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Investigation of parasitic contamination in Kufa river water-Al-Najaf province

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Abstract

This study was carried out to estimate the prevalence and potential for human infectivity of parasites in Kufa river. Samples were collected from three stations across Kufa river from July (2012) to February (2013) at approximately half monthly intervals.

The first two stations represent the location of the most frequent sources for water pollution: Station where sewage and drainage water have discharged and station of slaughterhouse where the animal's residues shed to water. The third station was the place where Najaf city supply with water Liquefaction of water.

There was a trend to higher concentration and more frequent incidence of parasites in the spring and fall, but positive samples were found in all seasons. Distribution of parasitic contamination in station one, determining the incidence and prevalence of human enteric protozoan parasites such as *Giardia lamblia*, *Cryptosporidium parvum* , *Entamoeba coli*, *Entamoeba histolytica* , *Balantidium coli*, in different parasitic contaminated samples will provide baseline data against the risk factors associated with waterborne pathogenic protozoa transmission.

In the second station worms are the most common distributed parasites which transmitted via water to humans, such as *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Trichuris trichura*, and *Taenia saginata*, and *Fasiola hepatica* while the third station were also positive but for protozoa (*Giardia lamblia*, *Entamoeba coli*, *Entamoeba histolytica* and *Cryptosporidum parvum*). These are water transmitted protozoa.

Introduction

Water pollution is the contamination of water (lakes, rivers, oceans and groundwater). Water pollution occurs when pollutants are discharged directly or indirectly into water without adequate treatment to remove harmful compounds [1].

Water contamination affects plants and animals (living in these water or that depend on it); and, in almost all cases the effect is damaging not only to individual species and populations, but also to the natural biological communities [2].

In developing countries, waterborne gastrointestinal parasite pathogens such as *Cryptosporidium parvum*, *Giardia lamblia*, and *Entamoeba histolytica* are frequently associated with morbidity, particularly in children. These parasites are the most common cause of infection worldwide [3,4,5]. In developed nations, outbreaks of E. histolytica infections have been caused by sewage contaminated water supplies [6]. In Iraq , the prevalence of *E. histolytica* is lower than that of giardiasis, and the prevalence of cryptosporidiosis is low in humans[7]. Waterborne diseases are caused by pathogenic microorganisms which are directly transmitted when contaminated fresh water has consumed. Contaminated fresh water, used in the preparation of food, can be the source of food borne disease through consumption of the same microorganisms. According to the WHO 2010 , diarrheal disease accounts for an estimated 4.1% of the total daily global burden of disease and is responsible for the deaths of 1.8 million people every year. It was estimated that 88% of that burden had attributable to unsafe water supply, sanitation and hygiene and are mostly concentrated in children in developing countries. [1,8,9].

Epidemiological studies of waterborne outbreaks have indicated that the most important waterborne pathogens are enteric parasites, such as *Giardia lamblia*. and *Cryptosporidium parvum*. They have not been reported to cause waterborne epidemics in Finland according to the National Infection Register and Iraq currently only has proper wastewater treatment facilities for urban areas, typically only for the provincial capitals. Even in the serviced provincial capitals, a significant percentage of the population does not have their waste sent to a treatment plant; rather, it is piped directly into a waterway, or into predetermined dumping areas. Rural areas are almost without exception not linked to sewage treatment plants. For example, in Najaf, an estimated 45% of the inhabitants of Kufa City are linked to a network that sends their waste to a treatment plant, while less than 2% of people outside of Najaf City have their waste processed. [10,11,19], but these parasites are well recognized as organisms that are able to cause severe waterborne enteric infections

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even at small doses, especially in immunocompromised persons [8,9,10,11,17]. Some data on the occurrence in Arbel of *Giardia lamblia*. and *Cryptosporidium parvum*. in surface waters are available [11,19].

Because of high level of parasites in water and lack of study about water pollution with parasites, our study aim to investigate simultaneously the occurrence of various pathogenic parasites belonging to different parasites groups in Kufa river.

MATERIALS AND METHODS

Sample collection:

Samples were collected from 3 stations across Kufa river from July 2010 to February 2011 at approximately half monthly intervals. These stations were not chosen randomly; rather, they were selected on the basis of their location, the first two stations represent the location of the most frequent sources for water pollution :

1. Station where sewage and drainage water have discharged
2. Station of slaughterhouse where the animal's residues shed to water
3. The third station was the place where Najaf city supply from liquefaction of water.

water samples from three spots in every the three station:

1. One spot in one side of the river water station.
2. One spot in another side of the river water station.
3. One spot in the middle of the river water station.

water samples from two different depths in each last spot:

1. Sample from the surface.
2. Sample from 2 meters deeply.

Microscopic organisms:

One liter of water sample was filter through a 0.45 μm cellulose membrane. the substrate remaining on the filter was concentrated in 10 ml distilled water .A drop of about 1 μl of such concentrate substrate was observed under microscope different magnifications (4x, 10x, 40x, 100 x (Oil lenses). During observations, living and parasite eggs identified and their pictures taken[12].

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RESULT:

Contamination rate by pathogenic of parasite in water :

Different types of parasites were separated by pathogenic or non-pathogenic of parasites are showed in Fig. 1.

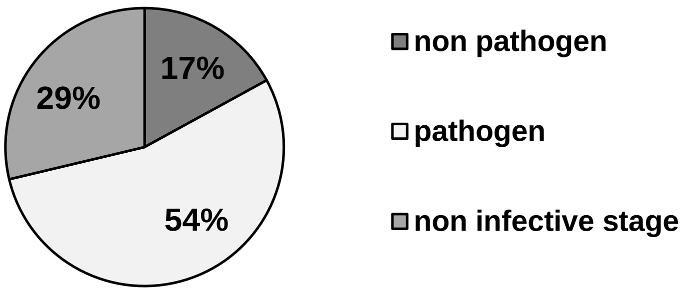

Fig1. Contamination rate by pathogenic of parasite in water.

Diversity of water parasitic contamination according to type:

Situation where sewage and drainage water have discharged.

Table 1: Distribution of parasitic contamination in situation one.

Parasite types	Stage	Surface	Deep 2 meter
Entamoeba coli	Cyst	+	+
Entamoeba histolytica	Cyst	+	+
Gairdia lamblia	Cyst	+	-
Balantidium coli	Cyst	+	-
Cryptosporidium parvum	Oocyst	+	-
Enterobius vermicularis	Egg	+	-
Ascaris lumbricoides	Egg	+	-
Trichuris trichiura	Egg	+	-
Taenia saginata	Egg	-	-
Fasiola hepatica	Egg	-	-
Ancylostoma duodenale	Egg	+	-

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Situation of slaughterhouse where the animals residues shed to water.

Table 2: Distribution of parasitic contamination in situation two.

Parasite types	Stage	Surface	Deep 2 meter
Entamoeba coli	Cyst	_	_
Entamoeba histolytica	Cyst	_	_
Gairdia lamblia	Cyst	_	_
Balantidium coli	Cyst	_	_
Cryptosporidium parvum	Oocyst	+	_
Enterobius vermicularis	Egg	+	_
Ascaris lumbricoides	Egg	+	_
Trichuris trichiura	Egg	+	_
Taenia saginata	Egg	+	_
Fasiola hepatica	Egg	+	_
Ancylostoma duodenale	Egg	_	_

The third Situation was the place where Najaf city supply with water from Liquefaction of water.

Table 3: Distribution of parasitic contamination in situation three.

Parasite types	Stage	Surface	Deep 2 meter
Entamoeba coli	Cyst	+	+
Entamoeba histolytica	Cyst	+	+
Gairdia lamblia	Cyst	+	_
Balantidium coli	Cyst	+	+
Cryptosporidium parvum	Oocyst	+	+

Enterobius vermicularis	Egg	+	_
Ascaris lumbricoides	Egg	+	_
Trichuris trichiura	Egg	+	_
Taenia saginata	Egg	_	_
Fasiola hepatica	Egg	_	_
Ancylostoma duodenale	Egg	+	_

DISCUSSION:

There is a direct relation between the prevalence of some parasitic diseases and the presence of those etiologic agents in water.

Our results clearly indicate that the number and viability of parasites are the factors determining the probability of infection with some isolates in water.The contamination rate in drinking water was very high in all three locations and in all spots (from both sides and middle) that indicated to the following:

1. There is high environmental contamination in Kufa river .
2. There are free-living stages of waterborne pathogenic parasites.
3. Free intermediate hosts.
4. Found the parasite maturation infection.

There was a trend to higher concentration and more frequent incidence of parasites in the spring and fall, but positive samples were found in all seasons.

A. **Distribution of parasitic contamination in station one:**

In this station the sewage and drainage water have discharged, determining the incidence and prevalence of human enteric protozoan parasites such as *Giardia*, *Cryptosporidium*, *Entamoeba coli*, *Entamoeba histolytica* ,*Balantidium* and etc., in different parasitic contaminated samples will provide baseline data against the risk factors associated with waterborne pathogenic protozoa transmission can be identified Infective stages can be passed through fecal matter, reaching the human host by direct consumption or by use of contaminated water [3,15,19,17,23].

Iraq currently only has proper wastewater treatment facilities for urban areas, typically only for the provincial capitals. Even in the serviced provincial capitals, a significant percentage of the population does not have their waste sent to a treatment plant; rather, it is piped directly into a waterway, or into predetermined dumping areas. Rural areas are almost without exception not linked to sewage treatment plants. For example, in Najaf, an estimated 45% of the inhabitants of Kufa City are linked to a network that sends their waste to a treatment plant, while less than 2% of people outside of Najaf City have their waste processed[5,8,17,21].

B. **Distribution of parasitic contamination in station two:**

This is the station of slaughterhouse where the animals residues shed to water, because of that the intensity of transmission of zoonotic infections or diseases from animals to humans are very common.

The environment-contaminating zoonotic or parasite stages depend on the abundance of infected animals, the number of transmission stages, agricultural practices, host status and habits, etc .[1,28].

Therefore worms are the most common parasites transmitted via water to humans, such as *Ascaris lumbricoides*, hookworm, *Trichuris trichura*, *Fasiola* and *Tenia*. These parasite population, which in turn helps in environmental contamination, distribute in animal hosts that not treated with antiparasitic drugs. zoonotic parasitic diseases such as teniasis fascioliasis, ascarisasis and trichurisasis play a major role in human and animal health in the region. Other finding of this study is about life cycle of these parasites. It seems that the main host of *F. hepatica* in Najaf city is cattle and other animals such as sheep and goat are rarely infected with this parasite. This may be due to resistance of sheep and goat to *F. hepatica*. Prevalence of teniasis, fasciolosis and ascarisasis in Iraq and Iran, respectively [28]. Incidences of 34 (0.07%), 318 (8.97%), 23 (0.14%) and 4 (0.03%) were found for cattle, camel, sheep and goats for ascarisasis, respectively, in Iran [29].9% infection of *F. hepatica* was reported for animals slaughtered in Yasuj industrial abattoir . [14,17,30]. Some data on the occurrence in Arbel of *Giardia lamblia*. and *Cryptosporidium parvum*. in surface waters are available [15,23].

C. **Distribution of parasitic contamination in station three**:

The third Station was the place where Najaf city supplies with water from Liquefaction of water drinking water samples in these areas were also positive (contaminated) especially for protozoa (*Giardia*, *Entamoeba coli*, *Entamoeba histolytica* and *Cryptosporidum*). These are water transmitted protozoa [21,23].

we results proved that these particular parasites are not destroyed by routine doses of chlorine in drinking water; hence, epidemics may occur [22,23,24]. Iraq's water treatment plants largely extract water from the Tigris and Euphrates Rivers, and their various tributaries. Indeed, one of the problems currently facing Iraq is its relative lack of urban reservoirs[22].

In contrast to other waterborne pathogens, such as *G. lamblia*, the occurence of cryptosporidiosis is unknown in many parts of the world, However, the mean prevalence rate of *Cryptosporidium* infection is between 1 and 3% in Europe and North America and 5% in Asia [25]. Moreover, some parasites such as *C. parvum*, *Giardia* and *Entamoeba* have been identified as significant waterborne pathogens and have been found responsible for several serious outbreaks worldwide over the past ten years [26,27,28].This study was the first to investigate waterborne protozoan parasites and helminthic in Kufa river water-Al-Najaf province in Iraq.

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التحري عن التلوث الطفيلي في مياه نهر الكوفة في محافظة النجف

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كلية العلوم /جامعة الكوفة

الخلاصة

أجريت هذه الدراسة لتقدير معدل انتشار واحتمالات العدوى البشرية من الطفيليات في نهر الكوفة .تم جمع عينات من ثلاث محطات في نهر الكوفة من تموز (2012) إلى شباط (2013) على فترات نصف شهرية. تمثل المحطتان الاوليتان المواقع الأكثر شيوعا لتلوث المياه : محطة تفريغ الصرف الصحي (مياه المجاري) ومحطة مياه مجزرة الكوفة اذ تسلط مخلفات الحيوان الى مياه النهر.

كانت المحطة الثالثة مكان إمدادات مدينة النجف بالمياه و هي اسالة ماء الكوفة. كان هناك توقع بان حدوث اعلى تركيز للطفيليات في الربيع و الخريف، ولكن تم العثور على العينات موجبة في جميع المواسم .

وجد ان المحطة الاولى كانت ملوثه بالابتدائيات الطفيلية المعوية التي تتنقل عن طريق المياه وهي الجاردية اللامبيلية *Giardia lamblia* و طفيلي الخبيئات المعوية

*Cryptosporidium parvum*و الاميبا القولنية*Entamoeba coli* و الاميبا الحالة للنسيج *Entamoeba histolytica*و القربيات المعوية *Balantidium coli*.

في المحطة الثانية هي الأكثر شيوعا في تواجد الديدان التي تنتقل عن طريق توزيع المياه ، مثل الصفر الخراطيني*Ascaris lumbricoides*، الدوده الشصية*Ancylostoma duodenale* ، الدوده السوطية *Trichuris trichura* ، والدوده الشريطة البقرية *Taenia saginata* و دودة حلزون كبد الاغنام *Fasiola hepatica* ، في حين أن المحطة الثالثة اعطت نتائج موجبة (ملوثة) ولكن للابتدائيات الطفيلية (الجاردية اللامبيلية *Giardia lamblia* ، الاميبا القولنية *Entamoeba coli* ، الاميبا الحالة للنسيج *Entamoeba histolytica*و طفيلي الخبيئات المعوية*Cryptosporidium parvum*) . كل هذه الابتدائيات الطفيلية تكون المنقولة من خلال المياه.