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# STUDIES ON HELMINTHIC PARASITES ASSOCIATED WITH DIARRHOEA AMONG CHILDREN (LESS THAN FIVE YEARS OLD) IN TWO PUBLIC HEALTH FACILITIES IN MAKURDI METROPOLIS BENUE STATE NIGERIA

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ABSTRACT

This study investigated the helminthic parasitic infections associated with diarrhoeal diseases in under-five children in two public health facilities namely: Benue State University Teaching Hospital (BSUTH) and General Hospital (GH) in Makurdi, North Central Nigeria. A total of 400 children with diarrhoeal cases (0 – 4½ years) were sampled (220 at BSUTH and 180 at GH). Stool sample collection, preparation and parasitological examination of helminthic ova followed standard practices. Data were analysed on the SPSS for description and inferences at 95% confidence limit. Prevalence of diarrhoeal infection was 59.4 % at the GH and 54% at BSUTH. The overall prevalence in the study area was 56.5 %. Age 48-59 months was the most predominant (96.2 %) followed by those within 36-47 months of age (90 %). Helminthic infection associated with diarrhoeal cases was 25.3 % prevalent. Individual helminthic infections cases were higher at the BSUTH than at the General Hospital (GH) except in hookworm infection which was lower at the BSUTH (8.18%) than the GH (8.88%). In the overall, *A. lumbricoides* had the highest prevalence of 11.5% followed by hookworm (8.5 %) and *E. vermicularis* (5.3 %). Level of infection among the helminthes are significantly different (F=141.2, p=0.001). Helminthes were highly present within 36-47 month old children (7.5 % prevalent) followed by 24-35 months and 12-23 months (5.75 % prevalent each). Helminthes were more in female than in males but not significant ($\chi^2$ =0.09, p>0.05). A total of 101 intestinal helminthes were identifies from the stool culture. *Ascaris lumbricoides* was the dominant type (45 %). The infection is highly prevalent among children in the State regardless of the health facility type and sex of children (P>0.05) but age dependent (P<0.05). The information provided in this report is important in the prevention, control and management of diarrhoea among children in Benue State. The high prevalence of diarrhoea caused by helminthes calls for a quick intervention among stakeholders in addressing the problem

Keywords: Children, Control, Diarrhoea, Helminthes, Parasite, Prevalence

## INTRODUCTION

Intestinal parasitic infections (IPI's) caused by both pathogenic helminthes, bacteria, viruses and protozoan species are endemic throughout the world and are major health problems in developing countries (WHO, 2000). The distribution and occurrence of intestinal infections depend on socio-demographic variables associated with poverty (Sayyari *et al.*, 2005). Diarrhoea has been described as the passage of unusually loose or watery stools, usually at least three times within 24 hours period (Gimba *et al*., 2015). It results from an imbalance in the absorption and secretion properties of the intestinal tract, if the absorption decreases and secretion increases diarrhea results (Hungs, 2006). Diarrhoea had been reported to be a common symptom of gastrointestinal infection where most common bacterial, protozoans and helminthes are implicated (Gimba *et al*., 2015).

Diarrhoea is the most important public health problem connected to water and sanitation and can be both "waterborne" and "water-washed". In recent decades, a consensus developed that the key factors for the prevention of diarrhoea are sanitation, personal hygiene, availability of water and good quality

drinking water; and that the quantity of water that people have available for hygiene is of equal or greater importance for the prevention of diarrhoea as the bacteriological water quality (Hungs, 2006).

In Nigeria, the control of diarrhoeal disease (CDD), including promotion of Breast-feeding, oral rehydration therapy and specific health education are part of the National strategies aimed at improving the quality of life and reducing the burdens caused by diseases. Despite this fact, diarrheal disease is still the second leading cause of morbidity and mortality in children under- five years as well as in adults in Nigeria (Hungs, 2006). The World Gastroenterology Organization in 2012, reported that the prevalence of these etiologic agents varies with geographical areas, diarrhoea is commonly caused by protozoans, helminthes and bacteria than by virus in developing countries (WGO, 2012). The main aim of this study was to investigate the helminthic parasitic infections associated with diarrhoeal diseases in under-five children in two public health facilities in Makurdi, Nigeria.

## MATERIALS AND METHODS

**The Study Area**

The study was carried out at Benue State University Teaching Hospital and General Hospital, North Bank all in Makurdi, North Central Nigeria.

**Sampling Technique and Size**

The sample size was determined using the method of Krejcie and Morgan (1970) as given as;

$$n = \frac{N}{1+N(e)^2}$$

n = sample size; N = the finite population = 4,353,641; e = 0.05 (level of significance)

$$n = \frac{4,253,641}{1+4,253,641(0.05)^2} = 399.9 \approx 400$$

A total of 400 children with diarrhoea aged 0 – 59 months (0 – 4½ years) presenting to the study health facilities with diarrhoea (at least three loose stool or watery bowel movement per day), (whose parents/guardians gave consent to take part in the study and were not on antibiotics and antiparasitic treatments) were included. One hundred and eighty of the children (45%) were sampled from General Hospital North Bank. Two hundred and twenty (55%) were sampled from Benue State University Teaching Hospital, Makurdi.

**Collection of Stool Samples / Laboratory Analysis**

Stool samples were collected into clean, sterile sample bottles (universal bottles) and transported in an ice pack to the laboratory and investigated (Mulatu *et al.*, 2015). The methods used were Standard Smear Microscopy (Stool Microscopy) and Stool Culture by Cheesbrough (2006) adopted by Mulatu *et al.* (2015) and Preilla (2003). Direct wet mounts of the fresh stool samples were microscopically examined to detect the ova (eggs), larval cyst and other forms of the IPIs at 10x and 40x objective lens (Preilla, 2003). In the direct wet mount processing, a small amount of the stool sample was mixed with a drop of physiological saline using an applicator stick, covered with a cover slip and examined under the microscope.

**Identification of Parasites**

***Ascaris lumbricoides***

Demonstration of both fertilized and unfertilized eggs in stools samples was done through direct microscopy and concentration of the faeces by formalin-ether concentration. However, eggs may not be seen if only male worms are presence (Arora and Arora, 2012).

**Hookworm (*Ancylostoma duodenale* and *Necator americanus*)**

The eggs of *Necator americanus* are indistinguishable from those of *Ancylostoma duodenale* and their life cycle, pathogenicity and diagnosis are also similar. Demonstration of the characteristic eggs in the faeces is by direct microscopy or by concentration methods. Therefore, faecal egg count is important in identifying *A. duodenale* and assessment of the severity of cases. This also reflects the number of adult hookworms present. Adult female hookworms produce about 2,500 to 5000 eggs per day and this confirms both the presence of hookworm and the severity of infection.

**Analysis of Data**

Analysis of Data was done using SPSS (Statistical Package for the Social Science) 20.0 version and Minitab 16.0 version. Descriptive Statistics included: Measures of Central Tendency (The Mean Values), Computation of Percentages, Construction of Tables and Charts. Data were summarized accordingly. Inferences were drawn using Independent t-test, One Way ANOVA, Two Way ANOVA and Chi Square tests. Post Hoc analysis was also done using the

Games-Howell method. Confidence level used was 95% (P≤0.05).

## RESULTS AND DISCUSSIONS

The overall prevalence of the diarrhoeal infection in the study area is presented in Table 1. The infection level was 59.4 % at the General hospital while BSUTH had a prevalence of 54 %. The differences in the prevalence rate recorded in the two hospitals are not significant ($t = 0.89$, $p<0.05$) indicating that prevalence was the same in the two hospitals. The overall prevalence of diarrhoeal infection in the study area was 56.5 %. In terms of relative level of diarrhoea, age bracket 48-59 months was the most predominant (96.2 %) followed by those within 36-47 months of age (90 %). Patients below 23 months of age recorded fewer cases of the infection compared to the elderly children.

**Table 1: Prevalence of Diarrhoeal Infection Across the Health Facilities**

| **Age groups (months)** | **Number Examined** | | **Total number examined** | **Number infected** | | **Total prevalence (%)** |
|---|---|---|---|---|---|---|
| | Gen. Hosp | BUSTH | | Gen. Hosp | BUSTH | |
| **< 6** | 0 | 0 | 0 | 0 | 0 | 0(0) |
| **6-11** | 26 | 22 | 48 | 11 | 9 | 20(41.67) |
| **12-23** | 55 | 105 | 160 | 19 | 34 | 53(33.1) |
| **24-35** | 40 | 45 | 85 | 22 | 33 | 55(64.7) |
| **36-47** | 46 | 34 | 80 | 43 | 29 | 72(90.0) |
| **48-59** | 13 | 14 | 27 | 12 | 14 | 26(96.2) |
| **Total** | 180 | 220 | 400 | 107<br>59.4 % | 119<br>54 % | 226(56.50) |

Health facilities ($t = 0.89$, $p>0.05$)

Helminthic infection associated with diarrheal cases was 25.3 % prevalent in the study area as shown in table 2. Infection was 25.59% at the General Hospital and 25.08% at the BSUTH. Individual helminthic infections cases were higher at the BSUTH than at the General Hospital (GH) except in hookworm infection which was lower at the BSUTH (8.18%) than the GH (8.88%) In the overall, *A. lumbricoides* had the highest prevalence of 11.5% followed by hookworm (8.5 %) and *E. vermicularis* (5.3 %) as given in table 3.The infection levels of the three helminthes associated with diarrhea are significantly different ($F=141.2$, $p=0.001$).

**Table 2: Prevalence of Helminthes Infection Associated with Diarrhoea Across the two Health Facilities in Makurdi**

| | **No of Children Infected** | |
|---|---|---|
| **Helminthe parasites** | **General Hospital (%)** | **BSUTH (%)** |
| **Hookworm** | 16(8.88) | 18(8.18) |
| ***Enterobius vermicularis*** | 9(5) | 12(5.45) |
| ***Ascaris lumbricoides*** | 21(11.7) | 25(11.36) |
| **Total** | **46(25.59)** | **55(25.08)** |

Helminthes ($F = 141.15$, $p = 0.001$, $p< 0.05$)

**Table 3: Infectious Agents Identified in Diarrheic Faeces of Under-Five Children in Makurdi the two Health Facilities**

| Causative agents | Pathogen | Frequency | Percentage (%) |
|---|---|---|---|
| **Parasitic Helminthes** | Hookworm | 34 | 8.5 |
| | *Enterobius vermincularis* | 21 | 5.25 |
| | *Ascaris lumbricoides* | 46 | 11.5 |
| **Sub-Total** | | 101 | 25.25 |

Table 4 shows the distribution of intestinal helminthes of diarrhoeal children across the two hospitals in relation to age and sex. Helminthes were highly present within 36-47 month old children (7.5 % prevalent) followed by 24-35 months and 12-23 months (5.75 % prevalent each). The level of the parasite declined within 48-59 months old children (4 %). Only children above 6 months old had cases of intestinal helminthes parasites. Statistically, helminthes level was associated with age groups of children ($\chi^2$ =43.9, p<0.05). Helminthes level was higher in female than in males but the differences are not significant ($\chi^2$ =0.09, p>0.05). A total of 101 intestinal helminthes were identifies from the stool culture as shown in table 5. *Ascaris lumbricoides* and Hookworm were the dominant groups (45 % and 33.7 % respectively). *Enterobius vermicularis* was less than 1 % of the total helminthes identified.

**Table 4: Distribution of Intestinal Helminthes from Stool Samples of Under-Five Children in Makurdi Across the two Health Facilities in Relation to Age and Sex**

| Age group (months) | Sex (M/F) M | F | No. of Helminthes (%) | GH (%) | BSUTH (%) |
|---|---|---|---|---|---|
| **< 6** | 0 | 0 | 0(0) | 0(0) | 0(0) |
| **6 - 11** | 4 | 2 | 6(1.5) | 3(0.75) | 3(0.75) |
| **12 - 23** | 12 | 11 | 23(5.75) | 8(2) | 15(3.75) |
| **24 - 35** | 9 | 14 | 23(5.75) | 9(2.25) | 14(3.5) |
| **36 - 47** | 14 | 19 | 33(7.5) | 18(4.5) | 15(3) |
| **48 - 59** | 10 | 6 | 16(4.0) | 7(1.75) | 9(2.25) |
| **Total** | **49** | **52** | **101(24.5)** | **45(11.25)** | **56(13.25)** |

Age:$\chi^2$= 43.9, p < 0.01 (Association exists)

Sex: $\chi^2$ = 0.09, p > 0.05 (No association

**Table 5: Distribution of Intestinal Helminthes Identified from Stool Samples of Under-Five Children in Two Health Facilities in Makurdi**

| Helminth type | Number Identified | Percentage per total No. of each helminthes Identified |
|---|---|---|
| **Hookworm** | 34 | 33.7 |
| ***Ascaris lumbricoides*** | 46 | 45 |
| ***Enterobius vermicularis*** | 21 | 0.8 |
| **Total** | **101** | **100** |

F = 141.15, p < 0.05: Distribution is not the same

Table 6 shows the distribution of parasitic helminthes across the age groups of children. Parasites were not observed in less than 6 months of age. Age 6-11

had all the three helminthes types with a total of 6 cases, hookworm being the most dominant (3 cases). In age 12-23 months, the number of helminthes cases increased to 26 where hookworm was still dominant (10) followed by *A. lumbricoides* (9). Age 36-47 months recorded the highest cases of intestinal helminthes (40) with *A. lumbricoides* (19) as the dominant species.

**Table 6: Distribution of Parasitic Helminthes by Age Group**

| Age in months | Hookworm | | *E. vemicularis* | | *A. lumbricoides* | |
|---|---|---|---|---|---|---|
| | Pos | Neg | Pos | Neg | Pos | Neg |
| **< 6** | 0 | 0 | 0 | 0 | 0 | 0 |
| **6 - 11** | 3 | 31 | 1 | 20 | 2 | 44 |
| **12 - 23** | 10 | 24 | 7 | 14 | 9 | 37 |
| **24 - 35** | 8 | 26 | 6 | 15 | 8 | 38 |
| **36 - 47** | 7 | 27 | 4 | 17 | 19 | 27 |
| **48 - 59** | 6 | 28 | 3 | 18 | 8 | 38 |
| **Total** | 34 | 136 | 21 | 84 | 46 | 184 |

The present study has successfully reported the prevalence of diarrhoea and the associated helminthic parasites among children less than 5 years of age across two major public health facilities in Benue State. The reported diarrhoeal prevalence rate of 56.5% was quite high. This might be responsible for high rates of infants mortality in the study area and by extension, Nigeria (Ifeanyi *et al.*, 2009) considering the present outcome. This aligns with previous reports on high prevalence of diarrhoea among children across different parts of Nigeria (Ogbu *et al*., 2008; Abdullahi *et al*., 2010; Sule *et al*., 2011; Okolo *et al*., 2013) and outside Nigeria (Vargas *et al*., 2004; Reither *et al*., 2007).

Children within age range of 24-47 months are most vulnerable to diarrhoea while those below this age range are less vulnerable. Results have shown high cases of the three functional helminthic pathogens within this age. This could be attributed to the care and attention given to newly born infants most especially in the feeding practices (Okolo *et al*., 2013). It takes about 12 months to practice exclusive feeding or 6 months with supplemented baby foods as advised by the WHO (2000). If this is the case, children undergoing breastfeeding might have developed some levels of immunity against entero-pathogens associated with diarrhoea. This is because the breast milk contains some hormones and nutrients that activate the immunoglobulin cells for optimal functions (Abdullahi *et al*., 2010). Moreover, the present study has established a connection between diarrhoeal cases among children and breastfeeding practices of the mother.

According to Patwari *et al*. (1993), most diarrhoea episodes occur during the first 2-3 years of life due to combined effects of declining levels of maternally acquired antibodies, the lack of active immunity in the infant, the introduction of food that may be contaminated with faecal entero-pathogens and direct contact with human or animals faeces when the infant starts to grow.
Helminthic infection associated with diarrhoeal cases is 25.3 % prevalent. All the three helminthes (*A. lumbricoides*, hookworm and *E. vermicularis*) are highly implicated. This outcome agrees with other views. According to Bethony *et al*. (2006), of particular worldwide important helminthes are the roundworms (*Ascaris lumbricoides*), whip worms (*Trichuris trichiuria*), and hook worms (*Necator americanus* or *Ancylostoma duodenale*). Considering the health implications, the WHO (2000) passed a resolution urging member state to control the morbidity of soil transmitted helmintic infections through large-scale use of antihelmintic drugs for school-aged children in less developed countries.

The present results have confirmed theoretical affirmations on the epidemiology of diarrhoea that the infection is an important public health problem connected to water and sanitation and can be both “waterborne” and “water-washed. This is because all functional entero-pathogen identified and listed above are capable of causing serious health problem individually as water or food borne pathogens (Hungs, 2006). According to Ifeanyi *et al*. (2009), characterization of the enteropathogens involved in diarrhoeal diseases is an essential step towards the implementation of effective primary health care activities against the disease (Ifeanyi *et al*., 2009). Functional types of entero-pathogens characterized in this study aligned with previous reports in Nigeria, though with minor variation in prevalence (Ogunsanya *et al*. 1994, Olowe *et al*. 2003). However, studies in Asia revealed minor differences in functional types of enteropathogens associated with diarrhoea, notably *Campylobacter* and Rotavirus. This suggests that complications arising from diarrhoea may be linked to different groups of pathogens as well as geographical locations (WGO, 2012).

In the present outcome, the results of diarrhoeal cases obtained from the two health facilities in Benue State are consistently the same as backed up by statistical inferences meaning there are no significant differences between the two health facilities. This confirms that the infection is rampant among children in the State regardless of the health facility consulted. Also the infection is not linked to the sex of the children as male and females are equally vulnerable.

## CONCLUSION

The overall prevalence of diarrhoeal infection in the study area was 56.5%. Bacteria (20 %), protozoa (11.25 %) and helminthes (25.3 %) are important groups of pathogens associated with diarrhoea.The three implicated helminthes are: *Hookworm, Enterobius vermicularis* and *Ascaris lumbricoide*. Diarrhoeal cases are associated with age of children. Sex of children is unconnected with predisposition to this disease. The information provided in this report is important in the prevention, control and management of diarrhoea among children in Benue State. The high prevalence of diarrhoea caused by helminthes calls for a quick intervention among stakeholders in addressing the problem

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