Prevalence of Cryptosporidiosis among Primary School Pupils in Gboko, Benue State, Nigeria

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***Abstract*: - Cryptosporidiosis is a parasitic infection of public health concern and a great burden in Nigeria. It affects a wide range of vertebrates including humans. *Cryptosporidium spp* is a ubiquitous obligate intracellular parasite of many vertebrate species that is responsible for diarrhoeic conditions which can be either self-limiting in immunocompetent individuals or severe in immunocompromised individuals. This study was carried out to identify *Cryptosporidium* oocysts from faecal samples of primary school pupils in Gboko, Benue state and determine its prevalence in the study area. A total of 280 samples were collected from school-aged pupils including those with diarrheic faeces, who consumed water from public supplies and eat unsuspectedly contaminated food, who had contact with companion animals, visited endemic areas, swam, did not wash their hands after eating or toilet use amongst other factors studied, and analyzed using modified Ziehl-Neelson staining technique for presence of oocyst. 82 samples were positive, giving a prevalence of 29.29%. It was observed that promotion of public and personal hygiene, drinking of portable water and health education is strategic to ensuring management and prevention of *Cryptosporidium* infection among the study subjects going forward.**

Keywords: **Cryptosporidiosis, Parasite, Oocyst, Prevalence, Ziehl-Neelson.**

I. INTRODUCTION

Cryptosporidium is a ubiquitous parasite that infects awide range of vertebrates including humans (Leav*et al.*,2003; Xiao *et al*., 2004).They are obligate intracellular parasites of man and animals on all continents except Antarctica. Cryptosporidios is ranks 5th among the 24 most important food borne parasites globally (Aniesona and Bamaiyi, 2014; Bamaiyi *et al.,* 2013; Rossle and Latif, 2013). *Cryptosporidium* species are considered one of the most important parasitic diarrhoeal agents globally (Bodager *et al.*, 2015). The disease usually manifests as a self-limiting diarrhoea in immuno-competent individuals, and as a progressively life threatening diarrhoea in immuno-compromised patients such as those with human immunodeficiency virus infection/acquired immunodeficiency syndrome (HIV/AIDS); the young and the elderly; individuals undergoing cancer chemotherapy, and any other condition that compromises the immune system including simple malnutrition. The size of the inoculum does not have any apparent effect on the severity and duration of disease. As a few as 10 oocysts are capable of causing severe infection with only partial immunity acquired after 2 weeks of recovery from primary infection and subsequent challenge or exposure with the same organism (Miller *et al.,* 1990).A specific treatment has not yet been developed for cryptosporidiosis in man and animals, but nitazoxanide (Alinia) has shown encouraging results as it undergoes clinical trials (Aly *et al.,* 2015). Nitazoxanide has as yet not become available worldwide. However, effects of nitazoxanide in HIV/AIDS or immuno-deficient patients are not any better than a placebo for treating cryptosporidiosis. Paromomycin and other antibiotics such as Spiramycin have been used, but their efficacy is in doubt. Fortunately, cryptosporidiosis is a self-limiting disease in healthy adults, and can be expected to subside with conservative measures and dietary manipulation (Acikgoz *et al.,* 2012).Despite the seemingly ubiquitous nature of cryptosporidiosis, sufficient attention has not been paid to it, prompting the World Health Organization (WHO) in 2004 to list it among globally "neglected diseases" which have a common link with poverty in most developing countries. In Nigeria, Cryptosporidiosis has been documented in the North, Middle Belt, East and the South-Western parts of the country (Kwaga*et al.,* 1988; Banwat *et al.,* 2003).In developing countries like Nigeria, the impact of protozoan pathogens on gastrointestinal infections cannot be overemphasized as they occupy a significant role as causative agents of diarrheal infections (Kwaga *et al.,* 1988). It has been known that *Cryptosporidium* is responsible for about 20% of infantile diarrhoeal infections in these developing countries. Despite our knowledge of cryptosporidiosis transmission, the exact mode of transmission is often difficult to establish. The importance of certain risk factors for acquiring infection remains unclear. For instance, the extent to which socio-economic, behavioural and environmental factors contribute to the transmission of this disease is not sufficiently established. *Cryptosporidium* infection in Gboko is not an exception to this unusual condition. What therefore is the prevalence of cryptosporidiosis and what are the factors that contribute to the spread of the infection among primary school children in Gboko? This is the problem and gap in knowledge that this study hopes to fill.

II. MATERIALS AND METHODS

The Study Area: The Study was carried out in Gboko, Benue State, Nigeria. Gboko is a fast-growing town with subsistence farming as a primary occupation, while other inhabitants carry out trading and civil service. The climate in Gboko is tropical, comprising two seasons; rainy and dry season. The average

annual temperature ranges between 32ºC-34ºC with an annual rainfall averaging 1479mm.

Experimental Design: A Cross-sectional study design was adapted for the study. Allpupils at the selected schools were given opportunity to participate in the study. Pupils were briefed on the health implication of being infected with *Cryptosporidium* parasite and the relevance of the study. Participation was made voluntary and each participant was required, with the aid of the study nurse, to fill a structured questionnaire. Ethical Clearance and written permission was sought for and obtained from the Ethical Committee, headmasters of the schools as well as the parents of the individual participants.

Collection of Samples: Clean universal sample containers were handed out to each pupil to produce their faeces. A total of 280 faecal samples were collected from the pupils. The samples collected were transported in icepack to the Microbiology laboratory of University of Mkar, Mkar and analyzed immediately.

Modified Ziehl-Neelsen Staining Procedure: A thin smear of faeces was prepared on a grease-free slide and air-dried. It was then fixed with methanol for about 2-3 minutes and stained with cold carbol-fuchsin for 15 minutes and washed off with distilled water. Decolorization was done with 1% acid alcohol for 10-15 seconds, washed off with water and counter-stained with 0.5% malachite green for 30 seconds and washed off with water. The slides were then placed on a draining rack to dry after which they were observed under the microscope using x100 objectives (oil immersion) for the presence of oocysts.

Microscopy of Cryptosporidium

The stained slides were observed under the microscope using x100 objectives (oil immersion) for the presence of oocysts. Oocysts of *Cryptosporidium* appeared as small, round to oval, pink red stained bodies or objects, measuring about 4-6µm in diameter.

III. RESULTS

The distribution of Cryptosporidium infection by gender and age is as presented in Table 1 while Table 2 reports the distribution of infection by their parent's occupation, history of diarrhoea, personal hygiene, environmental hygiene, zoonotic possibility and travel to endemic areas.

Table 1: Distribution of *Cryptosporidium* oocysts infection bygender and age

Gender	Number examined (%)	Number positive (%)	Number negative (%)
Female	172 (61.43)	54 (19.29)	118 (42.14)
Male	108 (38.57)	28 (10.00)	80 (28.57)
Total	280 (100.00)	82 (29.29)	198 (70.71)
Age range	Number examined (%)	Number positive (%)	Number negative (%)
1-4 years	74 (26.43)	18 (6.43)	56 (20.00)
5-8 years	78 (27.86)	34 (12.14)	44 (15.71)
9-12 years	128 (45.71)	30 (10.71)	98 (35.00)
Total	280 (100.00)	82 (29.29)	198 (70.71)

Table 2: Distribution of *Cryptosporidium* infection rate among primary school children by their parent's occupation, previous history of diarrhoea, personal hygiene, environmental hygiene, zoonotic possibility and travel to endemic areas

Occupation	Number examined (%)	Number positive (%)	Number negative (%)
Civil servant	104 (37.14)	30 (10.71)	74 (26.43)
Farmer	58 (20.71)	12 (4.29)	46 (16.43)
Business Man/Woman	88 (31.43)	30 (10.71)	58 (20.71)
Others	30 (10.71)	10 (3.57)	20 (7.14)
Total	280 (100.00)	82 (29.29)	198 (70.71)
Recent history of diarrhea	Number examined (%)	Number positive (%)	Number negative (%)
No	72 (25.71)	22 (7.86)	50 (17.85)
Yes	208 (74.29)	60 (21.43)	148 (52.86)
Total	280 (100.00)	82 (29.29)	198 (70.71)

Personal Hygiene	Number examined (%)	Number positive (%)	Number negative (%)
Handwash after toilet use No	252 (90.00)	76 (27.14)	176 (62.86)
Yes	28 (10.00)	6 (2.15)	22 (7.85)
Total	280 (100.00)	82 (29.29)	198 (70.71)

Biting of fingernails	No	128 (45.71)	30 (10.71)	98 (35.00)
	Yes	152 (54.29)	52 (18.57)	100 (35.71)
Total		280 (100.00)	82 (29.29)	198 (70.71)

Environmental Hygiene		No. Examined (%)	No positive (%)	No negative (%)
wash of toilet	Weekly	194 (69.29)	62 (22.14)	132 (47.14)
	Daily	86 (30.71)	20 (7.15)	66 (23.57)
Total		280 (100.00)	82 (29.29)	198 (70.71)
source of water	well	20 (7.15)	6 (2.14)	14 (5.00)
	Tap	100 (35.71)	14 (5.00)	86 (30.71)
	Borehole	134 (47.86)	52 (18.57)	82 (29.29)
	Sachet	26 (9.29)	10 (3.58)	16 (5.71)
Total		280 (100.00)	82 (29.29)	198 (70.71)
Type of toilet	open defecation	20 (7.15)	4 (1.43)	16 (5.71)
	pit latrine	52 (18.57)	12 (4.29)	40 (14.29)
	water cistern	208 (74.28)	66 (23.57)	142 (50.71)
Total		280 (100.00)	82 (29.29)	198 (70.71)

Zoonotic possibility		No. Examined(%)	No.Positive(%)	No.Negative(%)
Companion animals	Yes	160 (57.14)	50 (17.86)	110 (39.29)
	No	120 (42.86)	32 (11.43)	88 (31.42)
Total		280 (100.00)	82 (29.29)	198 (70.71)

Endemic area		No. Examined (%)	No. Positive (%)	No. Negative (%)
Village visit	Yes	208 (74.29)	66 (23.57)	142 (50.71)
	No	72 (25.71)	16 (5.72)	56 (20.00)
Total		280 (100.00)	82 (29.29)	198 (70.71)

IV. DISCUSSION

The data from this study provides evidence of the link between certain socio-environmental factors and cryptosporidiosis in Gboko, Benue state of Nigeria. It showed that cryptosporidiosis is an endemic childhood condition. The overall result of this study shows that 82 (29.29%) primary school pupils out of 280 examined were infected with *Cryptosporidium* oocysts. The distribution of *Cryptosporidium*oocyts in this study based on gender showed the female pupils had a higher positive result of 54 (19.29%) compared to the male pupils with result of 28 (10.00%).The similar prevalences of *Cryptosporidium* species among both genders in this study contradict some previous reports (Kwaga *et al*., 1988; Okafor & Okunji, 1994).But a number of reports indicate that the infection may not always have a positive association with gender since in many communities both gender are equally exposed to similar risks of infection. Both sexes engage in same recreational activities and so are likely to be equally exposed to any environmental contamination.

This study also supports the finding that cryptosporidiosis is an infection most often seen in children with diarrhoea history. Those who had a previous history of diarrhoea gave a high positive result of 60 (21.43%) which may be due to chronic presence of *Cryptosporidium*. Children have been reported to be asymptomatic carriers of *Cryptosporidium* but not adults. The practice of water fetching from wells, boreholes and taps for drinking and other domestic purposes is another source of concern in the study area. Unfortunately, almost half of the children from households using the above-mentioned sources of water were highly positive for *Cryptosporidium* infection as they are potentially contaminated by faeces and other human-generated wastes and, therefore, are unsuitable for direct human use. The presence of *Cryptosporidium* in those using public pipe-borne water may be supportive of the known fact that the oocysts of the parasite are resistant to most water purification methods including chlorination (Leav*et al*., 2003).

V. CONCLUSION

In conclusion, the major infection source to humans is through direct contact with contaminated faeces or water and pasture run-off (LeChevallier *et al*., 1991). The presence of *Cryptosporidium* in the faecal samples examined is related to a few important variables of human behaviour (personal hygiene), certain environmental and socio-demographic factors. *Cryptosporidium* is a parasite which has direct life history, being transmitted from human to human by faecal-oral route during which the oocyst is discharged in human stool, widespread contamination of the environment occurs and eventually infective stages are swallowed by a susceptible human host. All these can be prevented by promoting public and personal hygiene, portable drinking water and health education.

VI. RECOMMENDATION

The following recommendations are given based on the finding from this research:

1. Adequate basic social amenities such as good drinking water, affordable and culturally acceptable means for disposal and treatment of human faeces to be provided as proper faecal disposal can contribute most to the control of *Cryptosporidium*.
2. It imperative to state here that, while access to improved facilities and sanitation are key factors to reduction in parasitic burden, the behaviour and education of the children is an important factor hence they should be monitored especially in school(s) where they spend more time.
3. Primary health care personnel or community health workers and facilities should be made available in all schools to ensure proper spread of information and advice on health matters.
4. Training and workshops should be introduced into curriculum of primary schools syllabus to ensure proper handling of food, proper dissemination of good health and hygiene practices among children to minimize exposure to *Cryptosporidium* infections and effect on their well-being.

CONFLICT OF INTEREST

The authors hereby state that there is no conflict of interest in the course of this study.

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