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Contamination of Water by Cryptosporidium; an Infectious Neglected Threat for Public Health

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Cryptosporidiosis due to its zoonotic possibility is an important global public health problem. It is one of the most infectious protozoan disease that causes gastrointestinal tract infection worldwide and also in Iran. Based on the studies conducted in Iran and other parts of the world, *Cryptosporidium parvum* is the most important cause of the human cryptosporidiosis that is followed by *Cryptosporidium hominis* with lower prevalence [1, 2, 3, 4]. *C. parvum* and *C. hominis* penetrates the host's gastro-intestinal tract, especially the small intestine, as an obligate intracellular parasite to produce oocysts. The oocysts which exist and spread through feces are the only stage of protozoan life cycle that they can be seen outside the host body. This parasite produces two types of oocysts in intestine; thick-walled oocysts and thin-walled oocysts. The former is responsible for the infection's survival and spread in the environment as well as its transmission to the host. The latter one's duty is to increase the intestinal infectious form of disease. However, sometimes extra-intestinal cycle of disease can be observed in the liver, lung, or gall bladder. Cryptosporidiosis is one of the most prevalent pathogens worldwide with higher rates in developing countries. Multiple different hosts have been reported for this pathogen, such as mammalian, avian, etc. There are also enough evidences proving transmission of infection from animals, specifically livestock, to humans [3, 5, 6]. Swimming in infected pools and drinking infected water are the most important ways of cryptosporidiosis transmission. Not only swimming pools but also water parks, hot tubs, ponds, lakes, and rivers can be sources of infection. The initial identification of cryptosporidiosis as a waterborne pathogen was in an outbreak in Texas (1984), in which more than 2,000 persons were infected with *C. parvum* [5]. Since then, several outbreaks of cryptosporidiosis affected more than hundred thousands of people from the whole world. Up to year 2000, this disease has been reported from 95 countries [6]. The largest recorded waterborne-disease outbreak happened in Wisconsin, USA in 1993; 403,000

cases of infection were observed only in the United States [7].

Cryptosporidiosis is common among babies, children, and the elderlies since they lack appropriate personal hygiene. Pregnant women are also placed in the risk group because hormonal changes debilitate their immune system. Sometimes this disease does not show any symptoms; asymptomatic carriers are very common in cryptosporidiosis which can spread the infection easily. Primary symptoms include the abdominal pain, acute watery diarrhea, vomiting, anorexia, occasionally depression, and sometime a low-grade fever.

In immunocompetent people, disease often tends to be self-limited, while in immunocompromised patients, especially in patients with AIDS and those who are undergoing immunosuppressive therapy, it can be a serious problem. It can lead to repeatedly acute watery diarrhea that causes high dehydration, severe general weakness, and finally death in acute phase. Therefore, the threat of this global infection is highly felt in the community. So, appropriate measures should be taken by health organizations to prevent and control this underestimated threat as soon as possible.

One of the neglected ways for distribution of oocysts is migration of fish-eating birds to open water resources. This may have special epidemiological effects even though these birds are not susceptible hosts for this infection [2]. *Cryptosporidium* oocysts often appear in surface waters as well as sewage discharges [8]. Unfortunately, *Cryptosporidium* is also found in refined drinking water as a serious warning for the public health [9]. Today EPA (United States Environmental Protection Agency) uses *cryptosporidium* as one of the three important indicators for evaluating the performance of refineries. According to this principle, standard performance of refinery is removal of at least 99% of *C. parvum* oocysts from surface water [10]. Based on the data collected from an outbreak of drinking waterborne diseases in the United States and the United Kingdom, the concentration of 10 to 30 oocysts per 100 liters of water can lead to an outbreak of cryptosporidiosis in society [9].

Oocysts of *Cryptosporidium* are very resistant against routine antiseptics in normal concentrations. Their strong external shell with multi-layered wall causes this long survival in different conditions. So, they survive in old traditional refineries with normal doses of chlorine. In this regard, they should be separated physically prior to chlorination or change in the type of disinfectants. Eradication of C. parvum oocysts from drinking water depends on adequate and appropriate filtration before their chlorination. It seems that new approaches such as using reverse osmosis (RO), radiation technique, or electronic method are more effective than incompetent traditional methods [9].

Finally, it should be noted that *C. parvum* is a highly infectious enteric protozoan pathogen that is changing into a serious problem. Hygiene is a simple but effective way to prevent from this parasite infection. At the same time, a deep perception of cryptosporidiosis' status in public health issues and the fact that such risk factors can lead to development of effective strategies. Such strategies aim to prevent from this universal highly infectious threat of water resources and consumers, specifically newborns and immune-suppressed patients worldwide.

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