Intestinal Parasitism In Rural And Urban Areas Of North Central Nigeria: An Update

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Citation

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Abstract

An updated study of intestinal parasites, including the emerging protozoan pathogens was carried out in the rural and urban areas of North Central Nigeria in June/July 2005. A total of 111 and 93 fecal samples were collected from the rural and urban areas respectively and examined using the Formol-ether and modified Ziehl Nielsen techniques. A prevalence of 50.5% for intestinal parasitism (excluding Cryptosporidium parvum and Microsporidia) was recorded for the rural area as against 44.1% for the urban area (P>0.05). The prevalence of the individual parasites in the rural and urban areas respectively was: Microsporidia (48.6% and 47.3%); C. parvum (29.7% and 19.4%); Entamoeba histolytica (18.9% and 18.3%); E. coli (16.2% and 9.7%); Endolimax nana (16.2% and 18.3%); Schistosoma mansoni (9.9% and 0.0%); Giardia lamblia (7.2% and 4.3%); Hookworm (4.5% and 5.4%); E. hartmani (1.8% and 0.0%); Strongyloides stercoralis (0.9% and 0.0%); Iodamoeba butschlii (0.0% and 1.1%); Enterobius vermicularis (0.0% and 1.1%). Polyparasitism was recorded in 24(21.6%) of the rural population as against 10(10.8%) in the urban population (P<0.05). All the sampled age groups were positive for intestinal (P<0.05), but there was no relationship between the gender of the subjects and the prevalence of intestinal parasitism (P>0.05). There was an inverse relationship between the BMI (Kg/m2) and the prevalence of intestinal parasitism (P<0.05). The prevalence of helminths in the rural population was 22.1% compared with 11.1% in the urban population (P<0.05); while protozoans (apart from C. parvum and Microsporidia) recorded 77.9% and 88.9% in the rural and urban populations respectively (P>0.05). There was also no significant difference in the prevalence of Entamoeba species in both the rural and urban areas with 53.2% and 46.2% respectively (P>0.05). For the ruminants (Cattle, sheep and goats), prevalence of 13.0% and 17.4% were recorded for C. parvum and Microsporidia respectively. The oocysts of C. parvum were not detected in the feces of the screened goats. This study has therefore shown that the prevalence of intestinal parasitism in both the rural and urban areas is still unacceptably high and frantic efforts should be made to reduce this trend. The high prevalence of C. parvum and Microsporidia in the screened population, coupled with the increasing incidence of HIV/AIDS is not commendable, since these parasites play a role in the etiopathogenesis of chronic diarrhoea in AIDS patients.

INTRODUCTION

Inadequate water, sanitation and hygiene are responsible for a major proportion of the burden of disease and death in developing countries, apart from causing hundreds of millions of people to surrender their rights to healthy and dignified lives. The common consequences of intestinal parasitic infections have been shown to affect nutritional status, physical development, mental function, verbal ability and inhibition-control aspects of cognitive behaviour in children ([1,2,3,4]). Intestinal parasitism is endemic in Nigeria due to poor environmental situation in most communities, improper disposal of wastes, gross environmental pollution with agrochemicals and industrial wastes plus the steady contamination of surface and underground water ([5]). Poorly planned housing and human habitation patterns also contribute to environmental decay, as urbanization in developing countries usually results from unplanned, uncontrolled and constant migration of people from the rural areas to the urban centres in search of employment opportunities.

The socio-cultural and agricultural practices of the people also combine with such factors as ecosystem degradation in creating conditions favourable for the high transmission and sustenance of many human diseases, especially parasitic diseases ([6, 7, 8]). The intestinal parasitic agents thrive mostly in such polluted environments such as refuse heaps, gutters and sewage units in and around human dwellings ([9]). Living conditions of the people in crowded or unhealthy situations may also facilitate the spread, distribution and sustenance of various Helminthic infections ([10]).

The present study was therefore carried out to update the prevalence of intestinal parasites, including the emerging protozoan pathogens in both rural and urban areas of North Central Nigeria.

MATERIALS AND METHODS

STUDY AREAS AND PARTICIPANTS.

The rural area for the study consisted of 3 villages that are close together in Toro Local Government Area of Bauchi state. The villages are situated at a distance of about 70km from Jos, which is the selected urban area.

All study participants gave their informed consent and responsible authorities approved the procedures for sample collection and analysis. All the villagers who consented were recruited into the study while the participants in the urban centre were randomly selected. The survey was carried out during the months of June and July 2005.

METHODOLOGY

Both the subjects (n=111) and controls (n=93) were measured for height and weight and their submitted stool samples processed for microscopy by using Formol-ether concentration method as modified by Allen and Ridley ($_{11}$) and modified Ziehl Nielson's method ($_{12}$). Fecal samples from 46 ruminants (Cattle, Sheep and Goats) were also collected from the rural area and processed using the modified ZN method ($_{12}$).

'P' values of <0.05 were accepted as statistically significant.

RESULTS

The demographic data and relative prevalence of intestinal parasitism in relation to age groups, gender and BMI (Adults only) of the rural population is shown in Table 1. Intestinal parasites (apart from C. parvum and Microsporidia) were recovered in 56 of the rural subjects giving a prevalence of 50.5%. The 11-20 year age group had a prevalence of 65.9%, while 0-10 year group had the least prevalence of 7.0% (P<0.05). The males recorded a prevalence of 44.2%, as against 55.9% in females (P>0.05). In relation to BMI, subjects with BMI of ≥25 kg/m ^{2} had the highest prevalence of 66.7%, compared with 51.7% and 45.0% for BMI of 18.5 – 24.9 kg/m ^{2} and <18.5 kg/m ^{2} respectively.

Figure 1

Table 1: Demographic Data And Relative Prevalence Of Intestinal Parasites In The Rural Population Of North Central Nigeria.

Parameter	Total No. of subjects	Infected subjects	Relative %
Age group (Years)			
0-10	20	7	7.0
11-20	41	27	65.9
21-30	15	5	33.3
31-40	13	6	46.2
41-50	10	4	40.0
51-60	5	2	40.0
61-70	6	2	33.3
>70	1	1	100.0
Total	111	56	50.5
Gender			
Males	52	23	44.2
Females	59	33	55.9
BMI (kg/m^2) (Adults only) n=52			
<18.5	20 (38.5%)	9	45.0
18.5-24.9	29 (55.8%)	15	51.7
≥25	3 (5.8%)	2	66.7

Table 2 shows the prevalence of the individual parasites in the studied rural population. Microsporidia recorded the highest with 48.6%, followed by C. parvum with 29.7%. Polyparasitism was recorded in 24 of the subjects giving a prevalence of 21.6%.

Figure 2

Table 2: Prevalence Of Intestinal Parasites In Rural Population In North Central Nigeria.

Parasite	No. Positive	Infection rate
Entamoeba coli	18	16.2
E. histolytica	21	18.9
Endolimax nana	18	16.2
Entamoeba hartmani	02	1.8
Giardia lamblia	08	7.2
Schistosoma mansoni	11	9.9
Strongyloides stercoralis	01	0.9
Hookworm	05	4.5
Ascaris lumbricoides	02	1.8
Cryptosporidium parvum	33	29.7
Microsporidia	54	48.6
Polyparasitism	24	21.6

The demographic data and relative prevalence of C. parvum and Microsporidia in the rural population is shown on Table 3. For C. parvum, the age group of 11-20 years recorded the highest with 43.9%, while 61-70 and above 70 years each recorded a zero prevalence (P<0.05). With respect to Microsporidia, the highest prevalence of 69.2% was recorded in the 31-40 year group, while the 61-70 and above 70 years had 33.3% and zero prevalence respectively (P<0.05). Females recorded a prevalence of 53.4% as against the 46.2% in males for Microsporidia (P>0.05); while 36.5% and 24.1% were recorded for C. parvum in males and females respectively (P>0.05). In relation to BMI, those with BMI of ≥18.5 kg/m ^{2} had 56.3% and those with <18.5 kg/m ^{2} recorded 45.0% for Microsporidia (P>0.05). C. parvum recorded 28.1% and 5.0% for BMI of ≥18.5 kg/m ^{2} and <18.5 kg/m ^{2} respectively (P<0.05).

Figure 3

Table 3: Demographic Data And Relative Prevalence Of Cryptosporidium Parvum And Microsporidia In Rural Population Of North Central Nigeria.

Parameter	Total No. of Subjects	Infected subjects (Relative %)	
Age group (Years)		C. parvum	Microsporidia
0-10	20		
11-20	41	05 (25.0)	05 (25.0)
21-30	15	18 (43.9)	24 (58.5)
31-40	13	01 (6.7)	06 (40.0)
41-50	10	05 (38.5)	09 (69.2)
51-60	5	02 (20.0)	05 (50.0)
61-70	6	02 (40.0)	03 (60.0)
>70	1	0 (0.0)	02 (33.3)
Total	111	0 (0.0)	0 (0.0)
		33 (29.7)	54 (48.6)
Gender			
Male	52	19 (36.5)	24 (46.2)
Female	58	14 (24.1)	31 (53.4)
BMI (kg/m^2) Adults only			
<18.5	20 (38.5%)	01 (5.0)	09 (45.0)
≥18.5	32 (61.5%)	09 (28.1)	18 (56.3)

Table 4 shows the demographic data and relative prevalence of intestinal parasites in the urban population. The prevalence of intestinal parasites (apart from C. parvum and Microsporidia) was 44.1%. All the sampled age groups were infected (P>0.05), while the males recorded a prevalence of 58.1% as against 37.1% in females (P>0.05). In relation to BMI, the highest prevalence of 57.1% was recorded in subjects with BMI of ≥39 kg/m ^{2} (P<0.05) and this consisted of 7.9% of the studied urban population.

Figure 4

Table 4: Demographic Data And Relative Prevalence Of Intestinal Parasites In The Urban Population Of North Central Nigeria.

Parameter	Total No. of subjects	Infected subjects	Relative %
Age group (Years)			
0-10	0	0	0.0
11-20	09	02	22.2
21-30	38	12	31.6
31-40	19	10	52.6
41-50	13	06	46.2
51-60	08	05	62.5
61-70	04	04	100.0
>70	02	02	100.0
Total	93	41	
Gender			
Males	31	18	58.1
Females	62	23	37.1
BMI (kg/m^2) (Adults only) n=89			
<18.5	06 (6.7%)	03	50.0
18.5-24.9	58 (65.2%)	25	43.1
25-29.9	18 (20.2%)	08	44.4
≥30	07 (7.9%)	04	57.1

The prevalence of the individual parasites in the urban population is shown in Table 5. Microsporidia had the highest prevalence of 47.3%, followed by C. parvum with 19.4%. Polyparasitism was recorded in 10 of the subjects with a prevalence of 10.8%.The demographic data and relative prevalence of C. parvum and Microsporidia in the urban population is shown in Table 6. All the studied age groups were infected (P>0.05); while C. parvum recorded 22.6% and 19.4% for males and females respectively (P>0.05). For Microsporidia, females had 53.2% compared with 32.3% in males (P<0.05). With respect to BMI, for C. parvum, subjects with BMI of ≥18.5 kg/m ^{2} recorded 21.7% compared with zero prevalence in those with <18.5 kg/m ^{2} (P<0.05). For Microsporidia, those with BMI of ≥18.5 kg/m ^{2} recorded a prevalence of 49.4% as against 33.3% in those with BMI of <18.5 kg/m ^{2} (P<0.05).

Figure 5

Table 5: Prevalence Of Intestinal Parasites In Urban Population In North Central Nigeria.

Parasite	No. Positive	Infection rate
Entamoeba coli	09	9.7
E. histolytica	17	18.3
Endolimax nana	17	18.3
Iodamoeba butschlii	01	1.1
Giardia lamblia	04	4.3
Hookworm	05	5.4
Enterobius vermicularis	01	1.1
Cryptosporidium parvum	18	19.4
Microsporidia	44	47.3
Polyparasitism	10	10.8

The prevalence of helminths in the rural population was 22.1% compared with 11.1% in the urban population (P<0.05). Intestinal protozoa (apart from C. parvum and Microsporidia) recorded 77.9% in the rural population and 88.9% in the urban population (P>0.05). Entamoeba species had a prevalence of 53.2% and 46.2% for the rural and urban populations respectively (P>0.05).

Figure 6

Table 6: Demographic Data And Relative Prevalence Of Cryptosporidium Parvum And Microsporidia In Urban Population Of North Central Nigeria.

Parameter	Total No. of Subjects	Infected subjects (Relative %)	
Age group (Years)		C. parvum	Microsporidia
0-10	0		
11-20	09	0 (0.0)	0 (0.0)
21-30	38	02 (22.2)	03 (33.3)
31-40	19	07 (18.4)	19 (50.0)
41-50	13	04(21.1)	10 (52.6)
51-60	08	02 (15.4)	05 (38.5)
61-70	04	01 (12.5)	03 (37.5)
>70	02	01 (25.0)	02 (50.0)
Total	93	01 (50.0)	02 (100.0)
		18 (19.4)	44 (47.3)
Gender			
Male	31	07 (22.6)	10 (32.3)
Female	62	12 (19.4)	33 (53.2)
BMI (kg/m^2) Adults only			
<18.5	06 (6.7%)	0 (0.0)	02 (33.3)
≥18.5	83 (93.3%)	18 (21.7)	41 (49.4)

Table 7 shows the prevalence of C. parvum and Microsporidia in the studied ruminants in the rural area. A total prevalence of 17.4% was recorded for Microsporidia

compared to 13.0% for C. parvum. The goats had no C. parvum oocysts.

Figure 7

Table 7: Prevalence Of Cryptosporidium Parvum And Microsporidia In Some Ruminants In The Studied Rural Area.

Animal	No. Sampled	Infected Animals (Relative %)	
		C. parvum	Microsporidia
Cattle	22	02 (9.1)	04 (18.2)
Sheep	12	04 (33.3)	02 (16.7)
Goats	12	0 (0.0)	02 (16.7)
Total	46	06 (13.0)	08 (17.4)

DISCUSSION

Our studies have documented a very high prevalence of intestinal parasites in both the rural (50.5%) and urban (44.1%) populations of North Central Nigeria. There were also no statistically significant differences in the prevalence of the entire encountered intestinal protozoa between the rural and urban centres. This also applies to Entamoeba species and Microsporidia. Intestinal helminths and C. parvum were more significantly seen in rural population. Thus, the advantages of living in the urban centres could have been offset by such factors as problems of drainage, lack of adequate sources of clean water, and indiscriminate defecation. It should also be indicated that sanitary measures can no longer keep pace with the problems created by the fast-growing urban population. In addition, the good hand-washing practices which ordinarily should interrupt the transmission of some of the parasites is expectedly inadequate in situations where water supply takes a lot of manual effort and the tendency is to use water sparingly. This eventually results in further transmission by direct and indirect contact.

The common practice of emptying the watery portion of filled septic tanks into the gutters, and burying the solid faecal wastes in the soil might have also contributed to the high prevalence of intestinal parasites in the urban centre. The watery portion eventually contaminates bodies of water used by humans and the buried wastes contaminate underground surface water. This is a very bad practice that affects the epidemiology of the intestinal parasites in the urban areas in this part of the country.

The lower prevalence of intestinal helminths in the urban population may be attributed to routine administration of anti-helminthic drugs by the urban dwellers. Although the self medication has reduced the prevalence of intestinal helminths, it has no effect on the intestinal protozoa, since the inhabitants hardly take the anti-protozoan drugs except on prescription. The high prevalence rates of Entamoeba species in both rural and urban populations shows that person-to-person transfer through food or water is high and this confirms that there is a high level of contamination by human feces. Manure heaps and faecal droppings from both animals and humans are found in most places. As a consequence, the well water (from hand-dug wells) which was originally clean became contaminated by the sinking contaminated surface water. In the urban centre, some of the water pipes are passed through drainage pathways and in some instances, the pipes are broken and left unattended to for sometime. It was also noted that the dam that supplies water to the water-treatment plant is unprotected from animals which eventually contaminate the water which often is not properly treated before distribution.

The study has also highlighted the presence of two of the emerging protozoan pathogens (C. parvum and Microsporidia) in both the rural and urban areas. These two parasites have been reported to be responsible for some of the cases of severe diarrhoea in medically immunosuppressed individuals and can be a life-threatening infection associated with HIV/AIDS infections ([13], [14]). We are of the opinion that efforts should be made to routinely search for these parasites, especially in immunocompromised individuals. Secondly, the high prevalence of these parasites in apparently healthy populations confirms the high levels of morbidity and mortality associated with them when the immune system is compromised.

In relation to gender, except for Microsporidia, there was no significant difference in the prevalence of the intestinal parasites. The infections are likely to be related to the daily activities of the individuals rather than gender. In the urban centres, females are mainly engaged in animal husbandry and this might be responsible for the significantly high prevalence of Microsporidia in females. It is to be noted that all the sampled age groups were infected with intestinal parasites thus, confirming almost equal chances of exposure especially by the feco-oral route.

With respect to BMI and intestinal parasitism, it appears that there is an inverse relationship between the BMI and the prevalence of intestinal parasitism. For Microsporidia, there was no significant difference for the rural population but there was a significant difference for the urban population.

The study of some of the ruminants has indicated that cattle, sheep and goats are serving as reservoirs of Microsporidia,

while only cattle and sheep may be the reservoirs of C. parvum; apart from the infected humans. The increased incidence and numbers of patients with prolonged diarrhoea due to these emerging pathogens indicate the need for increased clinical vigilance with regard to the inclusion of these parasites in the routine screening for intestinal parasites, especially if the patient is compromised.

Efforts should be intensified towards the provision of adequate and clean water, public education on improved personal and environmental hygiene as these will go a long way in reducing the morbidity and mortality associated with intestinal parasitism.

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