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Prevalence of Cryptosporidial Oocysts in Soil of Recreational Parks in Abuja, Nigeria

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Abstract

Contamination of soil with cryptosporidial oocysts poses a great health risk to people especially in individuals who are immune-compromised. Exposure to contaminated soil can cause diarrhoea in humans especially in children who play around the parks and may not wash their hands before handling food. The prevalence of cryptosporidial oocyst in soils of 4 recreational parks in Abuja, Nigeria was investigated. Four hundred soil samples were collected from various locations within the recreational parks and examined for the presence of cryptosporidial oocyst using modified acid fast staining technique. In nine (2.3%) of the samples, 8 were from park A and 1 was from park B contained cryptosporidial oocyst. There was significant association (χ^2 = 20.1; df = 2; p = 0.00004) between prevalence of *Cryptosporidium* oocysts and level of hygiene of the parks. It was concluded that soil in recreational parks may be a source of infection with *Cryptosporidium* oocysts.

Keywords

Cryptosporidial Oocyst, Recreational Parks, Abuja, Health Risk

1. Introduction

Cryptosporidium, a zoonotic coccidian protozoan parasite that has gained significant attention in the last 20 years as a clinically important human and animal pathogen [1] [2] is one of the most common aetiological agents

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of gastroenteritis and diarrhoea in several animal species especially calves, lambs and man [3] [4]. Cryptosporidiosis is considered one of the most prevalent parasitic infections in domesticated caged and wild birds including ducks, canaries, chickens, parrots and domestic geese from Asia, Australia, Europe, North America and North Africa [5]-[7]. Many species of *Cryptosporidium* infect humans and a wide range of animals; however, *Cryptosporidium parvum* is the most important species causing disease in humans [8]. *Cryptosporidium* oocysts are able to move through various soil types and resist environmental pressures such as temperature and pH, indicating its potential to contaminate and survive in the environment [9].

Contaminated water and food are known sources of infection among international travellers and water-borne outbreaks have been reported in North-America and Europe [10]. The parasite is transmitted from person to person through ingestion of contaminated food or drinking water and water used for recreational purposes, from animal to person, or by contact with environmental surfaces contaminated with faeces [11]. The public health importance of cryptosporidiosis has not been widely reported in Nigeria. This can be attributed to the non-routine screening for *Cryptosporidium* oocyst in stools of diarrhoeal patients in health institutions [12]. Kwaga *et al*. [13] reported a prevalence rate of 21% of *Cryptosporidium* in patients with diarrhoea in Zaria and further reported the prevalence of 0.66% *Cryptosporidium* in calves and 15.7% in piglets in some parts of Kaduna state [14]. Ayeni *et al.* [15] reported in Ile-Ife the prevalence of cryptosporidial oocysts of 32.6%, 4.2%, 12.0% and 7.6% among pigs, goats, sheep and cattle respectively. These prevalence rates found in man and animals in the face of poor hygiene and animal husbandry give room for the contamination of soil and water with *Cryptosporidium* contaminated faeces. In some areas in Nigeria where hygiene is poor, the detection of *Cryptosporidium* in soil may have health implications. The present study was therefore conducted to determine the status of cryptosporidial oocysts in soil in Abuja recreational parks.

2. Materials and Methods

2.1. Sample Collection

The study was conducted between September 2010 and February, 2011. Samples were collected on a weekly basis from four parks in Abuja and a total of 400 samples (100 from each of the 4 recreational parks) using a clean garden trowel.

2.2. Analysis of Samples

Ten grams of each soil sample was mixed with 100 mls of 10% formol saline in a universal bottle and was sieved through cotton gauze and poured using a funnel into a centrifuge tube. Ten (10) mls of diethylether was added to the filtrate and thoroughly mixed. The suspension was centrifuged at 5000 rpm for 10 minutes using an MS centrifuge, the supernatant was decanted and a smear was made from the sediment on a microscope slide and air-dried. The smear was fixed for 3 minutes with 3% hydrochloric acid-methanol and flooded with 1% aqueous safranin, heated over a Bunsen flame for 1 minute, and the slide was then flooded with water and air-dried. It was counter-stained with 1% methylene blue for 1 min followed by washing with buffered distilled water. The slides were air dried and the prepared slides were examined by light microscope at 40× objective under a bright field.

2.3. Level of Hygiene as Used in the Study

In this study, the index for determination of the level of hygiene was based on the level of sanitation and beautification of the environment. The different levels as used in the study are enumerated below:

LH = 1 (low): when the environment is untidy and no structured pattern of waste collection with heaps of refuse and wastes littering the whole place.

LH = 2 (moderate): same as LH = 1 but there is a defined area for waste collection.

LH = 3 (high): there is no littering of wastes within the sites, there is availability of waste disposal bins and collected wastes are either burnt or buried.

2.4. Data Analysis

Chi-square was used to analyze the data for associations with variables and values of $p < 0.05$ considered significant.

3. Results

Table 1 shows the percentage prevalence of cryptosporidial oocysts in soil samples from each of the four recreational parks. Among the 400 soil samples examined, 9 (2.3%) contained *Cryptosporidium* oocysts. Park A recorded the highest prevalence of 8.0%, while park B had 1.0% prevalence. However, no cryptosporidial oocyst was detected in samples collected at parks C and D. There was a significant association ($\chi^2 = 20.35$; df = 3; p = 0.0001) between the prevalence of cryptosporidial oocysts in the soil samples and the four recreational parks.

Prevalence of *Cryptosporidium* oocysts according to level of hygiene is shown in **Table 2**. The highest prevalence (8%) was in parks of moderate level of hygiene, followed by low level (0.5%). No *Cryptosporidium* oocyst was detected in parks of high level of hygiene. There was significant association ($\chi^2 = 20.1$; df = 2; p = 0.00004) between prevalence of *Cryptosporidium* oocysts and level of hygiene of the parks.

4. Discussion

The prevalence of cryptosporidial oocysts in parks as observed in this study, though relatively low, is of importance considering the fact that *Cryptosporidium* can cause illness especially in immune-compromised individuals. There is increasing concern that foods, particularly those of animal origin, may play a role in the transmission of *Cryptosporidium parvum* to humans. Contaminated soil may also poses a great health risk to humans as meat sold for consumption may be in contact with soil and this may help in the transfer of the oocysts to humans. The low detection rate of cryptosporidial oocysts may not be unconnected to technique employed as pathogen like *Cryptosporidium* that can occur in low numbers requires a more sensitive method for isolation.

The highest prevalence of cryptosporidial oocysts in park A may not be unconnected with the layout of the park as there is a bridge and running water across the park which may help in the dispersion of *Cryptosporidium* oocysts within the area especially during severe flooding. Oocysts may be carried along such water bodies. The prevalence in park B though relatively low may be because of the activities and location of zoo in the park. It was not surprising that no *Cryptosporidium* oocyst was detected in park C which was the biggest and in terms of hygiene and sanitation the neatest of all the parks. In contrast, park D that was almost the opposite of park A in terms of level of hygiene also recorded no *Cryptosporidium* oocyst. This may be that the park was not contaminated with *Cryptosporidium* oocyst or that the soil samples were not taken from *Cryptosporidium* contaminated areas. It may also mean that number of oocysts present was so low that the technique used failed to detect a positive sample.

Table 1. *Cryptosporidium* oocysts in recreational parks soil samples in Abuja.

Parks	No. of soil samples examined	No. (%) positive
A	100	8 (8)
B	100	1 (1)
C	100	0 (0)
D	100	0 (0)
Total	400	9 (2.3)

$\chi^2 = 20.35$; df = 3; p = 0.0001.

Table 2. Prevalence of *Cryptosporidium oocysts* in soil samples according to level of hygiene in parks within Abuja metropolis.

Level of hygiene	No. of samples examined (%)	Positive samples (%)
Low	200 (50)	1 (0.5)
Moderate	100 (25)	8 (8)
High	100 (25)	0 (0)
Total	400 (100)	9 (2.3)

$\chi^2 = 20.1$; df = 2; p = 0.00004.

Though no *Cryptosporidium* oocyst was detected in park of high level of hygiene, the highest prevalence of *Cryptosporidium* oocyst in parks moderately rated in terms of level of hygiene may be because of increased activity within the parks and a possibility of mechanical transfer of oocysts from one location to another. The occurrence of *Cryptosporidium* in the soil within the recreational parks, especially in areas where children play, should be a source of concern to public health officials and regulators of these recreational parks as contaminated soils may be a source of infection with *Cryptosporidium* oocyst. Also, animal fecal waste applied as manure to soils should be effectively managed to minimize environmental and public health risk.

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