Asian Journal of Pharmaceutical and Health Sciences
www.ajphs.com

Intestinal Parasitosis Among Undernourished Children of an Urban Settlement in West Africa: Pattern and Types

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ARTICLE HISTORY

Received: 7-May-2011

Accepted: 21-Jun-2011

Available online: 10-Nov-2011

Keywords:

Children, Intestinal parasitosis, Undernourished

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ABSTRACT

Human intestinal parasites and malnutrition still constitute a major health challenge in several parts of sub-saharan Africa with the attendant clinical and social impact on the people. This study was set up to ascertain the level of intestinal parasitosis among undernourished children in Jos with a view of improving on the quality of their medicare. The study was hospital based. Children aged 6 to 70 months attending Paediatric clinic in Jos comprising 311 undernourished and 97 controls were consecutively recruited into the study. Relevant information on the subjects and their respective caregivers such as age, sex, occupation, educational levels and wealth index were obtained with the aid of structured questionnaires while stool samples were collected, stored and processed using standard methods to identify stool parasites. The incidence of intestinal parasites among the undernourished children was 63.3% compared to 22.7% among the control (P<0.001). The most common parasites recovered were *Entamoeba dispar* 27.6% (64), *Entamoeba coli* 19.7% (46), *Cryptosporidium parvum* 15.9% (34) and Hookworm 14.5% (34) while *Ascaris lumbricoides* 32.4% (15) was the commonest parasite recovered from the control group. Besides malnutrition, low educational levels, poor sanitary conditions, and obviously economic factors were all contributory to the high parasite burden. Health education on personal and environmental hygiene should be intensified and avenues to improve literacy levels pursued while mass chemotherapy with antihelminths be seriously considered in the interim.

INTRODUCTION

It is generally estimated that at least 2.5 billion of the estimated world's 6.9 billion people are currently infected with intestinal parasites cutting across all continents and regions of the world [1-3]. These parasites of which *Enterobius vermicularis, Giardia lamblia, Ancylostoma duodenale, Necator americanus* and *Entamoeba dispar* are generally the commonest globally and account for over 70% of the intestinal parasitic load in the tropical and sub-tropical regions of the world [4-6]. In some communities in sub-saharan Africa, infection rates as high as 70% of the entire population has been documented, thus still making the disease of serious public health importance due to its direct or indirect association with the prognostic outcome of several diseases [7,8].

The first global initiative to fight intestinal parasites was constituted by John D Rockefeller, a philanthropist per excellence in New York city through Rockefeller foundation's International Health Board (IHB) in 1909 who used the potentially poisonous oil of chenopodium to expel hookworm thought to responsible for the backwardness of then southern USA9. The outcomes generally beneficial were often disastrous with fatal outcomes. The activities of IHB were eventually taken over by the world health organization (WHO) in 1945 [9,10].

Presently the control of intestinal parasites has highly been decentralised to governmental and non-governmental organizations, international organizations, community-based organizations, health institutions, philanthropists and private individuals all working towards common goal to rid planet earth of the present parasite burden through health education, provision of quality water, improvement in personal and environmental hygiene as well as qualitative and quantitative food security [11-13].

Malnutrition has been adjudged one of the commonest childhood ailments in Nigeria and several parts of sub-saharan Africa and directly or indirectly accounts for most of the paediatric out patient presentations as well as admissions. It is also a fact that in most parts of sub-saharan Africa facilities for maternal and child both diagnostic and therapeutic are often in

short supply and facing various challenges of quantity and quality. The impact of HIV/AIDS on children has also been largely attributed to their nutritional status which influences the course and rate of progression of the disease. This makes malnutrition an important co-morbidity to several diseases of both adult and children [14-16].

A clear knowledge of the types of parasites prevalent among undernourished children would be useful in the management plan of medicare comprising nutritional and metabolic needs as well as a correct treatment of their infections and infestations especially in settings where facilities for comprehensive laboratory diagnosis may be lacking or in short supply [17-19]. It is in this regard that the present study was set up to assess the burden and types of intestinal parasites among undernourished children presenting at a University hospital in West Africa.

MATERIALS AND METHODS

Setting: The study was carried out in Jos, the capital city of Plateau state located in north central Nigeria between August and April 2009. Based on 2006 population census the city has an estimated population of 800,000 people and has a temperate-like climate with captivating hills surrounding it. Among several other large and small health institutions located in the city is the Jos University Teaching hospital (JUTH) which offers primary, secondary as well as tertiary healthcare to the people. JUTH is also a referral centre for neighbouring states such as Nasarawa , Benue, Gombe , Taraba and Federal Capital Territory Abuja.

Procedure: The study was carried out at the Jos University Teaching hospital (JUTH) on undernourished children who were between the ages of six months and five years old attending the Paediatric outpatient clinic or General outpatient clinic. Their nutritional status were assessed using weight – for – age, weight for height and height for age measurements. The measurements were expressed on standard deviations above or below the median value for corresponding sex and age of WHO reference population. Participation in the study was purely voluntary, verbal consent for participation was obtained from their mothers or accompanying adults. A questionnaire was administered on each participant and relevant information as age and sex of subjects, occupation of mothers or care givers and educational levels, methods for prevention of intestinal parasites, sources of drinking water and methods of sewage disposal were obtained [20].

Specimen Collection and Processing: A clean wide mouth, transparent, dry and disinfectant-free universal container was given to accompanying relations of undernourished children and the process of collecting stool specimen was explained to them. Each of the stool specimens was examined macroscopically and microscopically using saline preparation and Lugol's Iodine staining procedure for wet mount. Formal ether concentration technique was used as the concentration procedure. Samples were examined microscopically using X5 and X10 objective lenses and rarely X40. Parasite density in terms of their number per medium power (X10) field of uncentrifuged stool specimen and number of species per stool specimen were also noted. Another group of 97 children age and sex matched were consecutively selected as control group whose stool specimens were also collected and analysed microscopically[20,21].

Analysis of Results: Data obtained was analysed using Pearson Chi square, Mantel-Haenszel Chi square, Regression and Analysis of variance (ANOVA) where applicable, P values were considered significant at 95% confidence interval.

Ethical Considerations: Ethical approval for the study was obtained from the Institutional Health Research ethical committee of the Jos university teaching hospital (JUTH) Jos. Verbal or written consents were obtained from informants of subjects for the study before voluntary enrolment.

RESULTS

A total of 311 undernourished children were studied comprising 150 males (48.2%) and 161 females (51.8%). The age range of the subjects was Six to Seventy months with mean age of 26 months, median age of 40 months and modal age of 29 months old. The incidence of intestinal parasites among the undernourished children was 63.3% (197/311) while that among the nourished children was 22.7% (22/97) {X^2 (Mantel-Haenszel)= 17.44, OR= 0.60, RR= 0.71, P< 0.0001}.

Analysis of age and gender distribution of intestinal parasites among undernourished children in Jos showed that the age range with the lowest rate of infection was those aged less than 10 months old {1 (11.1%) male and 2 (22.2%) females} with no significant age association (P> 0.05). Similarly, the rate of infection among males was 72.6% (109/150) and that among females was 54.7% (88/161) with no significant gender difference (P> 0.05) (Table No.1).

The most common parasites recovered from stool specimens of undernourished children were *Entamoeba dispar* 27.6% (64), *Entamoeba coli* 19.7% (46), *Cryptosporidium parvum* 15.9% (34) and Hookworm 14.5% (34). Others were Giardia lamblia 10.5% (24), Ascaris lumbricoides 9.2% (21) and Trichuris

Table No.1: Age* and gender** distribution of intestinal parasites among undernourished children in Jos, Nigeria (N=311).

Age (Months)	Parasites Present		Parasites Absent		Total
	Male (%)	Female (%)	Male (%)	Female (%)	
=10	1 (11.1)	2 (22.2)	3 (33.3)	3 (33.3)	9
11-20	11 (25.6)	14 (32.6)	9 (20.9)	9 (20.9)	43
21-30	47 (50.5)	17 (18.3)	16 (17.2)	13 (14.0)	93
31-40	19 (39.6)	22 (45.8)	2 (4.2)	5 (10.4)	48
41-50	10 (27.0)	12 (32.4)	6 (16.2)	9 (24.3)	37
51-60	8 (30.8)	10 (38.5)	2 (7.7)	6 (23.0)	26
61-70	13 (23.6)	11 (20.0)	3 (5.5)	28 (50.9)	55

Key:

*X^2 (Pearson's)= 70.0, df=66, 95% CI -AS (2-Sided) P=0.345

**X^2 (Mantel-Haenszel)= 1.36, OR= 2.09, RR= 1.54, P= 0,24.

trichiura 2.6% (6). *Ascaris lumbricoides* 32.4% (15) was the commonest parasite recovered from the control group (Table 2).

A review of the species of parasites per stool sample among the infected undernourished subjects showed that 74.1% (164) were infected with one parasite species, 16.3% (32) with two parasite species, and 9.6% (19) with three or more parasites species. Multiple intestinal parasite infections were not common findings among the nourished children {X^2 (Mantel-Haenszel)= 19.34, OR= 0.71, RR= 0.92, P< 0.0001}(Figure 1).

Analysis of the socio-demographic factors associated with intestinal parasites among undernourished children showed that knowledge of methods of prevention, methods of sewage disposal, educational levels of mothers or care givers and wealth index were important contributory factors towards infection (P< 0.05). Also occupations of mothers or care givers such as petty trading, artisans and farming were associated with significantly higher rates of infection among their children compared to others like civil servants and health workers (P< 0.05) (Table 3).

Table No.2: Parasites recovered from stool specimens of undernourished children at Jos, Nigeria (N=232).

Parasites	Frequency	Percent (%)
Entamoeba dispar	64	27.6
Entamoeba coli	46	19.7
Cryptosporidium parvum	37	15.9
Hookworm	34	14.5
Giardia lamblia	24	10.5
Ascaris lumbricoides	21	9.2
Trichuris trichiura	6	2.6
Total	232	100

NB: There were cases of multiple intestinal parasite infestation.

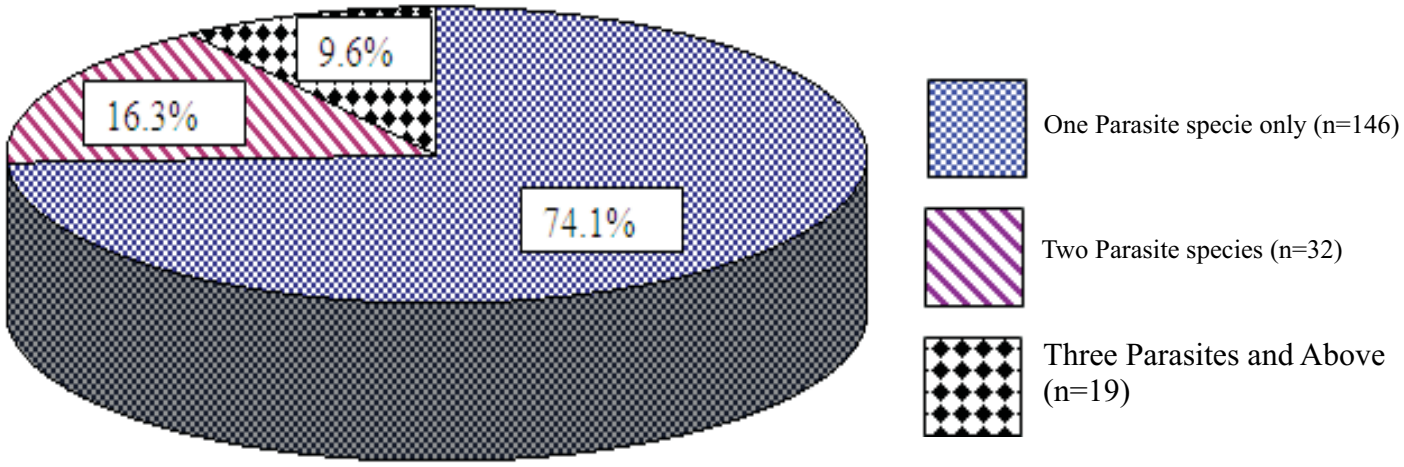

Fig. 1: Number of parasite species per stool sample among undernourished children in Jos, Nigeria

DISCUSSION

The incidence of intestinal parasites infestation among undernourished children in Jos was 63.3% while that among the control was 22.7% (P< 0.05). Methods of sewage disposal such as trenches, open air defaecation, low educational levels of care givers, inadequate knowledge about the prevention of intestinal parasites and economic factors were found to be important contributory factors to the high rate of infection (P< 0.05). Sources of drinking water being either tap, bore hole, shallow well or stream did not significantly influence the rate of infestations (P> 0.05). The most common parasites recovered from stools of malnourished children were *Entamoeba dispar* 27.6%, *Entamoeba coli* 19.7%, Hookworm 14.5% while *Trichuris trichiura* 2.6% was the least common. These findings have shown that intestinal parasitic infections are still of serious public health importance in the community, undernutrition further worsening the impact of the disease.

The findings from the present study compares well with that from related studies in Onitsha, Ondo and Lagos in Nigeria where infection rates of 44.5%, 40.9% and 70.6% were respectively documented [22-24]. Also similar high rates of 57.0% and 95.0% were respectively reported from separate studies in Guinea and South African rural dwellers [25-26]. The combined effect of water and environmental sanitation on high intestinal parasitic load among Africa's both urban and rural dwelling children has elaborately been documented. The fact that quality and sources of water for domestic use in the present study had little impact on intestinal parasite load shows that more needs to be done in the area of public enlightenment on the benefits derivable from quality water utilization. Also other factors such as sewage disposal facilities and occupational inclinations of children's care givers could have masked the potential benefits of quality water supply.

With the high rate of intestinal parasites among undernourished children in the present study, dieticians and clinicians while attending to this group of children should as well emphasise important components of personal hygiene such as frequent hand washing, washing of all fruits and vegetables with clean water before eating raw as well as boiling and filtering of water before drinking. This would reduce the general parasite load among children generally including the undernourished one who bear a greater brunt of the disease [27-29].

Table No.3: Socio-demographic factors associated with intestinal parasites among undernourished children in Jos, Nigeria.

Parameter	Parasites present (%)	Parasites absent (%)	Total(%)	P Values
Methods of Prevention				**< 0.05**
Nil	121 (82.3)	26 (17.7)	128	
One method	54 (59.3)	37 (40.7)	77	
Two and Above	22 (30.1)	51 (69.9)	59	
Sources of domestic water			47	**> 0.05+++**
Tap Water	53 (51.6)	33 (38.4)	86	
Well water	62 (54.8)	51 (45.2)	113	
Stream/River	82 (23.2)	38 (26.8)	112	
Methods of Sewage Disposal				**< 0.05**
Water system	32 (34.8)	60 (65.2)	92	
Pit Latrine/ Trenches	126 (75.9)	40 (24.1)	166	
Trenches/Open air defaecation	39 (75.0)	13 (25.0)	52	
Educational level of mothers*				**< 0.05**
Nil	51 (75.0)	17 (25.0)	68	
Primary	53 (73.6)	19 (26.4)	72	
Secondary	69 (60.5)	45 (39.5)	114	
Tertiary	24 (42.1)	33 (57.9)	57	
Wealth Index of Family				**<0.05**
First Quartile	93 (72.7)	35 (27.3)	128	
Second Quartile	52 (67.5)	25 (32.5)	77	
Third Quartile	33 (55.9)	26 (44.1)	59	
Fourth Quartile	19 (40.4)	28 (59.6)	47	
Occupation of Mothers*				**†= P < 0.05**
Civil servant	5 (21.7)	18 (78.3)	23	
Petty Trading†	23 (62.1)	14 (37.9)	37	
Artisans†	9 (52.9)	8 (57.1)	17	
Business	4 (19.0)	17 (81.0)	21	
Health Worker	1 (11.1)	8 (89.9)	9	
Military/Paramilitary	4 (33.3)	8 (66.7)	12	
Applicant†	87 (82.1)	19 (17.90	106	
Farming†	64 (74.4	22 (25.6)	86	

NB: Information were obtained from accompanying informants
*= or child's care giver

The findings from the present study are partly different from that of: Adamu in Ethiopia [30] where parasites such *Blastomycis hominis*, *Hymenolepsis nana* and *Encephalitozoon intestinalis* were recovered from children with diarrhoea; Ogbonna, et al. in Nigeria [31] where *Ascaris lumbricoises* was the most frequently recovered parasite in stool specimens of under fives; Phiri in Malawi [32] and Mascarini - Serra et al. in Brazil[33] where *Ascaris lumbricoides* was among the commonest parasites

recovered; and Mahdi in Iraq [34] where *Crytosporidium parvum* was recovered from over 50% of animal handlers. The high rate of *C. parvum* and *Isospora belli* recorded in Ghana [35] and Ethiopia [36,37] is understandably from HIV/AIDS patients. Besides the geographical species variations and morbid and pre-morbid conditions associated with intestinal parasitosis, the disease burden is generally high across entire sub-saharan Africa [38-40].

The present study is limited by the fact that the HIV-serostatus of the subjects was not ascertained so as to appreciate its contributory role. This is well noted although studies have shown that intestinal parasite load is not significantly higher in HIV-seroconverted carriers whose immune status is still intact compared to the HIV-seronegative subjects [41-43].

Recommendations

Due to the porous knowledge about prevention of intestinal parasites public enlightenment should be intensified with emphasis on regular hand washing, boiling of drinking water as well as proper ways of sewage disposal. Government and other voluntary organizations should build public toilets in the city's strategic locations with proximity gauged to serve the sanitary needs of the people. Provision should be made for their regular maintenance and the public encouraged to use them at minimal or no cost. Strategies for garbage and refuse dump clearance should be mapped out and efforts intensified to secure a clean and habitable environment.

Education should ensure that school curricula right from elementary classes upwards to probably the general studies courses at university entry should emphasise strongly environmental health, hygiene and sanitation. This would internalise the culture of personal and environmental sanitation among children as they grow to adulthood to become care givers and parents.

Facilities for adult formal and informal education should be provided and adults carefully mobilized to enrol in order to raise their literacy levels. Curricula should as well be designed to cover the key aspects of environmental health, hygiene and sanitation.

Mass treatment should be carried out non-selectively on all school children using dewarming medications albendazole and mebendazole which are relatively safe. Pre-school children could be reached through local community-based or religious organizations and other social gatherings so as to prevent a re-introduction of new infections in schools from new entrants.

Mass treatment with de-warming medications is also strongly advocated for among both adults and children in communities so as to break the chain of infection and re-infection. Government should assist in the distribution of anti-helminths through recruitment of community medicine distributors (CMDs) and other volunteers who would carry out house to house medications on regular intervals. These would also assist in health education as well as information dissemination.

CONCLUSION

The present study has shown that intestinal parasitosis is still a major health problem among children in Jos but more especially among the under-nourished ones. While economic factors play significant role, other associated factors such as personal and environmental sanitation also constitute significantly to the parasite load in the community. Health education should be intensified on personal, environmental health and hygiene while avenues for mass chemotherapy of both children and adults with appropriate antihelminths be created and seriously pursued to bring down the intestinal parasite load in the community.

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