Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.5, No.23, 2015

Determination of Some Protozoan Agents of Diarrhoea and Their Relation with Socio-Economic Factors and Hygienic Habits in Orphanages in Benue State

ATU, Bernard Ortwer JIMOH, Patrick Ozaveshe
Department of Biological Sciences, Faculty of Sciences, Benue State University, P.M.B 102119 Makurdi, Nigeria

Abstract
This research adds to the shortfall in the research on the prevalence status and the actual agents of diarrhoea in the orphanages in Nigeria. This study was to determine the prevalence of *Giardia lamblia* and *Cryptosporidium parvum* as agents of diarrhoea in children living in the orphanages in Benue State and to determine the socio-economic factor(s) and hygienic habit(s) responsible for the prevalence of the parasites in orphanages in Benue State. Stools were collected from children (n=128) living in the four orphanages; Children of Mary Orphanage and Motherless Babies Home, Otukpo; Gidan Bege Orphanage Home, Makurdi; Mama Abayol Children's Home, Makurdi and N.K.S.T Orphanage Home, Mkar. The stools were screened using 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. Socio-economic factors such as age, gender, and sources of water were significantly ($P<0.05$) associated with the prevalence. While hand washing, an hygienic habit, also had significant ($P<0.05$) effect on the prevalence. Routine diagnosis of diarrhoeic stool specimens brought to the labouratories should include *Giardia* and *Cryptosporidium.* Proper hand washing and good personal hygiene should be encouraged in the orphanages so as to reduce the burden of pathogenic diseases.
Keywords: Diarrhoea; Socio-economic; Orphanage; Benue; ELISA

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). The incidence of diarrhoeal diseases varies greatly with the seasons and a child's age. The youngest children are most vulnerable: Incidence is highest in the first two years of life and declines as a child grows older (UNICEF/WHO, 2009).

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).

The frequency of infections may be related to the inadequacy of sanitation in the environment. In general, the infections are more common in developing countries but expanding poverty, urban migration, air travel and immigrant populations in conjunction with other societal and environmental changes make the distinction between tropical and western enteric diseases such as those caused by parasitic protozoans less clear cut than it has been in the past (Chalmers *et al,* 2011).

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). Studies on human parasitic infections have demonstrated a common relationship between parasitic infections and lower socioeconomic status of the region (Nematian *et al.*, 2004; Corrales *et al*., 2006; Balcioglu *et al.*, 2007; Kia *et al*., 2008).

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. There is paucity of published researches on the prevalence of intestinal protozoan in children living in orphanages in Nigeria. There are only two published researches (Ogbe and Ado, 1990; Nwaneri and Omuemu, 2012) on intestinal helminthiasis in orphanages in Nigeria. This research was therefore intended to add to the shortfall in this area. This study was to determine the prevalence of *Giardia lamblia* and *Cryptosporidium parvum* as agents

of diarrhoea in children living in the orphanages in Benue State and to determine the socio-economic factor(s) and hygienic habit(s) responsible for the prevalence of the parasites in orphanages in Benue State.

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 32,518km^2 (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.

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 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.

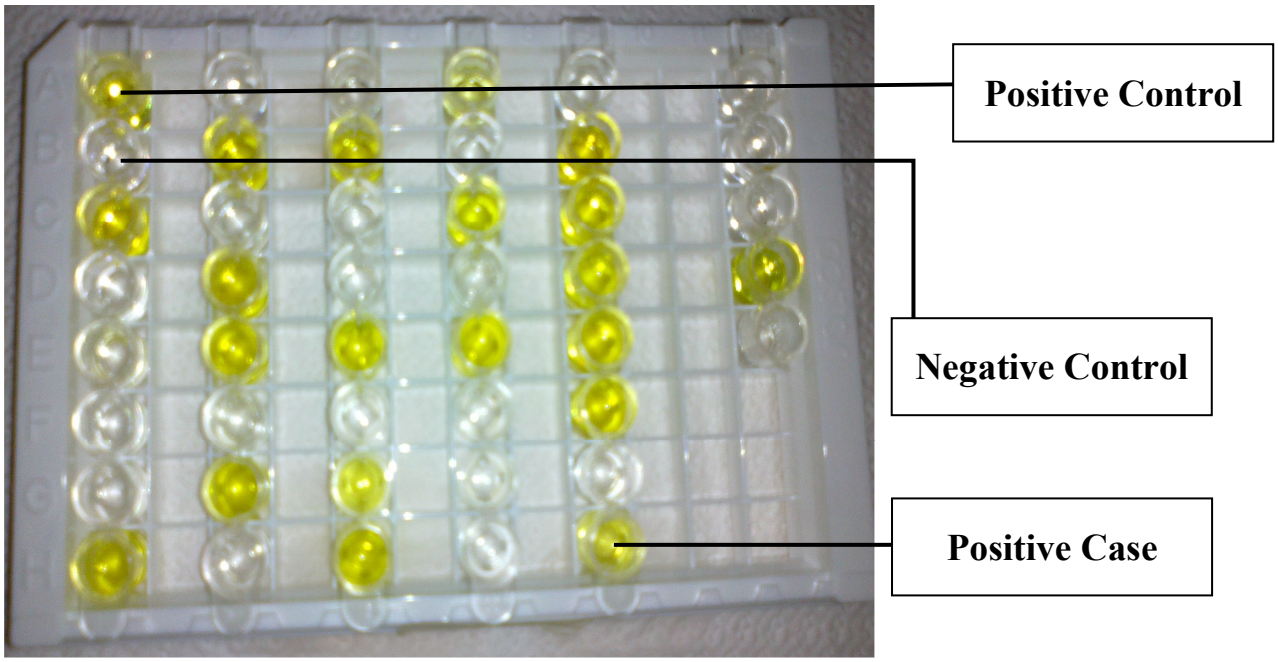

Plate 1: Microwells containing anti-*Giardia* antibodies - 96 test wells in a test strip Holder

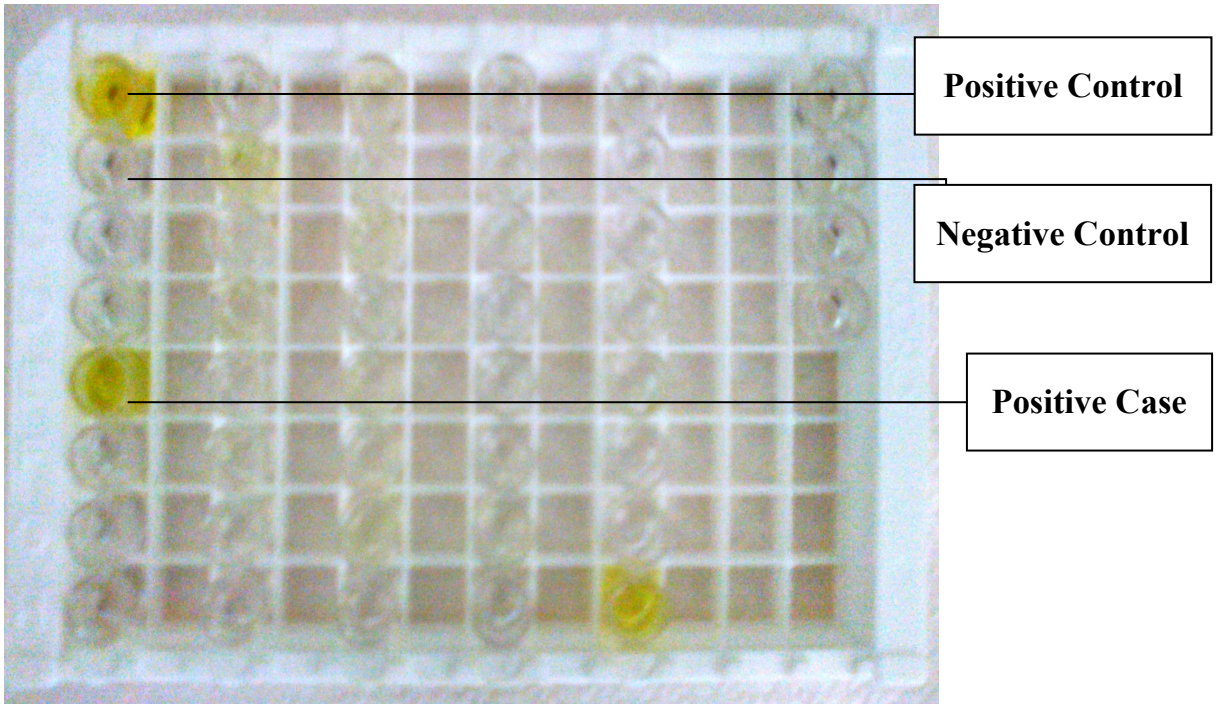

Plate 2: Microwells containing anti-*Cryptosporidium* antibodies - 96 test wells in a test strip Holder

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)**.

This study revealed that gender significantly affects the prevalence of parasites and recorded higher prevalence in the overall intestinal protozoan among the male children (46.3%) than the female children (39.6%) (**Table 3)**.

Table 4 shows that those who use private well had the highest prevalence (52.4%) of the enteric protozoan, while tank water users had the least prevalence (39.2%).

Children who do not often wash their hands after toilet had the highest prevalence (49.1%) of enteric infections while the least prevalence (36.5%) was recorded among those who wash their hands sometimes after toilet. However, the least number of cases (10) was recorded among those children who wash their hands most times after toilet (**Table 5**)

Discussion

This study recorded a high prevalence (43.8%) of some agents of diarrhoea among children living in the orphanages in Benue State. This 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 high prevalence among ages 0-2 years 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.

This result of higher prevalence record in male children than female children agrees with the research report of Lindo *et al.*, 1998; Dwivedi *et al.*, 2007; Amuta *et al.*, 2009; Inabo *et al.*, 2011; Suman *et al.,* 2011; Atu, 2012; Iboyi, 2012 and Júlio *et al.*, 2012. This higher prevalence could be attributed to behavioural differences in gender in terms of personal hygiene, sanitation, and recreational activities; as the male children go to play football and end up going to bed without a bath with soap and water. Unlike this result, some previous researchers (Sadjjadi and Tanidhe, 2005; Botero-Garces *et al.,* 2009; Garba and Mbofung, 2010; Inabo *et al.*, 2011) reported that there was no significance in the effect of gender on prevalence. Also, some previous researchers (Okafor and Okunji, 1990; Sherchand and Shrestha, 1996; Saksirisampant *et al.*, 2003) reported a higher prevalence in females than males. The personal hygiene and cultural & social practices of the study population differs and may be responsible for the difference (Amuta *et al.*, 2009).

Those using water from private well had the highest prevalence (52.4%) of infection by diarrhoeic agents, which could be attributed to contamination by surface run-offs, poor personal hygiene and unhealthy practices by users (Atu, 2012). This result agrees with previous researchers (Kramer *et al.*, 1996; Hunter, 1997; Barwick *et al.*, 2000).

The high prevalence (23.8%) of cryptosporidiosis among those who washed their hands most times, could be attributed to the practice of washing hands without soap (Atu, 2012) and sometimes hand washing is done with little quantity of water. Also, unkempt finger nails serve as reservoirs of these pathogens when the hands and nails are not properly washed with soap and rinsed thoroughly with water.

Socioeconomic factors such as gender, age, and water facilities; and hygienic habits such as hand washing after toilet strongly influenced the prevalence of some protozoan agents of diarrhoea in orphanages in Benue State. Children should be taught and encouraged to practice good hygiene always for healthier, safer orphanages.

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

ORPHANAGE	Total Examined	Number Positive For: G^+ (%)	C^+ (%)	G^+C^+ (%)	Total (%)
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)**

$\chi^2 = 35.866$, df= 9, P= 0.000

Key: G^+ = *Giardia lamblia*, **C^+** = *Cryptosporidium parvum,* No. = Number, χ^2 = Chi-square value, df = degree of freedom, P = P-value.

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

AGE GROUP (Years)	Total Examined	Number Positive For: G^+ (%)	C^+ (%)	G^+C^+ (%)	Total (%)
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)

$\chi^2 = 28.016$, df= 9, P= 0.001 **Key: G^+** - *Giardia lamblia*, **C^+** - *Cryptosporidium parvum.*

Table 3: Prevalence of *G. lamblia* and *C. parvum* in Relation to Sex Distribution.

SEX	Total Examined	Number Positive For: G^+ (%)	C^+ (%)	G^+C^+ (%)	Total (%)
MALE	80	19 (23.8)	11 (13.8)	7 (8.8)	**37(46.3)**
FEMALE	48	18 (37.5)	1 (2.1)	0 (0.0)	**19 (39.6)**
TOTAL	128	37 (28.9)	12 (9.4)	7 (5.5)	56 (43.8)

$\chi^2 = 10.755$, df= 3, P= 0.013 **Key: G^+** - *Giardia lamblia*, **C^+** - *Cryptosporidium parvum.*

Table 4: Results of *G. lamblia* and *C. parvum* prevalence in Relation to Water Source.

SOURCE OF WATER	Total Examined (%)	Number Positive For: G^+ (%)	C^+ (%)	G^+C^+ (%)	Total (%)
BOREHOLE	35 (27.3)	5 (14.3)	4 (11.4)	5 (14.3)	**14(40.0)**
PRIVATE WELL	42(32.8)	19 (45.2)	1 (2.4)	2 (4.8)	**22(52.4)**
TANK	51(39.8)	13 (25.5)	7 (13.7)	0 (0.0)	**20(39.2)**
TOTAL	128(100.0)	37 (28.9)	12 (9.4)	7 (5.5)	56(43.8)

$\chi^2 = 18.681$, df= 6, P= 0.005 **Key: G^+** - *Giardia lamblia*, **C^+** - *Cryptosporidium parvum.*

Table 5: Results of *G. lamblia* and *C. parvum* Prevalence with Respect to Hand Washing after Toilet.

	Total Examined	Number Positive For: G^+	C^+	G^+C^+	Total
MOST TIMES (%)	21 (16.4)	2 (9.5)	5 (23.8)	3 (14.3)	**10(47.6)**
SOMETIMES (%)	52 (40.6)	13 (25.0)	4 (7.7)	2 (3.8)	**19(36.5)**
SELDOM (%)	55 (43.0)	22 (40.0)	3 (5.5)	2 (3.6)	**27(49.1)**
TOTAL	128	37	12	7	56

$\chi^2 = 15.460$, df= 6, P= 0.017 **Key: G^+** - *Giardia lamblia*, **C^+** - *Cryptosporidium parvum*

References

Amuta, E.U., Olusi, T.A. and Homsou, R.S. (2009). Relationship of Intestinal Parasitic Infections among School Children in Makurdi, Benue State, Nigeria. *Internet Journal of Epidemiology*. 7(1): 11-16.

Atu, B.O. (2012). An Epidemiological Study of Protozoa Causing Diarrhoea in Parts 0f Benue State Using Microscopic and Rida® Quick Immunochromatographic Methods. Ph.D. Thesis. Ahmadu Bello University, Zaria, Nigeria.

Bailey, C., Lopez, S., Camero, A., Taiquiri, C., Arhuay, Y. and Moore, D.A.J. (2013). Factors associated with parasitic infection amongst street children in orphanages across Lima, Peru. *Pathogens and Global Health*; 107(2):52-57.

Balcioglu, I.C., Kurt, O., Limoncu, M.E., Dinc, G., Gumus, M., Kilimcioglu, A.A., Kayran, E. and Ozbilgin, A. (2007). Rural life, lower socioeconomic status and parasitic infections. *Parasitology Interntional*; 56:129-33.

Barwick, R.S., Levy, D.A., Craun, G.F., Beach, M.J. and Calderon, R.L. (2000). Surveillance for waterborne-disease outbreaks—United States, 1997–1998. *Morbidity and Mortality Weekly Report (*MMWR); 49(SS-4).

Beaver, P.C., Jung, R.C. and Cupp, E.W. (1984). Clinical Parasitology (9th Ed.) Lea and Fabinger, Philadelphia. 358p.

Biu, A.A., and Dauda, M. (2008). Prevalence study on enteric protozoans responsible for diarrhoea in patients attending Local Health Centres in Maiduguri, Nigeria. *International Journal of Biomedical and Health Sciences,* 4(1):29-32.

Boschi, P.C. (2009). 'The Global Burden of Childhood Diarrhoea', In: Ehiri, J.E., M. Meremikwu (editors), International Maternal and Child Health, pp. 23-48.

Botero-Garces, J.H., García-Montoya, G.M., Grisales-Patiño, D.G.M., Aguirre-Acevedo, D.C. and Álvarez-Uribe, M.C. (2009). *Giardia intestinalis* and Nutritional Status in Children Participating in the Complementary Nutrition Program, Antioquia, Colombia, May - October 2006. *Journal of the Institute of Tropical Medicine of Sao Paulo;* 51(3):155-162.

Chalmers, R.M., Smith, R., Elwin, K., Clifton-Hadley, F.A. and Giles, M. (2011). Epidemiology of anthroponotic and zoonotic human cryptosporidiosis in England and Wales, 2004-2006. *Epidemiology and Infections*; 139: 700–712.

Corrales, L.F., Izurieta, R. and Moe, C.L. (2006). Association between intestinal parasitic infections and type of sanitation system in rural El Salvador. *Tropical Medicine and International Health*; 2: 1821-31.

Dozie, I., Nkem, B., and Chukwuocha, U. (2011). Cryptosporidiosis in Imo State, Nigeria. *Journal of Rural and Tropical Public Health*, 10: 106 - 110.

Dwivedi, K.K., Prasad, G., Saini, S., Mahajan, S., Lal, S. and Krishan, U. (2007). Enteric opportunistic parasites among HIV infected individual: associated risk factors and immune status. *Japan Journal of Infectious Disease* 60: 76–81.

Garba, C.M.G. and Mbofung, C.M.F. (2010). Relationship between Malnutrition and Parasitic Infection among School Children in the Adamawa Region of Cameroon. *Pakistan Journal of Nutrition*. 9(11): 1094-1099.

Hula, M.A. (2010). Population Dynamics and Vegetation Change in Benue State, Nigeria. *Journal of Environmental Issues and Agriculture in Developing Countries;* 2(1): 53-69.

Hunter, P.R. (1997). Waterborne Disease: Epidemiology and Ecology. Wiley, Chichester, 128p.

Iboyi, E.A. (2012). Prevalence of *Entamoeba histolytica*, *Giardia lamblia* and *Cryptosporidium* species in Pre School Children With Diarrhoea In Anyigba, Kogi State, Nigeria. M.Sc. Thesis. Ahmadu Bello University, Zaria, Nigeria.

Inabo, H.I., Ya'u, B. and Yakubu S.E. (2011). Asymptomatic Giardiasis and Nutritional Status of Children in Two Local Government Areas in Kaduna State, Nigeria. *Sierra Leone Journal of Biomedical Research*, 3(3): 157-162.

Júlio, C., Vilares, A., Oleastro, M., Ferreira, I., Gomes, S., Monteiro, L., Nunes, B., Tenreiro, R. and Ângelo, H. (2012). Prevalence and risk factors for *Giardia duodenalis* infection among children: A case study in Portugal. *Parasites & Vectors*, 5: 22.

Kramer, M.H., Herwaldt, B.L., Craun, G.F., Calderon, R.L. and Juranek, D.D. (1996). Surveillance for waterborne-disease outbreaks—United States, 1993– 1994. *Morbidity and Mortality Weekly Report* (MMWR); 45(SS-1).

Lindo, J.F., Levy, V.A., Baum, M.K. and Palmer, C.J. (1998). Epidemiology of Giardiasis and Cryptosporidiosis in Jamaica. *American Journal of Tropical Medicine and Hygiene*; 59(5): 717–721.

Mbanugo, J.I. and Agu, V.C. (2006) Prevalence of *Crptosporidium parvum* infections in children, aged 0-15years, in Anambra State, Nigeria. *Nigerian Journal of Parasitology*; 26:1-5.

Nematian, J., Nematian, E., Gholamrezanezhad, A. and Asgari, A.A. (2004). Prevalence of intestinal parasitic infections and their relation with socioeconomic factors and hygienic habits in Tehran primary school students. *Acta Tropica*; 92:179-86.

Nimri, L.F. & Batchoun, R. (1994). Prevalence of *Cryptosporidium* Species in Elementary School Children. *Journal of Clinical Microbiology*, 32(4): 1040-1042.

Nwabuisi, C. (2001). Childhood Cryptosporidiosis and intestinal parasitosis in association with diarrhoea in Kwara State, Nigeria. *West African Journal of Medicine;* 20(2): 165 – 168.

Nwaneri, D.U. and Omuemu, V.O. (2012). Risks of intestinal helminthiasis in children living in orphanages in Benin City, Nigeria. *Nigeria Journal of Paediatrics*; 39(3): 118 – 123.

Nyagba, J. L. (1995). The Geography of Benue State. In Denga D. J. (ed.) Benue State the Land of Great Potentials: A Compendium. Calabar: Rapid Educational Publisher Limited, Nigeria.

Ogbe, M.G. and Ado, O.O. (1990). Intestinal helminthiasis in an orphanage in Nigeria. *Bioscience Research Communications*; 2:105-118.

Okafor, J.I. and Okunji, P.O. (1994). Cryptosporidiosis in patients with diarrhea in five hospitals in Nigeria. *Journal of Communicable Disease*. 26:75-78.

Ozcelik, S., Poyraz, O., Saygi, G. and Ozturkcan, S. (1995). Prevalance of Intestinal Parasites in Children of the Orphanage in Sivas, Turkey. *Indian Pediatrics*; 32: 230-232.

Roy, S.L., DeLong, S.M., Stenzel, S.A. and Shiferaw, B. (2004). Risk Factors for Sporadic Cryptosporidiosis among Immunocompetent persons in the United States from 1999 to 2001. *Journal of Clinical Microbiology*. 42(7): 2944–2951.

Sadik, A. (2010). Orphanage children in Ghana: Are their dietary needs met? *Pakistan Journal of Nutrition*; 9(9): 844-852.

Sadjjadi, S.M. and Tanidhe, N. (2005). Nutritional Status of Preschool Children Infected with *Giardia intestinalis. Iranian Journal of Public Health.* 34: 451-457.

Saksirisampant, W., Nuchprayoon, S., Wiwanitkit, V., Yenthakam, S. and Ampavasiri, A. (2003). Intestinal parasitic infections among children in an orphanage in Pathum Thani province. *Journal of the Medical Association of Thailand*; 86: S263-270.

Sherchand, J.B. and Shrestha, M.P. (1996). Prevalence of *Cryptosporidium* infection and diarrhea in Nepal. *Journal of Diarrhoeal Diseases Research;* 14:81–84.

Suman, M.S.H., Alam, M.M., Pun, S.B., Khair, A., Ahmed, S. and Uchida, R.Y. (2011). Prevalence of *Giardia lamblia* infection in children and calves in Bangladesh. *Bangladesh Society of Veterinary Medicine*, 9(2): 177 – 182.

United Nations Children's Fund (UNICEF, 2008a). State of the world children 2008- Child survival. Available in http://www.unicef/who. Accessed on 10/01/2014.

UNICEF (2008b). Orphan situation in Nigeria. UNICEF Press release 2008. Available in http://www.unicef/orphan_situation_in_nigeria.htm. Accessed on 10/01/2014.