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Research Paper

The Role of Finger Sucking and Animal Domestication in the Prevalence of Agents of Diarrhoea in Orphanages in Benue State

Science

KEYWORDS : Diarrheoa; Finger sucking; Domestic; Orphanage; Benue

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ABSTRACT

This study determined the prevalence of Giardia lamblia and Cryptosporidium parvum as agents of diarrhoea in children living in the orphanages in Benue State and the role of finger sucking and animal domestication in the prevalence of the parasites. Stools were collected from children (n=128) living in the four orphanages. The stools were screened with the Giardia and Cryptosporidium 2nd Generation ELISA test kits (Diagnostic Automation, Inc.). Cryptosporidium parvum and Gardia lamblia were highly prevalent (43.8%) with 28.9% been Gardia lamblia infection, 9.4% been Cryptosporidium parvum; and co-infection was 5.5%. Mkar orphanage (22/42) and Otukpo orphanage (11/21) had the highest prevalence (52.4%) but with the highest positive cases in Mkar, while the least prevalence (30.0%) of enteric protozoan infection was recorded in Mama Abayol, Makurdi. Finger sucking and practice of animal husbandry had significant (P<0.05) effect on the prevalence. Routine diagnosis of diarrhoeic stool specimens brought to the labouratories should include Giardia and Cryptosporidium. Finger sucking among the children should be disabused using simplified habit reversal method, while proper system of animal husbandry should be practiced for healthier living condition. Good personal hygiene should be encouraged in the orphanages so as to reduce the burden of pathogenic diseases.

Introduction

Diarrhoea remains the second leading cause of death among children under five globally. It kills more young children than acquired immune deficiency syndrome (AIDS), malaria and measles combined (UNICEF/WHO, 2009). Each year, an estimated 2.5 billion cases of diarrhoea occur among children under five years of age, and estimates suggest that overall incidence has remained relatively stable over the past two decades (Boschi, 2009). More than half of these cases are in Africa and South Asia, where bouts of diarrhoea are more likely to result in death or other severe outcomes (UNICEF/WHO, 2009). Despite much progress in the understanding of pathogenesis and of management, diarrhoeal illnesses remain one of the most important causes of global childhood mortality and morbidity. Infections account for most illnesses, with pathogens employing ingenious mechanisms to establish disease. Blood in stool could indicate an acute diarrhoeal illnesses or dysentery, irrespective of frequency (Thapar and Sanderson, 2004).

Poverty and social exclusion, and the lack of political and financial priority given to building the capacity of vulnerable families to care for and protect their own children, are driving factors behind the abandonment of children into institutions. Furthermore, the lack of priority given to children requiring out-of-home care is perpetuating the inappropriate use of institutional care over more positive family and community based alternatives, as well as sustaining the poor care standards found in many institutions (UNICEF, 2008a).

It is estimated that approximately 50.0% of infants at one year of age suck thumb or finger and this number reduces rapidly by ages 4-5 years (Fukuta *et al.*, 1996). Generally, the prevalence rates of finger sucking decrease with age, and it is typically considered a benign activity for infants and young children, many of whom discontinue this behavior before age five (Van Norman, 1997; Stansbery *et al.*, 2008).

Unlike the other intestinal spore forming protozoa, *C. parvum* has little host specificity. Its acquisition from animals such as calves, cattle, goats and other farm animals has been documented (Fang *et al.,* 1991). In the setting of a developing country, apart from the level of sanitation, one predictor of *Giardia* and other intestinal pathogens was a high intra/peridomicilliary concentration of domestic animals. Children who lived in such households were two to five times more likely to be infected compared with children who did not live in such households. Domestic animals could be a reservoir for *Giardia* and other intestinal protozoan infections or a marker of overall poor sanitation (Ali and Hill, 2003).

Children in orphanage homes, especially in Africa, are prone to the infection of parasitic protozoan due to the prevailing socio-economic and human factors (Sadik, 2010). Children living in orphanages in Benue State, Nigeria are no exception of this life threatening disease, but the prevalence status and the actual cause(s) of diarrhoea in the orphanages are not well known. This study determined the prevalence of *Giardia lamblia* and *Cryptosporidium parvum* as agents of diarrhoea in children living in the orphanages in Benue State and the role of finger sucking and animal domestication in the prevalence of the parasites.

Methodology

Description of Study Area

Benue State lies in longitude 7° 47' and 10° 0' East, Latitude 6° 25' and 8° 8' North with a population of 4,253,641 and occupies a landmass of 32,518km2 (Nyagba, 1995; Hula, 2010). The targeted populations were the children (0-19 Years) in the Orphanage homes; Children of Mary Orphanage and Motherless Babies Home, Otukpo in Otukpo L.G.A.; Gidan Bege Orphanage Home, Makurdi in Makurdi L.G.A; Mama Abayol Children's Home, Makurdi in Makurdi L.G.A and N.K.S.T Orphanage Home, Mkar in Gboko L.G.A. (Figure 1).

Test Method

Enzyme Linked Immunosorbent Assay (Sandwich, Antibody Coated Plate, Diagnostic Automation, Inc. USA).

Interpretation of Results

Results were estimated visually by naked eye.

Reactive: Sample well that is obviously more yellow than the negative control well.

Non-reactive: Sample well that is not obviously more yellow than the negative control well (Plates 1 and 2).

Analyses of Data

Data collected at the end of the study was entered into the Statistical Package for Social Sciences (SPSS) version 20.0 (SPSS Inc. Chicago, IL, USA). Statistical methods were employed which

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included descriptive statistics; employing frequencies and percentages. The significance of association between variables was tested using Chi-square test. The level of significance of each test was set at $p < 0.05$. Frequency of responses to risk factors listed in the questionnaires were also determined and analyzed.

Figure 1: Map of Benue State showing the LGAs of Study (Shaded portions).

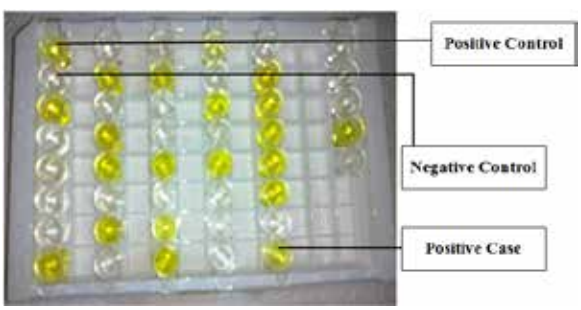

Plate 1: Microwells containing anti-*Giardia* antibodies - 96 test wells in a test strip Holder

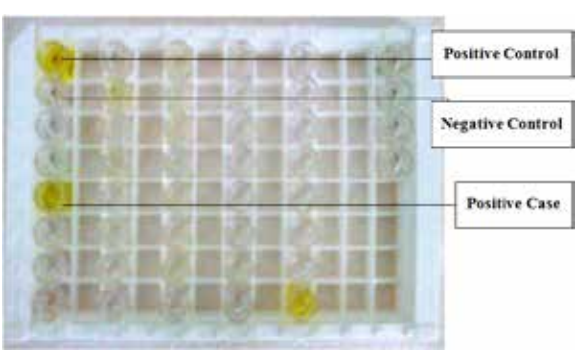

Plate 2: Microwells containing anti-*Cryptosporidium* antibodies - 96 test wells in a test strip Holder

Results

A total of 128 Children living in the orphanages in Benue State were sampled with prevalence of 43.8%; with 28.9% for *Gardia lamblia* only, 9.4% for only *Cryptosporidium parvum* while only 5.5% were positive for both *G. lamblia* and *C. parvum*. The highest prevalence 52.4% of enteric infection was found in the orphanages in Mkar and Otukpo but with a higher sample size in Mkar (42) than Otukpo (21). The least prevalence (30.0%) of enteric protozoan infection was recorded in Mama Abayol, Makurdi (**Table 1**).

Ages 0-2 had the highest prevalence (62.2%) of enteric protozoan infection followed by ages 3-5 with a prevalence of 44.0% but had same number of case, 11 with the other age groups (**Table 2)**.

Of the 128 sampled children living in the four orphanages in Benue State, 24.2% suck their fingers while 75.8% do not suck their fingers habitually as shown (**Table 3**). Children who suck their fingers habitually had higher prevalence (61.3%), while those who do not suck fingers habitually had higher number (37) of positive cases of infection. 51.6% of the sampled children who suck their finger habitually were found to be positive for *G. lamblia,* 6.5% positive for *C. parvum* and 3.2% were found to be co-infected with *C. parvum* and *G. lamblia.* These differences in the prevalence of the intestinal protozoan in respect to the habit of finger sucking were very significant (χ^2 = 10.283, df= 3, P= 0.016).

The result showed a highly significant (χ^2 = 18.308, df= 3, P= 0.000) difference in the prevalence of *G. lamblia* and *C. parvum* amongst the orphanages where domestic animals are been taking care of and those where there are none. Children living in orphanages where animals are domesticated had higher prevalence (48.0%) than those living where there are no such practices (30.0%) (**Table 4)**.

Discussion

This study recorded a high prevalence (43.8%) of some agents of diarrhoea among children living in the orphanages in Benue State. The result was in agreement with the work of Bailey *et al.*, 2013, which reported similar prevalence of pathogenic species of parasitic infection amongst children across four orphanages in three districts of Lima, Peru. The result of overall prevalence in this study is lower than those recorded by previous researchers in other orphanages. For example, Ogbe and Ado (1990) recorded 63.6% of helminthic infection in Isolo, Lagos; Saksirisampant *et al.* (2003) recorded 81.1% of intestinal parasites in Thailand; and Ozcelik *et al.* (1995) reported 94.0% in Turkey. These differences could be attributed to differences in factors such as personal hygiene, access to portable water, season of sampling, person-to-person contact, diagnostic technique employed (Nimri and Batchoun, 1994; Roy *et al.*, 2004), sample size, and the nature and types of parasites; since this study only reported the prevalence of *Giardia* and *Cryptosporidium* as agents of diarrhoea.

The result of this study was higher than the prevalence (20.7%) of helminthic infection in the orphanage in Benin, Nigeria (Nwaneri and Omuemu, 2012). This agrees with Saksirisampant *et al.*, 2003 who opined that the prevalence of helminthic infections is usually lower than the prevalence of protozoan infection. The differences could also be attributed to differences in climatic conditions, sensitivity of the diagnostic technique used, sample size, personal hygiene and sanitation (Nimri and Batchoun, 1994; Suman *et al.*, 2011).

Ages 0-2 Years had the highest prevalence (62.2%) of overall enteric protozoan infection among the children living in the orphanages in Benue State. This agrees with Saksirisampant *et al.* (2003) which reported a prevalence of 81.1% among children of 0-7 Years in an orphanage in Panthum, Thailand. This could be due to immature immunity, habit of always putting whatever is in their hands into the mouth, frequent contact with faeces, sharing things among themselves, and lack of exclusive breastfeeding (Dozie *et al.*, 2011; Suman *et al.*, 2011; Iboyi, 2012). Previous researchers (Nwabuisi, 2001; Mbanugo and Agu, 2006; Biu and Dauda, 2008; Dozie *et al.*, 2011; Júlio *et al.*, 2012) have also reported higher prevalence of parasitic infection among younger children. The steady decline in prevalence of *Giardia lamblia* with respect to increase in age of the children as reported in this study, agrees with the United State Environmental Protection

Agency (US EPA, 1999) report that transmission of giardiasis occur more among the children in day-care centres due to the high level of person-to-person contact and sharing of things among the children. Also, they stated that the immunity of a child matures as the child gets older.

The prevalence (61.3%) of overall intestinal protozoan infection recorded among children that practice finger sucking habitually, agrees with Idowu *et al.* (2011) that reported a prevalence of 80.0% among finger sucking children of primary school age, which could be due to the viability of oo(cyst) of protozoan parasites. The oocysts remain viable for up to 5-minutes on the surface of the hand and for about 45-minutes under the fingernails (Beaver *et. al.*, 1984). From personal observation, some of these children suck their fingers with so much dexterity and concentration that it had left the fingers pale. They could end up sucking in the pathogens stocked in their finger nails and get infected. Finger sucking could be responsible for the prevalence of agents of diarrhoea amongst children in the orphanages in Benue State.

Several studies (Ellingson *et al.*, 2000; Stricker *et al.*, 2002; Stansbery *et al.*, 2008) have investigated the function of thumb sucking, suggesting that this behaviour occurs primarily in the absence of social stimuli and may be automatically reinforced. Simplified habit reversal is a method which has been used to eliminate thumb sucking in developmentally typical children, and includes training the child to recognize when thumb sucking occurs, and to engage in a competing behaviour when thumb sucking is detected (Stansbery *et al.*, 2008).

Zoonosis is an infection or infectious disease transmissible under natural conditions from vertebrate animals to humans. Some researchers (Fang *et al.*, 1991; Glasser *et al.,* 1994; Huang and Whyte, 2006; Smith *et al.* 2007; Yoder *et al.* 2010) have discussed the potentials of *Cryptosporidium parvum* and *Giardia lamblia* as zoonotic diseases.

This study recorded a high overall prevalence (48.0%) of some agents of diarrhoea among children living in orphanages where animal husbandry/domestication is practiced. This agrees with Roy *et al.*, 2004 that reported that contact with calves constituted a significant risk factor in transmission of enteric parasites, and also with Dwivedi *et al.*, (2007). Ali and Hill (2003) also opined that children who live in households where there is a high intra/peri-domicilliary concentration of domestic animals were two to five times more likely to be infected compared with children who did not live in such households.

There was also a high prevalence (23.3%) of *Cryptosporidium parvum* among children living in orphanages where there was no practice of animal husbandry. This result disagrees with Nimri and Batchoun (1994) that reported high prevalence of *Cryptosporidium* among those who live in houses with animals inside or around. The disparity could be attributed to poor personal hygiene, poor sanitation, unhygienic water, and frequency/intensity of contact with human/animal faeces. Zoonotic transmission to humans occurs mainly through contact with water and/or food contaminated with faeces of infected domestic animal as a result of the persistence of the oocyst in the environment (Hunter and Thompson, 2005).

Considering the prevalence status of these agents of diarrhoea in the orphanages, finger sucking among the children should be disabused using simplified habit reversal method, while proper system of animal husbandry should be practiced for healthier living condition. Good personal hygiene should be encouraged in the orphanages so as to reduce the burden of pathogenic diseases.

Table 1: Prevalence of *G. lamblia* and *C. parvum* across the Orphanages using ELISA

ORPHANAGE	Total Examined	Number Positive			Total (%)
		G^+ (%)	C^+ (%)	G^+C^+ (%)	
GIDAN BEGE	35	5 (14.3)	4 (11.4)	5 (14.3)	14 (40.0)
MAMA ABAYOL	30	2 (6.7)	7 (23.3)	0 (0.0)	9 (30.0)
OTUKPO	21	11 (52.4)	0 (0.0)	0 (0.0)	11 (52.4)
MKAR	42	19 (45.2)	1 (2.4)	2 (4.8)	22 (52.4)
Total	128	37 (28.9	12 (9.4)	7 (5.5)	56 (43.8)

χ^2 = 35.866, df= 9, P= 0.000

Table 2: Prevalence of *G. lamblia* and *C. parvum* in respect to age groups.

AGE GROUP (Years)	Total Examined	Number Positive			Total (%)
		G^+ (%)	C^+ (%)	G^+C^+ (%)	
0-2	37	20 (54.1)	3 (8.1)	0 (0.0)	23(62.2)
3-5	25	10 (40.0)	0 (0.0)	1 (4.0)	11(44.0)
6-12	34	4 (11.8)	4 (11.8)	3 (8.8)	11(32.4)
13-19	32	3 (9.4)	5 (15.6)	3 (9.4)	11(34.4)
Total	128	37 (28.9)	12 (9.4)	7 (5.5)	56 (43.8)

χ^2 = 28.016, df= 9, P= 0.001

Key: G^+ = *Giardia lamblia*, **C^+** = *Cryptosporidium parvum,* χ^2 = Chi-square value,

df = degree of freedom, P = P-value.

Table 3: Results of *G. lamblia* and *C. parvum* Prevalence with Respect to Finger Sucking.

	Total Examined	Number Positive			Total (%)
		G^+ (%)	C^+ (%)	G^+C^+ (%)	
FINGER SUCKING	31	16 (51.6)	2 (6.5)	1 (3.2)	19(61.3)
NON FINGER SUCKING	97	21 (21.6)	10 (10.3)	6 (6.2)	37(38.1)
TOTAL	128	37 (28.9)	12 (9.4)	7 (5.5)	56(43.8)

(χ^2 = 10.283, df= 3, P= 0.016) **Key: G^+** - *Giardia lamblia*, **G^+** - *Cryptosporidium parvum.*

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Table 4: Results of *G. lamblia* and *C. parvum* Prevalence with Respect to Animal Husbandry.

	Total Examined	Number Positive			Total (%)
		G^+	C^+	G^+C^+	
ANIMAL HUSBANDRY (%)	98	35 (35.7)	5 (5.1)	7 (7.1)	47(48.0)
NO ANIMAL HUSBANDRY (%)	30	2 (6.7)	7 (23.3)	0 (0.0)	9(30.0)
TOTAL	128	37 (28.9)	12 (9.4)	7 (5.5)	56(43.8)

χ^2 = 18.308, df= 3, P= 0.000

Key: G^+ = *Giardia lamblia*, **C^+** = *Cryptosporidium parvum,* χ^2 = Chi-square value,

df = degree of freedom, P = P-value.

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