

Short note

The effect of salt stress on biological diversity of parasites in marshes of southern Iraq

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ABSTRACT. Aquatic systems are affected by highly variable environmental conditions, including salinity changes. Changes in salinity may be gradual or sudden; such as evaporation during summer and warm periods which in turn either reduce or increase salinity. Parasites are the most common in aquatic ecosystems and their transmission is strongly influenced by environmental conditions. However, the effect of salinity on the transmission of water-dwelling parasites has not been well studied. The present study aimed to detect the effects of long-period exposure to salinity on parasites in the marshes of southern Iraq as a result of low water levels in the Tigris, Euphrates, and Shatt Al-Arab in recent years. The results appeared in this study the presence of pathogenic intestinal parasites in the marshes of southern Iraq including *Schistosoma* spp., *Polymorphus* sp., *Taenia* sp., *Ascaris lumbricoides*, *Strongyloides* spp., *Entamoeba histolytica*, *Giardia* sp., *Naegleria* sp., *Coccidia* sp., *Cryptosporidium* sp., *Acanthamoeba* sp. and *Blantidium* sp. which were found in Haur Al-Chebaiesh and Haur Al-Hawizeh. Also, it observed highly presence of cercariae. In conclusion, these results indicated the ability of parasites to tolerance the salt stress due to its presence highly in these environmental conditions.

Keywords: waterborne, *Schistosoma*, *Cryptosporidium*, *Giardia*, *Taenia*, *Acanthamoeba*, *Naegleria*

Introduction

Marshes are important ecosystems that are impacted by several natural powers and the activity of human. They are important as the environment for fish, and invertebrates, and have an essential role as a habitat for migrant waterfowl. Moreover, they are an important factor in life of the Shatt-Al-Arab Estuary, the Gulf, and the surrounding ecosystems. Therefore, the necessary is to protect marshes, and their health is improved. Particularly in the marshes, the major activities represent buffalo breeding, fishing, rice agriculture, hunting, and mat-knitting. In the period of 1980s, elevating salinity appeared as a dangerous menace to the wetland in Iraq [1]. Climate alteration is predictable to have negative outcomes, specifically for the biota of shallow coastal regions [2,3]. Those ecosystems are naturally dependent on severe environmental variations, involving alterations in salinity, leading to impose essential physiological challenges on their residents

[4]. As a part of ecosystems, the trematodes are not only the utmost common parasite group but are also of high ecological importance [5,6]. Although the actuality that parasites transition is highly affected by environmental situations [7]

Salinity is represent one of the significant environmental agents in coastal ecosystems, affecting small and large biotic reactions [8]. While utmost coastal systems have a comparatively stable salinity reaching 35 practical salinity units (PSU), salinity is especially in estuaries may differ gradually in seasons rapidly. Tides, freshwater inflow, rainfall, or runoff cause sudden declines in salinity, while evaporation in tide ponds raises salinity more than the normal levels [9]. Salinity influences the distribution, physiology, and reproduction of species. Salinity is known as a significant environmental agent for parasitism and infection in estuarine or slight salinity environments [10].

In spite of the enhancement of public health and amendment of lifestyle, parasitic infections stay

Table 1. Analysis of marshes water

Number	NaCl (%)	TDS (ppm)	EC (μ s)	pH	Temp. °C
1	3.7	1207	2383	2.72	21.5
2	4.2	1098	2191	8.29	23.2
3	3.8	1107	2177	7.78	22.3
4	3.7	1207	2383	7.72	21.5
5	3.9	1164	2186	7.73	22.1

public health issue on several sides of the world. Water is an essential source for the transmission of many pathogenic factors involving parasites, bacteria, and viruses. The biological factors are transmitted by non-sterilized water. World Health Organization showed there are 80 infectious factors or more that, are transmitted via water. The population increased growth, urbanization, the presence of infected animals, climate alterations, deficit water net system, and hygienic lack are the major factors for the prevalence of pathogenic parasites factors [11].

The pollution of water is a main global issue that needs ongoing assessment and revision of water resource strategy in all fields from global down to special aquifers and fully managed. Further, water pollution is caused death and infections, which caused more than 14000 death of humans daily [12].

Some studies indicated the prevalence of gastrointestinal parasitic infections via health organizing in the west of Ahvaz city during (2007–2017), this appeared an elevate the spread of gastrointestinal infections in related regions [13]. The study aimed to detect the effect of salinity on parasites in the marshes of Iraq.

Materials and Methods

Ten freshwater samples (5 samples/area) were collected from two side areas of marshes (Haur Al-Chebaiesh and Haur Al-Hawizeh). They were collected in a special bottle of 5 l which was labeled with place and date of collection. The samples were left to stay undisturbed for 24 hours at room temperature. The supernatant was sucked and removed. Sedimentation using a centrifuge (2300

Table 2. Species of parasites and number of positive water samples from marshes

Species of parasite	Stages parasites	No. of positive samples Haur Al-Hawizeh	No. of positive samples Haur Al-Chebaiesh
<i>Schistosoma</i> sp.	cercaria	13	6
	egg	18	7
<i>Blantidium</i> sp.	trophozoite	7	2
<i>Taenia</i> sp.	egg	16	8
<i>Giardia</i> sp.	cyst	9	5
<i>Cryptosporidium</i> sp.	oocyst	21	12
<i>Trichostrongylus</i> sp.	egg	6	2
<i>Coccidia</i> sp.	cyst	9	5
<i>Naegleria</i> spp.	trophozoite (amoeboid forms)	11	7
<i>Acanthamoeba</i> sp.	cyst	27	3
	trophozoite	18	8
<i>Entamoeba histolytica</i>	cyst	18	10
<i>Ascaris lumbricoides</i>	egg	13	5

rpm) for 1 min. Sediments of each sample were examined microscopically, as a saline smear, for parasite cysts, trophozoites, and helminth eggs. Samples were stained with Lugol's iodine, modified Ziehl-Neelsen acid-fast stain. The diagnosis were done in the laboratory for Ministry of Science and Technology, Iraq.

Results

Water samples were tested to measure the physical properties analysis as shown in the table 1. The results indicated increasing of NaCl, TDS (total dissolve solid), EC (electricity), pH and temperature. Moreover, the samples were positive for parasitic contamination with cysts and oocysts and there were helminths contamination in the studied water samples as shown in table 2.

Discussion

The current study represents the first study about the effect of salinity in Iraqi marshes on parasites while other researchers studied the effect of salinity through experimental studies [10] who investigated the impacts of long-term (several weeks) exposure to various salinities (25, 30, 35 and 40 PSU) on the transition of *Maritrema novaezealandensis* from its first host snail to a second host amphipod, in order to assess overall impacts. The current study found that there is an increasing number of cercariae emerging with increasing salinity. This finding is in accordance with most previous studies and also indicates a roughly two-fold increase in cercarial emergence with an increase of about 10 PSU. Conditions indicated the normal impacts to assess salinity levels as a result of evaporation. The impacts of the short-period salinity raise in experiments of also, the long-period response to the various salinities strongly indicated that cercarial production and development are highest at natural to raised salinities [10].

Concerning to temperature, this can be explained as an optimal transition strategy, whereby the production and development of cercariae are greater under situations that increase the chance of successful transition to the following host. The rate of presence cercariae is increased with elevating salinity, indicating the conditions are optimal for the transition of the parasite species are not only enhancing larger numbers of cercariae that release into the environment but also prolong their presence

[14]. Also, the cercariae infectivity has been appeared to raise with elevating cercarial density above threshold [15].

The severe infection was successful at 22°C. The higher infections with increasing temperature has been recorded as mentioned for several cases in laboratory and field experiments. The elevating temperatures speed the cercariae metabolism, provide ATP to penetrate the host tissue, and development to meta cercariae [16].

The present study appeared *Entamoeba* cysts were dominant in all region water sample of marshes which is accordant with the study of [11,17,18].

Low rates of water samples were polluted by *Giardia* cysts, which agree with studies from other parts of the world [11]. In this study all samples from marshes polluted by protozoan parasites, *Giardia* cysts were identified. In Italy, it was found *Giardia* cysts in raw water samples [19]. This disagree may be result of low of collected samples number for this study.

The reporting of the large number of parasites in marshes in current study is agree with [20] who reported presence of 17 parasites genera in fresh water of the Tigris River this parasites risk of health; especially for swimmers in these areas, all these parasites were recorded in Iraq previously in their hosts but in this study constitute new record in marshes of Iraq. Water-based diseases come from hosts that either live in water or require water for part of their life cycle. These diseases are passed to humans when they are ingested or come into contact with skin. The most widespread example in this category are schistosomoses. There are 160 million person in 74 of the world countries infected with schistosomoses, most of whom have acute effects [21]. Moreover swimmer's itch caused by *Polymorphus* sp. transmitted by aquatic birds such as Gadwall [22].

The current study revealed many intestinal parasites that presence in marshes like *Taenia* sp., *Ascaris lumbricoides*, *Strongyloides* spp., *Entamoeba histolytica*, *Giardia* sp., *Cryptosporidium* spp., *Naegleria* and *Acanthamoeba*.

The genera of free living amoeba are caused meningitis [23]. Swimming in water represent frequently assumed as the method of infection by the intranasal mucosa which caused primary amoebic meningoencephalitis by *Naegleria* [24]. On the other hand, the free-living amoebae of the genus *Acanthamoeba* are known to cause eye

infection and keratitis [25].

It was recorded the case infection for Iraqi woman by *Acanthamoeba* through her suffering from ocular itching and foreign body sensation and redness in eyes with blown lids of two weeks, that case of ocular acanthamoebosis [26].

Balantidium is the largest ciliated protozoan parasite that infect humans and animals and caused a disease called balantidiosis, clinical symptoms include dysentery (blood or mucus), vomiting, headache, nausea, abdominal pain, colitis and ulcers in large intestine [27]. The parasite transmitted to humans through consumption of contaminated food and water with infective cysts [28]. In one study in Iraq conducted for identification of *Balantidium coli* in bottled water. The outcomes appeared about 11.4% of bottled water contain *B. coli* [29].

Cryptosporidium oocyst reported in current study agreed with finding of [20,30]. The rivers and lakes contaminated by oocyst, cause the borne diseases transmitted by water [31]. The current study showed that the rate of parasitic infections in marshes is considerably high.

Altogether, it appeared in this study the diverse prevalence of parasites in marshes and their tolerance to salinity of marshes.

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