in the area where they were working. If they are, in which time of the year

they have noticed increasing the numbers. Also, participants were asked if they have any information about the background of the patients (where they have come from, level of education and the accommodations level over there). Interviews were conducted using the Arabic language to make the flow of interviews smoother due to Arabic being the mother language of the participants and researchers. Interviews were recorded and transcribed; participants were given the choice to reveal their identity. Field notes were also taken by the researchers.

Informed Consent was obtained before starting the interview.

Water testing

Water samples were collected from four different areas **Hama/** Salamieh Northern Area, **Damascus/** Jaramana, **Damascus/** Mazeh 86 and **Lattakia/** Northern Area. Tap water was collected in special containers and then given to specialist laboratory to be tested for variety of parameters. Physical status of water was tested by finding (PH, electrical conductivity and total dissolved solids), contamination of water was tested for two kinds of germs Escherichia coli and Salmonella.

Households' interviews

After collecting the results of water samples, few members from the same areas, were questioned. Same as the experts, those participants were introduced to the research then an informed consent was obtained. There was no strict condition to choose those household members other than living in the same area for a convincing period of time. Participants were asked by the researchers about sources of their drinking water and their behaviors while dealing with water.

Data collection and analysis were interrelated processes; the analysis was done after finishing collecting the data. Results from three parts of the research were put together and analyzed according to the situation of each area. Tables were formed showing the results of testing water, normal parameters were added to the tables to compare it with the results. Transcripts from the experts were studied to identify diseases mentioned most in a specific location. In the end, results were compared together in order to study the association between water status and communicable diseases' rates. Data collected from household members were used to know how society is reacting to such problems.

Results

Testing water resulted in different variable from the three states studies. Samples collected from Lattakia stated that pH value was (7.47), electric conductivity was (1270 SI) and lastly total dissolved solids were (840 ppm). For Hama state results were as follow pH (7.15), EC was (1200 SI) and TDS was (810). For the one part of Damascus (Jaraman), pH was (7.64), EC was (760 SI) and TDS was (540 ppm), for the second area in Damascus (Mazeh 86), pH was (7.91), EC was (370 SI) and TDS was (240 ppm). Physical state tests were not enough to figure out whether water was valid for human consumption therefor further tests were conducted; Coliform, E. coli and Salmonella tests were applied. Results are shown in table 1.

The Syrian National Standards for safe drinking water should be as the following:

PH = 6.5 _ 9 minimum

EC = 2000 mg/l maximum

TDS = 1200 mg/l maximum

E. coli = 0 maximum

Coliforms = 0 maximum

Salmonella = 0 maximum

	PH	EC	TDS	Coliforms	E. coli	Salmonella
Damascus/ Jaramana	7.64	760	540	125	100	0
Damascus/ Mazeh86	7.91	370	240	200	10	0
Lattakia	7.47	1270	840	150	25	0
Hama/Sala mieh	7.15	1200	810	200	175	0

Table 1. Results of testing water samples from three states in Syria

Interviews with experts and Doctors were conducted face-to-face; records of those interviews were saved and transcribed. After all the interviews were done, transcripts were studied and analyzed. This analysis resulted in finding some common diseases which are spread in a region. (Table 2) presents diseases that were found mostly in each state. However, some of those diseases were spread more than the other. Damascus was one of the states in Syria where they have faced a high rate of Hepatitis type A in addition to few cases of Hepatitis C. According to one of the participants who is director of communicable and infectious diseases department said

“ازدادت حالات التهاب الكبد الوبائي من النوع A في محافظة دمشق وريفها في الفترات السابقة خاصة من المناطق التي شهدت حصارا وكان من الصعب الوصول اليها. اكتشفت حالات عديدة في ملاجئ تلك المناطق وبعد فك الحصار عن هذه المناطق ازداد عدد المسجلين بالتهاب الكبد الوبائي من النوعين (A & C)”

“Number of Hepatitis type A cases increased in Damascus and its surrounding specially from Confiscated areas where it was difficult to reach the people over there. Many cases were coming

shelters near of these areas, and after end of confiscation the number increased even more specially from types (A & C) “

Participants from Damascus (doctors and experts) stated that the number of cases was increasing during summer. Children and elderly people were most affected therefor they had a higher rate of infections. Patients were mostly coming from conflict areas and shelters containing a huge number of refugees.

Lattakia was not much different; there were many cases of Hepatitis A and diarrhea. One more type of bacteria arose in the interviews many times which is the *Helicobacter pylori* which cause ulcers in stomach in addition to stomach cramps. Most of the cases were children coming from rural areas where there was less control of water quality.

Results from Hama confirmed the spread of the same diseases (Hepatitis A, diarrhea, enteritis...). One disease which was increasingly noticed during conflict time was the *Leishmania* which is a skin disease. Diarrhea was also noticed in a high rate specially from dry rural areas during summer where there was shortage of water.

Region	State of Diseases
Damascus	Hepatitis A, bloody diarrhea, diarrhea
Lattakia	<i>Helicobacter pylori</i> , diarrhea, cramps, Hepatitis A
Hama	<i>Leishmania</i> , Hepatitis A, diarrhea, enteritis, allergies, gastroenteritis

Table 2. Common disease in each state

Household members defined their sources of drinking water as one of them said

"نحصل على مياه الشرب من خطوط شبكة المياه الرئيسية لكننا نقوم باضافة اقراص الكلور مما يجعل المياه صالحة للشرب"

"We get our drinking water from the main water network but we add Chlorine tablets which make the water drinkable"

Chlorine tablets were distributed among households by some NGOs working in Syria. For Hama state there was Aga Khan Foundation which distributed the tablets to people of rural and urban areas with brochures and guideline to instruct the people how to purify water from main water network.

Other participants stated that NGOs and the government have built free drinking water units where people are allowed to get clean drinkable water for free.

Discussion:

Comparing water tests results with the National Syrian Standards which allowed us to know what this water can be used for. Results showed that the water samples did not match the National Syrian Standards of water to be safe for human consumption and use. Looking to the results of water samples tests showed a high rate of pollution and presence of E. coli. This made water not drinkable and not valid to animals' use as well. Due to that, the rate of communicable diseases caused and transmitted by water is expected to be high but interviews with doctors and experts reflected a reverse picture. Although there were increase in the number of cases comparing to the previous years when there was any conflict and water shortage, but prevalence of diseases was relatively low and under control. This can be referred to the corroboration of NGOs and government in spreading awareness and providing drinking water to the people.

However, in Damascus there were few places under Confiscation and NGOs where not able to access these regions therefor, people were not able to get secure drinking water. This is reflected

in the results; numbers of hepatitis type A and diarrhea rose noting to an outbreak event. Government and NGOs played a basic role in making the effects of water pollution less on the population. During the last few years, Syrians used to dig wells due to the shortage of water, those wells are not purely valid for human consumption but people were not able to afford buying water which is valid for human uses. This issue arose mostly in villages and countryside for that NGOs with collaboration with government have provided safe drinking water for everyone by building special units for water. Those units are regularly checked and ensured to maintain minimum standards.

Also, NGOs worked on distributing chlorine tablets which should be placed in water storage unit in each house. They have provided instructions and they gave brochures on the way those tablets must be used. However, In Hama, while visiting local health points there were many people with allergic symptoms. According to participants, people were concerned so much about the safety of their water, for that they have ignored the instructions of how to use chlorine tablets. People were adding an extra dose to their water thinking that it will help them purify it but the high concentration of chlorine in water caused allergy and scratches in their respiratory system.

In this research, the researchers faced some of the limitations during the project conduction period. To address the main challenges and limitations, firstly, the areas of conducting the project were not totally safe, due to the ongoing conflicts in different cities in Syria. So they were not able to go to all the water resources to collect the samples themselves, they had to contact some of the local people in that area to collect the water samples for the researchers. Some of the samples may not be taken by the best methods from water resources due to lack of skilled people who collected the samples on behalf of the researchers. Also, when

interviews were taking place with the doctors, there were some biased answers because some doctors were scared to relieve the real cases they had during their working period in the hospitals. They were scared of being questioned for penalties if they gave more information. Adding to the limitations, the testing of the samples was done in a laboratory, but the researchers were not allowed to see the process of testing but to wait to receive the results later on. Moreover, during the interviews, the doctors and the health offices were not allowed to give any statistics and exact numbers to the questioners as they did not have permission from the Syrian Health Ministry to access such information. So the information that was received were qualitative not quantitative. Adding to that, there is lack of online researches in this area of study in Syria, so there were lack of knowledge and support from the literature review part of this research.

Conclusion:

The war in Syria affected people's lives extremely in different scales such as health, facilities, education, economy and mentally. By focusing on health impacts, the war caused an increase of waterborne diseases due to the destruction of water facilities. The frequent attacks affected the water infrastructure and damaged the water supply system, which caused a lack of access to safe drinking water. Especially in the remote areas, when the water infrastructures destructed, people had to search for alternatives for their survival. They started to dig wells to use the underground water, however, because of the lack of awareness among the public, some of these water resources cannot be used directly for human consumption without any treatment. The use of such water resources caused some waterborne diseases to the consumers and it differs from one area to another according to the health care and the amount of damage in water infrastructures. This research aimed to study the connection between the use of polluted drinking

water and the rate of communicable diseases in that area. The research covered four main areas for testing water samples and clarifying the hospital cases that caused by drinking water from unsafe sources. For future researches, the research should be done in a better and more efficient way by getting permission for Syrian Health Ministry so the researchers can access the exact information if the health issues in the country. Also, the water samples testing could be collected from all the cities and in a different part of each city to picture the whole situation in the country and create a better understanding of the impact of water pollution on health situation.

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