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ORIGINAL ARTICLE

Prevalence of Intestinal Parasitic Infections and their Association with Nutritional Status of Rural and Urban Pre-School Children in Benue State, Nigeria

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ABSTRACT

Background and Objectives: Intestinal parasitic infections are highly prevalent in developing countries, contributing to high incidence of malnutrition and morbidity. This study aimed to find the prevalence of intestinal parasitic infections and their association with nutritional status of children in Benue State, Nigeria.

Methods: A cross sectional study conducted from January-June 2016, among 418 school children under-5 years of age. Anthropometric data, height-for-age, weight-for-height, and weight-for-age Z-scores from each child and fecal samples were collected and screened for intestinal parasites using standard laboratory methods.

Results: Among the intestinal parasitic infections detected, the prevalence of *E. histolytica* was higher (51.0% and 29.0%) than all other parasites encountered in rural and urban pupils (P<0.05). Other parasites were Hookworm (46.2% and 24.8%); *G. lamblia* (11.5% and 8.6%); and *T. trichiura* (2.4% and 5.2%). The prevalence of stunting (HAZ<-2), in rural and urban pupils were 43.8% and 32.9%; 64.4% and 39.0% rural and urban pupils were underweight (WAZ<-2), while 30.3% and 24.3% were wasted (WHZ<-2). Infected children had significantly (P<0.05) higher z-scores than the uninfected children.

Conclusion and Global Health Implications: Benue State is among the Nigerian states with the highest burden of tropical diseases with a current plan of elimination implemented through mass drug administration. This study identify/evaluate some essential information that will support the planning and implementation of the State's ongoing efforts.

Key words: Intestinal Parasites • Nutritional Satus • Preschool Children • Rural-urban • Benue State-Nigeria

1. Introduction

Hundreds of thousands of avoidable deaths are caused each year by parasitic infections, particularly the intestinal helminthes, and these infectious diseases affect the nutritional status of most children under the age of five.[1] It has been estimated to affect about 3.5 billion people globally and caused morbidity in approximately 450 million people.[1] Developing countries are the most affected, majority being school children because of their typical hand-mouth activity, uncontrolled fecal activity and their immature immune systems. The climatic conditions in this part of the world favor the development and survival of these parasites, the high prevalence in a region results to infection and diseases that are the immediate causes of malnutrition and death in young children.[2] Records show that a global estimate of 162 million under-five years old children are documented to be stunted, 99 million underweight and 51 million wasted.[3] A silent emergency already exists in Nigeria, as the country has extremely poor nutritional indices: stunting 37%, underweight 29% and wasting 18%.[4]

Diarrhea is the second leading cause of death among children under five in Nigeria after malaria.[5] *E. histolytica, G. lamblia, N. americanus, A. doudenale,* hookworm, ascariasis and trichuriasis are the other common intestinal parasitic infections in Benue State, Nigeria.[6] The incidence of the disease varies greatly with seasons and a child's age; the youngest children are most vulnerable, due to poor environmental sanitation and contamination of water.[7] Malnutrition and intestinal parasitic infections are common public health problems of children in Nigeria. These parasitic infections have detrimental impact on host nutritional status in several ways, they can depress appetite and food intake, compete for micronutrients, or blood loss resulting in the loss of iron, diarrhea, vomiting, dehydration, weight loss and growth retardation, fever, school attendance, physical activity and cognitive performance of school age children.[8-11] Thus, the objective of this study was to determine the prevalence of intestinal helminthic infections and assess the nutritional status of pre-school aged children in communities of Gboko Local Government Area of Benue State in Nigeria's Middle Belt region.

2. Methods

2.1. Study sites

The present research was a cross sectional study conducted from January-June 2016, among 418 school children under the age of five living in Gboko. The area covers a land mass of 2,264 square kilometers with a population of 361,325 people according to 2006 Nigeria census. On the geo-political map of Nigeria, the area is located between Latitude 630° and 810° north of the Equator and Longitudes 8° and 10° east of the Greenwich Meridian.

2.2. Subjects

A multistage sampling was used to select samples. The 17 council wards in Gboko Local Government Area (LGA) were clustered into districts. Five (5) council wards from the LGA were selected randomly. A list of certified primary schools was obtained from Benue State Ministry of Education, the schools in the randomly selected council ward (Gboko-north, Igorov, Mbadim, Ukpekper, Mbankur) were further clustered into urban and rural primary schools. These schools were further clustered into private and public schools in both urban and rural areas. In all, 4 schools were selected from a council ward (a private & a public school in both rural and urban areas of each council ward), making a total of 20 schools. Entirely, 422 pupils both boys and girls ranging from ages of 2-5 years were randomly selected. The actual size of those that participated in the research were 418 with 208 children from rural areas and 210 children from urban areas.

2.3. Ethical clearance

Before the commencement of the research, permission was obtained from the headmasters of all the schools including the pupil's parents/guardian. The study protocol was approved by the Benue state Ministry of Health's ethical committee with the reference number MED/156/VOL.1/56.

2.4. Anthropometric measurement

Anthropometric measurements such as height and weight were taken by a set of trained investigators following the internationally accepted standard

techniques.[12] Height and weight measurements were recorded to the nearest 0.1cm and 0.5kg respectively. Weight-for-height (WHZ), which was used to identify wasting in children, was computed for all boys and girls of ages 2-5 years. Height-for-age (HAZ) and weight-for-age (WAZ) ratios were used to diagnose children with stunted and underweight growth (<-2SD) respectively.[3,13]

2.5. Parasitological examination

Stool samples were collected in labeled screw capped plastic containers for parasitological examination within one hour of collection. All stool samples were re-examined microscopically using the formal ether concentration technique which is considered to be the most-sensitive method for most intestinal helminthes.[14]

2.6. Data analysis

SPSS windows version 21.0 was used for data analysis. Anthropometry indices were computed using the calculator mode of anthropometry calculating software program Epi Info version 6. Wasting, stunting and underweight were defined as Z score values of less than -2SD (Standard Deviation). Descriptive and inferential statistical tests were performed. The significance of the differences in frequency distribution was tested by using chi-square analyses. P-values less than 0.05 were considered statistically significant.

3. Results

The result presented below is the data for 418 pupils (208 rural and 210 urban) who returned stool sample and their anthropometric data were obtained. There were 103 males and 105 females for rural areas and 106 males and 104 females for urban areas. The subjects were grouped between 2-5 years with a mean age of 4.22 ± 0.81 years. Table 1 summarizes the prevalence of intestinal parasite in the pupils. Prevalence of infection was significantly (P<0.05) higher among the rural pupils than among the urban pupils. Prevalence of E. *histolytica* was higher in both rural (51.0%) and urban areas (29.0%) than all other parasites encountered in the study areas (P<0.05). Other parasites found in both rural and urban areas were Hookworm (46.2% and 24.8%); *G. lamblia* (11.5% and 8.6%); and *T. trichiura* (2.4% and 5.2%). The subjects co-infected with mixed species of parasites were (63.5% and 40.0%) in rural and urban pupils respectively (Figure 1).

There were significant relationships between intestinal parasitic infection and school types as well as the community (Table 2). Male and female pupils were equally likely to get a parasitic infection. The public school pupils were more infected with the parasites than the private school pupils (66.4% and 36.2%) and the pupils from the rural settings were more infected than those from the urban settings (63.5% and 39.5%).

Table 3 shows associations between the various risk factors and intestinal parasitic infections among

Table 1: Prevalence of intestinal parasites among children in rural and urban communities

Parasites	Rural children No (%) infected n=208	Urban children No (%) infected n=210	Total No (%) children infected n=418
E. histolytica	106 (51.0)	61 (29.0)	167 (40)
Hookworm	96 (46.2)	52 (24.8)	148 (35.4)
G. lamblia	24 (11.5)	18 (8.6)	42 (10.0)
T. trichiura	5 (2.4)	11 (5.2)	16 (3.8)
Mixed infection	132 (63.5)	84 (40.0)	216 (51.7)

Table 2: Prevalence of intestinal parasitic infection according to sex and school type in rural and urban communities

Variables	Helminthic Infection (%) Yes	No	Chi-square	p-value
Gender				
Male (209	114 (54.5)	95 (45.5)	1.62	P>0.05
Female (209)	101 (48.3)	108 (51.7)		
Community				
Rural (208)	132 (63.5)	76 (36.5)	23.96	P<0.05
Urban (210)	83 (39.5)	127 (60.5)		
School type				
Public (211)	140 (66.4	71 (33.6)	37.94	P<0.05
Private (207	75 (36.2)	132 (63.8)		

P<0.05 Statistically Significant

Table 3: Risk factors for intestinal parasitic infections

Variables	Rural n=208	%	Urban n=210	%
Drink water source				
Tap	74	35.6	149	71.0
Well	134	64.4	61	29.0
Type of toilet facility				
Water closet	69	33.2	164	78.1
Pit latrine	87	41.8	30	14.3
Bush	52	25.0	16	7.6
Type of floor				
Tiles	26	12.5	105	50.0
Carpet	40	19.2	26	12.4
Cement	63	30.3	79	37.6
Sand	79	38.0	0	0.0
De-worm last 6 months				
Yes	27	13.0	94	44.8
No	89	42.8	63	30.0
Never	92	44.2	53	25.2
Wash hands after toilet use				
Yes	32	15.4	56	26.7
No	176	84.6	154	73.3

the school pupils. Among all the potential risk factors explored, pupils from rural communities had the highest level of some risk factors that could easily result to infection. A total of 64.4% use well as their source of drinking water as against 29.0% in urban, 41.8% pupils in rural settings use pit latrine whereas only 14.3% in urban uses pit latrine, 38.0% pupil live in a house with sand as their type of floor as against 0.0% in urban areas and more importantly only 13.0% of the pupils in the rural area had been de-wormed in the 6 months preceding the study, 42.8% were not, while the remaining 44.2% had never been de-wormed. But in urban setting, 44.8% had been dewormed, 30.0% had not, and only 25.2% were never dewormed. The habit of washing hands after toilet use posed a problem in both rural and urban settings, 15.4% in rural settings still wash their hands while only 26.7% in urban settings do wash their hands after toilet use.

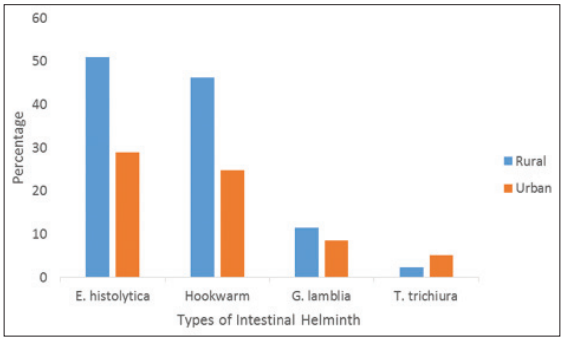

Figure 1: Prevalence of intestinal parasites among children in rural and urban communities

The overall prevalence of nutritional indicators below -2SD is presented in Table 4, the prevalance of stunting in rural and urban pupils were 43.8% and 32.9%; 64.4% and 39.0% rural and urban pupils were underweight while 30.3% and 24.3% were wasted. Rural children were significantly (P<0.05) more malnourished than urban children. Only *E. histolytica,* Hookworm and *G. lamblia* were significantly (P<0.05) associated with low height-for-age (stunting), weight-for-height (wasting) and weight-for-age (underweight).

4. Discussion

Generally intestinal parasitic infection are dangerous disease causing agents among school children ultimately resulting to malnutrition.[2] The prevalence of intestinal parasitic infection in this study (63.5%) in rural and (40.0%) in urban is lower (80.9% rural and 51.4% urban) than what was found by Opara *et al* in Eastern Nigeria,[2] and also the 75.7% found by Wosu *et al* in South Eastern Nigeria,[15] but higher than the 30.6% as reported by Adekunle et al, 45.5% that was reported by Emeka,[16] and the 52.0% reported by Adefioye *et al*.[17] These results evidently showed a high level of intestinal parasitic infection especially among the rural dwellers. Such prevalence has been attributed to ignorance, poverty, poor environmental and personal hygiene, shortages of clean potable water and indiscriminate defecation as most vegetable farmers use excreta as manure which is a veritable source of infection since children and

Table 4: Nutritional Status of Rural and Urban Children

Variables	Rural			Urban		
	HFA	WFA	WFH	HFA	WFA	WFH
	Stunting	Underweight	Wasting	Stunting	Underweight	Wasting
No. examined	208	208	208	210	210	210
No.below -2SD	91	134	63	69	82	51
% below -2SD	43.8%	64.4%	30.3%	32.9%	39.0%	24.3%
Mean Z-score	−1.869	−2.06	−1.72	−1.69	−1.81	−1.65
SD	0.64	0.73	0.75	0.68	0.78	0.71
Sex						
No.(%) of boys Below -2SD	50 (48.5)	74 (71.8)	36 (35.0)	40 (37.7)	44 (41.5)	23 (21.7)
No. (%) of girls Below -2SD	41 (39.0)	60 (57.1)	27 (25.7)	29 (27.9)	38 (36.5)	28 (26.9)

their mothers often go to the farm to tender to the vegetables.[18] Despite all these factors, the relatively high prevalence connotes continuous infection, re-infection and transmission of intestinal parasites. The commonest was the co-infection of *E. histolytica,* hookworm and *G. lamblia*. No individual had up to four parasites.

This present study recorded a high degree of malnutrition among the children investigated for intestinal parasitic infections. 64.4% of pupils in rural areas were found to be underweight whereas 39.0% in urban were underweight. This rate is similar to what was reported by Goon *et al*,[19] he reported 43% to be underweight in Benue State and Emeka[18] who reported 57.9%. Higher rates of underweight were however reported by Adekunle *et al*,[20] in rural and semi-urban communities of Osun State who reported 70.0% and 54.7% in the year 2015. These findings agree with the publication of other researchers.[8, 10] The high rate (>=30%) of stunting and underweight recorded in this study was due to high prevalence of *E. histolytica,* hookworm, *G. lamblia* and T. *Trichiura*. It has been documented by Crompton and Neisheimthat growth and development during childhood could be diminished by ascariasis, trichiuriasis and hookworm infection.[21]

Intestinal parasitic infections can cause vomiting, diarrhea, anorexia, abdominal pain and nausea that may result in reduced food intake, thereby further reducing nutrient availability hence contributing to undernutrition[22] therefore the government and other Non-governmental organizations (NGOs) involved in development should introduce adequate strategies to crisscross on personal and environmental hygiene, especially for the rural dwellers. There is also need for regular deworming of school-age children, especially those living in the rural communities. They should also design relevant policies or review existing ones in order to savage the situation because a greater proportion of the population still live in rural communities.[23]

5. Conclusions and Global Health Implications

The prevalence of intestinal helminthic infection in this study was high and was significantly associated with the nutritional status of the respondents. It was such that children with intestinal parasitic infections were more malnourished when compared with those with no infection. There is need for regular de-worming of preschool-age children, especially those living in the rural communities. Reducing the prevalence of parasitic infections in school children, may be of tremendous benefit on child growth, development and educational outcome.

Compliance with Ethical Standards

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Key Messages

- Intestinal parasitic infections prominently detected in Benue were *E.histolytica,* Hookworm*, G.lamblia, T.trichiura* and the prevalence of infection was significantly higher in rural than urban areas.
- Public school pupils were more infected with the parasites than the private school pupils.
- Among all the potential risk factors explored, pupils from rural communities had the highest level of some risk factors that could easily result to infections.
- The rural children were significantly more malnourished than urban children. Only *E.histolytica,* Hookworm, *G.lamblia* were significantly associated with stunting, underweight and wasting.

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