Investigate of contamination of some wells with infectious stages of intestinal parasites in Saladdin - Iraq

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Abstract. The study investigated the pollution of water of some wells with infectious stages of intestinal parasites. Eleven water wells were examined. The results of the microscopic examination of water samples were cysts of Entamoeba histolytica and Entamoeba coli and Toxocara canis and mature and immature eggs of Ascaris lumbricoides at different rates, as the results showed that the highest rate of E. histolytica is in the well number 10, which amounted cyst to 0.23 followed by cyst of E. coli in well No. 5, 0.11 and A. lumbricoides in wells 10 and 11 With 0.12 and 0.07 respectively, followed by I. canis eggs in both wells 9 and 2, 0.13 and 0.06 respectively, as well as physical and chemical tests of well-studied water. In this study, for the first time, the diagnosis of intestinal parasitic stages of infection in water wells, specifically in the province of Salah al-Din.

Key words: well water, contamination, intestinal parasitic, stages, physical test, chemical test.

Introduction

Water pollution is the change in the physical, chemical, and biological parameters of water which makes it unsuitable for drinking and domestic uses [1].

Water is obtained from two sources: surface water, including rivers, lakes, valleys, melting of snow, groundwater, and wells. Natural groundwater is considered to be uncontaminated, especially from biological causes, but may be contaminated for several reasons. And the lack of attention to the isolation of abandoned wells as well as the use of incorrect methods to get rid of all the waste and sewage and industrial and agricultural and animal products by soles them in the ground as well as the drilling of some wells near the sewer or the course of torrents, floods or health service and institutions [2].

Live pathogens, such as microorganisms and parasites, can reach water through human and animal wastes, leading to pollution and the consumption of dissolved oxygen in water[1]. The most important parasitic diseases transmitted by polluted water are amoebic dysentery, gastroenteritis and other infections, and parasitic pathogens transmitted by water according to [3, 4] are:

1 - Entamoeba histolytica: live in the large intestine and attack wall of intestines to feed on mucous membranes and subcutaneous and red blood cells to cause ulcers, which is known as amoebic
dysentery Amebe and may be borne by urinary vein to liver and other parts of body, symptoms of diarrhea and blood in the abdomen and loss Appetite, vomiting and mild fever.

2 - *Giardia lamblia*: Infects small intestine of humans and causes irritation of mucous membranes, which leads to increased secretion of mucus, and moving in communities that use surface water contaminated with human or animal faeces, symptoms of fatty diarrhea with high fever and arthritis in adults.

3- Worms or it's eggs: for examples

A) Bilharzia worms (*Schistosoma*): that live in mesenteric blood vessels of large intestine, or mesenteric veins of urinary system (bladder) of the host by type of these worms and transmitted to infect liver, lungs, spleen and heart, its symptoms: headache, loss of appetite and diarrhea with bloody blood Urinary tract infection) and a decrease in heart rate.

B - *Ascaris* worms: infects the intestines and feeds on digested food and put thousands of eggs a day "and symptoms of infection: abdominal pain, diarrhea, vomiting, anemia, nervousness and lethargy.

The current research aims to investigate the contamination and spread of pathogens intestinal parasites and their infectious pathways in water of some wells in Saladin Governorate.

**Materials and methods:**

1. Collect water samples: Water samples were collected from eleven wells from different areas of Salah al-Din governorate, including the Tikrit city and Dujail for January 2017, and 100 ml of water per well. The samples were placed in sterile plastic containers and brought directly to the laboratory after temperature and pH were measured simultaneously.

2. Conducting biological, physical and chemical tests:

2.1. Investigation of parasitic stages:
100 ml of water samples wells were taken with three replicates, and the Flotation Technique was used by [5], to investigate parasitic phases in well water. The parasites were then stained with Lugol, s Iodine [6] Ziehl-Neelsen stain to investigate of *Cryptosporidium*, and the parasitic stages of the study were examined and identified using a description [7].

2.2 Physical and chemical tests of water wells:
Some physical and chemical tests of water wells were carried out directly from the well and laboratory after being brought to the laboratory:

A – Measuring of water temperature:
Water temperature was measured immediately.

B- Electrical conductivity (E.C.): The electrical conductivity of water was measured using the Lovibond E.C meter.

C- PH measurement:
The pH of the samples was measured using a PH meter.

D- Salinity measurement:
Salinity was measured based on the electrical conductivity values of the models according to the method [8]. The results were expressed in mg / liter as in the following equation:

\[
\text{Salinity (gm/L)} = \left(\frac{\text{the electrical conductivity value of microcemince / cm- 14.78}}{1589.08}\right)
\]

E - Chloride Measurement (Cl):
Chloride is measured according to the ASTM method [9].

F-Phosphate PO₄: Active phosphate was measured using [10].

G- Measuring sulphates SO₄: Sulfate ions were estimated in a gravimetric method. Described in[11].

H- Measurement of Nitrates NO₃: The endol method was used to estimate nitrate level in water [12].

I - Measurement of sodium ion Na⁺:
The Flam Emission photometric method, described in [11].
J-Measurement of potassium ion $K^{+2}$: The Flame Emission photometric method, described in [11]

| No. of well | Location | Depth (m) | Drilling method | Age (year) | Distance from the Tigris River (m) | Diameter of well pump nozzle (inch) | Diameter of well tube (inch) | Uses |
|-------------|-----------|-----------|-----------------|------------|-----------------------------------|-----------------------------------|-------------------------------|------|
| 1           | Tikrit City inside Tikrit University | 110       | Mechanical      | 10         | 472                               | 4                                 | 8                             | Watering gardens and washing buildings |
| 2           | Tikrit City, Al-Fursan District, | 100       | Mechanical      | 13         | 3011                              | 3                                 | 8                             | Watering gardens and washing buildings |
| 3           | Tikrit City, Al-Qadissya Park     | 120       | Mechanical      | 5          | 2111                              | 4                                 | 8                             | Watering gardens and washing buildings |
| 4           | Tikrit City, Al-Qadissya playground | 90       | Mechanical      | 6          | 668                               | 3                                 | 8                             | Watering gardens and washing buildings |
| 5           | City of Tikrit, Department of wells, behind the industrial district | 96       | Mechanical      | 12         | 1655                              | 3                                 | 8                             | Watering gardens and washing buildings |
| 6           | City of Tikrit, City Center       | 120       | Mechanical      | 4          | 521                               | 4                                 | 8                             | Watering gardens and washing buildings |
| 7           | Tikrit City, Al-Zahour District, Second Flower Park | 120       | Mechanical      | 17         | 2361                              | 4                                 | 8                             | Watering gardens and washing buildings |
| 8           | Tikrit City, Shishin Park         | 110       | Mechanical      | 5          | 1871                              | 4                                 | 8                             | Watering gardens and washing buildings |
| 9           | District of Dujail, neighborhood Assembly | 18       | Mechanical      | 10         | 2100                              | 4                                 | 8                             | Watering gardens and washing buildings |
| 10          | Dujail district, modern district   | 22        | Mechanical      | 5          | 1750                              | 5                                 | 8                             | Watering gardens and washing buildings |
| 11          | Dujail district, Al Hussein neighborhood | 25       | Mechanical      | 9          | 1700                              | 4                                 | 8                             | Watering gardens and washing buildings |
Results and discussion:

The results of microscopic examination of water wells samples contained mature and immature and eggs for some parasites at different rates, as in tables 2 and 3, where was diagnosed with *Entamoeba histolytica* in well 10 as shown in (Fig.1) and *Entamoeba coli* in well 5 as shown in (Fig.2), as well as diagnosis of *Toxocara canis* in 2 and 9 wells as shown in (Fig. 3) and diagnosis of mature and immature egg of *Ascaris lumbricoides* in wells 10 and 11 as in (Figs. 4 , 5).

Figure (1): cyst of *Entamoeba histolytica* Lugal Iodein 100x

Figure (2): cyst of *Entamoeba coli* Lugal Iodein 100x
Figure (3): ovum of *Toxocara canis* (Lugal Iodein 100x)

Figure (4): mature ovum of *Ascaris lumbricoides* (Lugal Iodein 100x)
The diagnosis of protozoa cysts and intestinal helminth eggs in the wells water was due to contamination with sewage or human and animal wastes near the studied wells and the fact that these parasitic stages are resistant to temperature [5 and 3]. Insecticides may play an important role in the transmission of infectious parasitic infections, as their propagation in spring and winter contributes to mechanical transport of these stages and to long distances, thus increasing pollution rates.

**Table 2:** The relationship between the average number of Cystes and Eggs of the parasites and some physical and chemical characteristics of well water under study.

| No. of Well | Average of Cystes & Eggs | Temp. °C | pH  | E.C. µS/cm | Salinity ppm | Cl ppm | PO₄ ppm | NO₃ ppm | SO₄ ppm | Na⁺⁺ ppm | K⁺⁺ ppm |
|-------------|--------------------------|----------|-----|------------|--------------|--------|---------|---------|---------|----------|---------|
| 1           | 0                        | 23       | 7.49 | 2800       | 1.75         | 23.50  | 0.07    | 2.29    | 407     | 95.4     | 4.5     |
| 2           | 2                        | 21       | 7.45 | 2940       | 1.84         | 35.72  | 0.09    | 1.74    | 239     | 201.6    | 3.6     |
| 3           | 0                        | 21       | 7.50 | 2830       | 1.58         | 27.26  | 0.10    | 7.90    | 338     | 105.3    | 2.7     |
| 4           | 0                        | 21.5     | 7.54 | 2410       | 1.50         | 18.80  | 0.12    | 0.44    | 374     | 77.4     | 2.4     |
| 5           | 3.66                     | 22       | 7.53 | 2550       | 1.59         | 19.74  | 0.28    | 0.35    | 513     | 135.0    | 2.7     |
| 6           | 0                        | 22       | 7.59 | 2360       | 1.47         | 17.86  | 0.27    | 0.00    | 243     | 55.8     | 2.7     |
| 7           | 0                        | 23       | 7.58 | 2790       | 1.74         | 22.56  | 0.23    | 1.23    | 478     | 79.2     | 2.4     |
| 8           | 0                        | 20       | 7.40 | 2660       | 1.66         | 21.62  | 0.22    | 4.02    | 790     | 72.5     | 6.2     |
| 9           | 4.33                     | 20.5     | 7.39 | 2090       | 1.31         | 214.4  | --      | --      | 626.3   | 252.0    | 1.7     |
| 10          | 11.66                    | 20.7     | 7.13 | 1755       | 1.10         | 314.5  | --      | --      | 551.4   | 717.0    | 4.9     |
| 11          | 2.33                     | 19       | 7.38 | 1912       | 1.19         | 181    | --      | --      | 583.5   | 108.0    | 3.3     |

**Table 3:** Rate of Parasitic stages diagnosed in some of the wells under study.

| No. of Well | Stage of Parasite               | Rate of Parasitic stages |
|-------------|---------------------------------|--------------------------|
| 2           | Ova of *Toxocara canis*         | 6                        |
| 5           | Cyste of *Entamoeba coli*       | 11                       |
| 9           | Ova of *Toxocara canis*         | 13                       |
| 10          | Cyste of *Entamoeba histolytica*| 23                       |
|             | Ova of *Ascaris lumbricoides*    | 12                       |
| 11          | Ova of *Ascaris lumbricoides*    | 7                        |
The diagnosis of parasites or their stages in water wells, especially in the province of Salah Al-Din has not been recorded previously, as this is the first study in which diagnosis of parasitic stages in groundwater in province of Salah Al-Din and Iraq, have been recorded cysts Cryptosporidium in some sources of surface water in Basrah governorate in heavy water at a rate of 104.6 liters, the river water at 24.0 liters, the tap water at 17.2 liters, the water of two water purification stations [13] and the results of [14] in Kufa, where the cysts were diagnosed in heavy water and rivers.

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