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Prevalence of Intestinal Parasitoses in the Nsukka Community of South Eastern Nigeria

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Abstract: A study of intestinal parasitoses was carried out in the rural and urban areas of Nsukka, a metropolitan city in south eastern Nigeria from May to December 2005. A total of 2000 fecal samples were collected from individuals with symptoms suggestive of gastroenteritis from four different laboratories located within Nsukka Local Government Area. Prevalence of *Ascaris lumbricoides* (17.4%), *Entamoeba histolytica* (11.8), *Ancylostoma duodenale* (11.4%) and *Trichuris trichiura* (11.1%) ($p<0.05$) was established by the study. Infection rates of *A. lumbricoides* were higher in both the rural and urban centres than others (19.5 and 15.0%, respectively). A correlation between gender and urban parasitoses was also established: *A. lumbricoides* had higher prevalence rate among the males in the inland town of Nsukka (19 males infected), while *G. lamblia* was higher among the females (17 females infected). Within the University environment however, prevalence of *A. lumbricoides*, *E. coli* and *A. duodenale* were higher among the males (44, 43 and 39 males, respectively). Increased parasitoses was associated with unhygienic habits including eating with unwashed hands, improper waste disposal and/or gross environmental pollution with faecal matter, which constitute steady sources of contamination of surface and underground water supplies in these communities. Other factors include the common practice among children, of direct transfer of, or ingestion of cysts or ova of parasites from the anus to the mouth by not washing the hands after defecation. Evaluation of clinical cases established a close relationship between increased incidence of diarrhea, weight loss, anaemia severe abdominal cramps or pain and parasitic infestations particularly among children, thus incriminating intestinal parasites as major causes of morbidity and mortality among this group.

Key words: Prevalence, parasitoses, environmental pollution, morbidity and mortality rates

INTRODUCTION

Intestinal parasitoses have long been identified by the WHO as one of the most prevalent human problems causing morbidity and mortality especially among young children and the aged (WHO, 1996). Prevalence of these parasites among Nigerian children was reported by Oduntan (1974) and Ajayi (1999). These infestations have been recognized as being transmitted by unsanitary environments and personal unhygiene including inadequate water supplies, poor nutritional standards, improper waste disposal systems and poor housing or habitation patterns (WHO, 1987; Onadeko and Oladipo, 1989). Further spread of these infections is attributed to poor living condition such as overcrowding.

Diarrhea is a major clinical consequence of parasitoses. Others include anaemia, malnutrition, weight loss, irritability, rashes or anal itching and nausea. Diarrhea, defined as loose, watery stools bowel movements, sometimes with unusual colors occurring more than three times in one day is a common problem associated with parasitic infestations (Fisseha *et al*., 1998). It usually lasts a day or two and goes away on its own without any special treatment. However, prolonged diarrhea can be a sign of other problems. Diarrhea can cause dehydration, which is particularly dangerous in children and the elderly. Diarrhea may be accompanied by cramping abdominal pain, bloating, nausea, or an urgent need to use the bathroom. Depending on the cause, a person may have a fever or bloody stools. Diarrhea can be either acute (short-term) or chronic (long-term). The acute form, which lasts less than 4 weeks, is usually related to a bacterial, viral, or parasitic infection. Chronic diarrhea lasts more than 4 weeks and is usually related to functional disorders like irritable bowel syndrome or inflammatory bowel diseases like celiac disease. However,

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for ill or malnourished individuals, diarrhea can lead to severe dehydration and can become life-threatening without treatment.

Parasites incriminated in acute and chronic diarrheal diseases include: *Cryptosporidium parvum*, *Isospora belli*, Microsporidia species, *Giardia intestinalis*, *Entamoeba histolytica*, Cyclospora species, *Blastocystis hominis* and *Dientamoeba fragilis*. Others include Nematodes: *Strongyloides stercoralis* (Okodua *et al*., 2003). Parasites can enter the body through food or water and settle in the digestive system. Parasites that cause diarrhea include *Giardia lamblia*, *Entamoeba histolytica* and Cryptosporidium (Soave and Framm, 1997).

The types and pattern of distribution of intestinal parasitic infestations is depends largely on the locality (Agi, 1995). Although incidences of gastrointestinal disorders have been recently increasing in the Nsukka metropolis, virtually no studies have been carried out to correlate the emerging incidence of life threatening infestations (with parasitic pathogens) with the daily-recorded high mortality rates due to diarrhea and the associated anaemia, malnutrition, weight loss, intestinal obstruction and other gastrointestinal disorders. Consequently, this study was conducted with the view of determining the level or prevalence of these parasites and the relationship between clinical findings and the laboratory diagnosis of these parasites in some rural communities in and around Nsukka where the socioeconomic, socio-cultural and agricultural practices of the indigenes, the ecosystem degradation resulting from erosion as well as the constraint of inadequate water and the associated poor sanitary and hygienic conditions (Mota *et al*., 2000) predispose the inhabitants to intestinal parasitic infections. The study further aims, at elucidating the sociocultural and socioeconomic parameters enhancing the spread of intestinal parasitic infections with a view of providing adequate information and perhaps sensitization programmes to the indigenous population on the health hazards and/or consequences of unhygienic conditions.

MATERIALS AND METHODS

Sources of samples: A total of 2000 fecal samples were collected from individuals with symptoms suggestive of gastroenteritis from four different laboratories located within Nsukka Local Government Area. These consisted of the following groups: Rural dwellers (612), Urban centre of Nsukka (University of Nigeria, Nsukka Environment) (882) and Inland town of Nsukka (506) samples.

Sample collection and analysis: Faecal samples were collected in sterile universal containers (with reference of age and sex) were distributed to patients in different hospitals. These were analysed within 24 h of collection.

Macroscopic examination: Preliminary macroscopic examination of samples was carried out to determine the colour, consistency and/or texture as well as presence of blood, mucus, pus and worms in stool samples as described by Chessbrough (1998).

Wet mount microscopy: Aliquots of stool samples were examined for presence of trophozoites, cysts, oocysts, larvae and ova of intestinal parasites using normal saline, Giemsa and Dobell's iodine smears. Examination of samples in eosin preparations (pink-red background) provided an easier identification of cysts.

Formol ether concentration technique: The rapid formol ether concentration technique of Chessbrough (1998) which facilitates the removal of large fecal debris as well as the concentration of a wide range of parasites with minimum damage to their morphology, was used to detect cysts, oocysts and ova. Further concentration and extraction of parasites was carried out using the methods of Ridley. Modified Zeihl-Neelsen Technique, as modified by Sidney and adopted by Chessbrough (1998) was employed for the detection of oocysts in fecal smear, while safranin-methylene blue technique of Baxby was used for the detection of Cryptosporidium oocysts.

Evaluation of clinical records: A comparative review of clinical records at three major hospitals in the area was carried out to establish association of clinical symptoms with intestinal parasitoses. Ninety-five cases were reviewed in relation to the presenting symptoms of diarrhea, suggestive of parasitic infestations and the presence of parasitic infestations confirmed by laboratory diagnosis.

Questionnaire: Questionnaire administration was done at one monthly interval to illicit information from participants on socioeconomic factors of parasitic infestations such as availability of and sources of water for domestic uses; eating habits, housing patterns (accommodation facilities) and general sanitary conditions. Other factors included the possibility of pollution of water bodies by domestic sewage and their knowledge of intestinal parasitic infections and associated health hazards as well as other socio-demographic and environmental parameters of parasitic infestations.

RESULTS

Of the 2000 people examined for parasitic infestations, 1050 individuals from the different locations were infected with various types of intestinal parasites (Table 1). Infections with *Ascaris lumbricoides* (17.4%),

Table 1: Percentage distribution of intestinal parasites in surveyed areas n = 2000

Parasite	Frequency distribution	(%)
Ascaris lumbricoides	183	17.4
Entamoeba histolytica	124	11.8
Hookworm (*Ancylostoma duodenale)*	120	11.4
Trichuris trichiura	117	11.1
Entamoeba coli	101	9.6
Strongyloides stercoralis	93	8.8
Giardia lamblia (G. intestinalis)	85	8.0
Taenia saginata	82	7.8
Schistosoma mansoni	70	6.6
Entorobius vermicularis	64	6
Cryptosporidium parvum	11	1
Total	1050	

Table 2: Urban and rural prevalence rates of identified parasites parasite

Parasite	No. infected	Rural	(%)	Urban	(%)
Ascaris lumbricoides	183	109	19.5	74	15
Entamoeba histolytica	124	71	12.7	53	10.7
Hookworm (*Ancylostoma duodenale)*	120	62	11.1	58	11.7
Trichuris trichiura	117	68	12.1	49	9.9
Entamoeba coli	101	41	7.3	60	12.1
Strongyloides stercoralis	93	58	10.3	35	7.1
Giardia lamblia (G. intestinalis)	85	34	6.0	51	10.3
Taenia saginata	82	43	7.7	39	7.9
Schistosoma mansoni	70	30	5.3	40	8.1
Entorobius vermicularis	64	35	6.2	29	5.8
Cryptosporidium parvum	11	7	1.2	4	0.8
Total	1050	558	53.1	492	46.8

Table 3: Gender distribution of urban parasitaemia

Parasite	No. infected	Male	Female
Ascaris lumbricoides	74	41	33
Entamoeba histolytica	53	30	23
Hookworm (*Ancylostoma duodenale)*	58	21	37
Trichuris trichiura	49	23	26
Entamoeba coli	60	32	28
Strongyloides stercoralis	35	19	16
Giardia lamblia (G. intestinalis)	51	23	28
Taenia saginata	39	14	25
Schistosoma mansoni	40	21	19
Entorobius vermicularis	29	13	16
Cryptosporidium parvum	4	1	3
Total	492	230	262

Table 4: Gender distribution of parasitic infestation in the inland town of Nsukka

Parasite	No infected	Male	Female
Ascaris lumbricoides	30	19	11
Entamoeba histolytica	23	15	8
Hookworm (*Ancylostoma duodenale)*	19	6	13
Trichuris trichiura	14	10	4
Entamoeba coli	17	14	3
Strongyloides stercoralis	19	5	14
Giardia lamblia (G. intestinalis)	24	7	17
Taenia saginata	16	9	7
Schistosoma mansoni	21	12	9
Entorobius vermicularis	14	8	6
Cryptosporidium parvum	2	1	1
Total	199	106	93

E. histolytica (11.8%), *Ancylostoma duodenale* (Hookworm) (11.4%) and *T. trichuria* (11.1%) were higher among the population ($p<0.05$). However, there was no statistical difference in the observed rates of infections by *E. histolytica* (11.8%), *Ancylostoma duodenale* (11.4%) and *T. trichuria* (11.1%) ($p>0.05$). Similarly, no significant difference was established between the infection rates by *E. coli* (9.6%), *Strongyloides stercoralis* (8.8%), *Giardia lamblia* (8.0%) and *Taenia saginata* (7.8%) ($p>0.05$). *Cryptosporidium* parvum had the least prevalence rate (1%).

Table 5: Gender distribution of parasitaemia within the university of Nigeria

Parasite	No infected	Male	Female
Ascaris lumbricoides	44	28	16
Entamoeba histolytica	30	21	9
Hookworm (*Ancylostoma duodenale)*	39	22	17
Trichuris trichiura	35	20	15
Entamoeba coli	43	24	19
Strongyloides stercoralis	16	12	4
Giardia lamblia (G. intestinalis)	27	18	9
Taenia saginata	23	15	8
Schistosoma mansoni	19	12	7
Entorobius vermicularis	15	9	6
Cryptosporidium parvum	2	-	2
Total	293	181	112

Prevalence rates of the identified parasitic infections among the rural and urban dwellers are shown in Table 2. Parasitaemia was observed among 558 out of the 612 rural dwellers and 492 individuals out of the 1388 urban dwellers screened (Table 2). Infection by *Ascaris lumbricoides* was statistically higher than others in both urban and rural areas (19.5 and 15.0%, respectively) ($p<0.05\%$). However, no significant statistical difference was observed in the prevalence rates of *E. histolytica* (10.7%), Hookworm (11.7%), *Entamoeba coli* (12.1%) and *G. lamblia* (10.3%) among the urban dwellers ($p>0.05$). Similarly, there was no statistical difference in the prevalence rates of *Entamoeba histolytica* (12.7%), *Trichuris trichiura* (12.1%) and Hookworm (11.1%), among the rural dwellers ($p>0.05$). However, prevalence rates were least with *G. lamblia* and *C. parvum* 6.0% and 1.2%, respectively.

Investigation of gender distribution of urban parasitaemia indicated a high prevalence of *Ascaris lumbricoides* among the males, 41 infected. However, no significant statistical difference was established in the rates of infection of the parasite between both sexes ($p<0.05$) (Table 3).

While infestation by *Ascaris lumbricoides* was prevalent among the males in the inland town of Nsukka (19), there was an observed prevalence of *G. lamblia* among the females in the town (17 people infected). Least prevalence rates occurred in the infestation by *C. parvum* (Table 4).

Table 5 outlines the gender prevalence of parasitic infections within the University environment. A significant difference was established in the prevalence rates of *Ascaris lumbricoides* and *Entamoeba coli* among the males ($p>0.05$). However, no infection by *C. parvum* was observed among the males within the environment.

Table 6: Age distribution of parasitic infections among the rural population

Age range	No. tested	No. infected	(%)
0-10	141	138	97
11-20	122	120	98
21-30	96	93	96
31-40	71	66	92
41-50	85	72	84
51-60	54	40	74
>61	43	29	67
Total	612	558	

Table 7: Age distribution of parasitic infections among the urban population

Age range	No. tested	No. infected	(%)
0-10	139	61	43
11-20	135	55	40
21-30	249	90	36
31-40	83	29	34
41-50	275	98	35
51-60	254	87	34
>61	253	72	28
Total	1388	492	

Table 8: Occupational distribution of parasitic infections among urban dwellers

Occupation	No. tested	No. infected	(%)
Students	201	116	57
Civil servants	200	62	31
Artisans	186	101	54
Drivers	170	104	61
Traders	134	99	73

Table 9: Prevalence of intestinal parasites among case study group presenting with symptoms suggestive of parasitoses

Age range	No. tested	No. infected	(%)
0-10	30	18	60
11-20	22	11	50
21-30	17	8	47
31-40	9	4	44
41-50	7	3	42
51-60	7	3	42
>61	3	1	33
Total	95	48	

The result of the prevalence of parasitic infections among different age groups in the rural area surveyed is shown in Table 6. Highest prevalence of parasitoses was observed among those aged 0-10 years (97%). However, no statistical difference was observed in the prevalence rates of parasitoses in the age groups 0-10 to 31-40 years ($p>0.05$).

No significant statistical difference was observed in the prevalence rates of intestinal parasites among the urban dwellers aged 0-10 and 51-60 years (Table 7) similar infectivity ratio was thus observed to occur. However, those aged 60 years and above had lower rate of parasitic infestation.

The result shown in Table 8 indicates the prevalence of intestinal parasitaemia among different occupational groups among the urban dwellers of Nsukka. Highest prevalence was observed among the traders (73%) and the drivers (61%). No significant statistical difference was recorded in the prevalence rates of parasitic infection among the students (57%) and the artisans (54%) ($p>0.05$). However, prevalence rate was very low among the civil servants (31%).

Review of the clinical records of 95 individuals presenting with symptoms of parasitic infestations indicated the prevalence of parasitic infections among 48 (50.5%) of the 95 persons surveyed (Table 9) 60% of the 30 children aged 0-10 years had intestinal parasites, while 50% (11) of those aged 11-20 were also infected. Similarly, among 17 of those aged 21-30, 47% had intestinal parasitoses, while only 1 out of the 3 persons aged >61 was infected.

Clinical symptoms associated with identified parasitic infestations and the distribution of parasites among different age groups are shown in Table 10.

Table 10: Infecting parasites and clinical presenting symptoms of parasitoses among the case study group

	Age ranges								
Infecting parasites	0-10	11-20	21-30	31-41	41-50	51-60	>61	Total infected	Associated clinical symptoms
Ascaris lumbricoides	7	5	2	1	1	-		16	Diarrhoea, abdominal pains, constipation vomiting, weight loss and intestinal disorder or obstruction.
Entamoeba histolytica	1	1	1	1	-	-		4	Dysentery and epi-gastric pains.
Hookworm (*Ancylostoma duodenale*)	4	3		-	1	-		8	Diarrhoea, severe anaemia, abdominal pains, mental inertia, debility, weight loss and retarded growth.
Trichuris trichiura	1	1	1	-	2			5	Blood tingled diarrhoea, anaemia, weakness and abdominal pains.
Entamoeba coli		-		-		1	1	2	
Strongyloides stercoralis	3	1	2	-	-	-		6	Itching rashes, bloody diarrhoea, nausea, anaemia, weakness and abdominal pains.
Giardia lamblia (G. intestinalis)	1	-	1	-		1		3	Diarrhoea with pale fatty stools, flatulence and nausea.
Taenia saginata	-		1	-		-		1	Weight loss, weakness, abdominal pains and anaemia.
Schistosoma mansoni		-		1		-		1	
Entorobius vermicularis	1	-		-		-		1	Skin irritation,/itching and abdominal cramps.
Cryptosporidium parvum	-	-		1		-		1	Large volume non-bloody, watery diarrhoea, severe abdominal cramps and anaemia.
Total infected	18	11	8	4	3	3	1	48	

A. lumbricoides had the highest prevalence, infecting 16 of the 48 individuals; 8 others had hookworm infestation, 6 had *S. stercoralis* while 5 had *T. trichiura* infestations. *A. lumbricoides* occurred more among those aged 0-10 years old (7 infected) and 11-20 years old (5 infected), respectively. On the other hand, predominance of *A. lumbricoides* (7 infected), Hookworm (4 infected) and *Strongyloides stercoralis* (3 infected) was observed among the 0-10 years age bracket. However, no significant statistical difference was found in the prevalence rates of *A. lumbricoides* among the 0-10 and 11-20 age brackets ($p>0.05$). Diarrhoea, abdominal pains and cramps, weight loss and anaemia were the major presenting symptoms of intestinal parasitoses observed among the case study groups.

DISCUSSION

Prevalence of parasitic infections in the urban and rural areas of Nsukka and their association with enteritis and related conditions was established in this study. Result of the questionnaire responses outlined several factors that contributed to the observed prevalence namely: poor environmental and/or sanitary conditions in most communities, particularly the peri-urban communities as a result of unhygienic habits including eating with unwashed hands, eating and drinking of contaminated food and drink, improper waste disposal and/or gross environmental pollution with faecal matter which constitute steady sources of contamination of surface and underground water supplies in these communities. Other factors reported in the questionnaire include the common practice among children, of direct transfer of, or ingestion of cysts or ova of parasites from the anus to the mouth by not washing the hands after defecation. Socio-cultural and agricultural practices as well as ecosystem degradation by improper disposal of wastes reported by Agi (1995) and Huttly (1990) were also observed to contribute to the significant level of transmission and sustenance of parasitic diseases in the locality. Observed socio-economic factors reported in the questionnaire as inimical to improved health status of the area include poorly planned housing and human habitation patterns in the urbanized areas of Nsukka coupled with the overcrowding of the few available houses due to the daily upsurge of people to the area in search of academic or other job opportunities. These observations are supported by earlier reports of the involvement of poor sanitary conditions and socio-economic risk factors in gastrointestinal parasitoses by Okpala (1961) and Chessbrough (1998). Other socio-economic dimensions, namely poverty and associated unhygienic behaviours among the low-income groups in the rural areas studied were also contributory to parasitic infestations as reported by Lindo *et al.* (1998).

This study has established a very high prevalence of intestinal parasites in both the rural (53.1%) and urban (46.8%) populations of Nsukka (Table 2). Prevalence rates of the identified parasitic infections among the rural and urban dwellers indicate a high incidence of parasitoses in the population: 558 out of the 612 rural dwellers and 492 individuals out of the 1388 urban dwellers screened were infected (Table 2). No statistically significant difference was however established in the prevalence of the intestinal parasites outlined among the rural and urban communities ($p>0.05$).

It was also observed that the prevalence and types of intestinal parasites depends largely on the socio-cultural, socio-economic and agricultural dimensions of the locality. The observed prevalence is lower than what was earlier reported in Ilorin (70.8%) by Awogun (1984) and (89.5%) by Oyerinde *et al.* (1979) but was in agreement with the low rate (33.6%) reported by Agi (1995) in Sagbana community of the Niger-Delta and the prevalence rate of 44.8% reported by Awole *et al.* (2003) among HIV infected patients in Ethiopia. The low prevalence could however be attributed to drug abuse or self-administration of anti-helminthic drugs, a common phenomenon in the surveyed areas.

Infection by *Ascaris* was statistically higher than others in both urban and rural areas 19.5 and 15.0%, respectively ($p<0.05\%$) (Table 2). This parasite has a worldwide distribution and its prevalence in these areas is confirmed by the inadequate sanitation, arising from the use of faecally polluted water bodies for domestic and agricultural purposes, extensive use of pit toilets and/or surface latrines. This was followed by *E. histolytica* (11.8%), Hookworm (11.4%) and *Trichuris trichiura* (11.1%). This finding is in consonance with findings of Awogun (1984) on the high incidence of these intestinal parasites in Ilorin. A similar report by Okodua *et al.* (2003) on the prevalence of nematodes including Ascaris in acute diarrhea further confirms the results of this study. However, there was no statistical difference in the observed rates of infections by *E. histolytica*, Hookworm and *T. trichuria* ($p>0.05$). Similarly, no significant difference was established between the infection rates by *Entamoeba coli* (9.6%), *Strongyloides stercoralis* (8.8%), *G. lamblia* (8.0%) and *T. saginata* (7.8%) ($p>0.05$). The reported high prevalence rates of Ascaris, *E. histolytica* and Hookworm could be attributed to the widespread soil contamination with faecal matter, poor sanitation and domestic hygiene in both rural and urban areas of Nsukka. Further contamination with these parasites could have

also occurred by ingestion of infective eggs through unhygienic living standards such as unwashed fingers and indiscriminate defecation (by children) and indiscriminate eating of unwashed fruits, eating in bukas or hotels maintained by caregivers who might be carriers.

Nsukka is known for acute shortage of water for both domestic and industrial uses. Individuals of low income groups who constitute a majority of the food sellers and caregivers cannot afford the high cost of potable water. Consequently, these people by their unhygienic and poor sanitary activies become carriers of parasites and generously transmit same through the food items brought for public consumption. A particular case in question is the indiscriminate eating of the Nsukka delicacy Okpa and Agharagha by even the elites. These foods are often prepared by the local women under unknown hygienic conditions and no attention is ever given to the sanitary standards of these women. In addition, foods such as akara balls, fried fish and chicken, etc., are sold uncovered both on the roadsides and inside the markets, a situation that exposes these to gross infection by both bacterial and protozoan parasites. This pattern of parasitic infestation through poor living standards was earlier reported by Chessbrough (1998) and Lindo *et al.* (1998).

These reports are indications of similar level of sanitary conditions and subsequent rates of exposure of individuals to parasitic infestations as earlier described. No dividing line is established between the level of existence in both areas. Lifestyles in the urban areas are similar in terms of environmental and personal hygiene; one influencing the other in terms of migrational activities. There is a daily movement of rural dwellers to the urban centers for business activities, which culminates in transfer of infections, especially among food handlers and their clients. On the other hand, the low significant difference established in the pattern of parasitoses between the rural and urban dwellers could further be attributed to the fast-growing urban population with attendant overpopulation and overcrowding which is closely associated with unhygienic and unsanitary conditions, as well as problems of drainage, lack of adequate sources of clean water and indiscriminate defecation. The available governmental sanitary measures in the urban centres can no longer keep pace with the problems created by overcrowded populations. The good practice of washing and cleaning of homes and the environment has become impracticable in most homes as a result of acute shortage of water which necessitates using water very sparingly, a situation that greatly furthers the transmission of parasites. This view is supported by the findings of Huttly (1990) on the impact of inadequate sanitary conditions on health in developing countries.

Nsukka urban has a singular problem of very poor drainage system. The common practice of emptying refuse into the gutter as a result of poor sanitary inspection programmes seriously contributed to the high prevalence of intestinal parasites in the urban centre. With no rivers or streams available, the rainy season flushes refuse (both domestic and sewage) from one house to the other and from the city into every nearby rural community, thus furthering the pollution of the community. The ultimate effect is gross contamination of the hand-dug shallow wells or underground surface water, which serves as water reservoirs for the local or rural dwellers. Similar reports in support of these findings were found in the prevalence of parasites in the urban city of Lagos by Oyerinde *et al.* (1980). Another factor of high prevalence of parasitoses is the culture of self-medication. Self-administration of anti-helminthic drugs has become a common place in Nigeria. Individuals in these areas as everywhere in Nigeria, especially among the low income groups, routinely administer un-prescribed anti-helminthic drugs. This habit could confer resistance to these parasites particularly when taken in low and inaccurate doses, since these over-the-counter drugs are sold and taken without adherence to prescribed dosages.

Low prevalence of *C. parvum* obtained in this study is supported by the reports of Awogun (1984) and Okodue *et al.* (2003) who indicated the prevalence of and association of this parasite immune deficiency associated with HIV/AIDS. However, the findings are in contrast with the reports of Ike *et al.* (2006) who recorded a high prevalence of the parasite in Bauchi State and other Northern States, attributable to the high rate of animal grazing (a major course of the dissemination of the parasite, which is transferable to man through grazing animals such as cattle) in those areas, not commensurate with the rate available in the South. This phenomenon could have resulted in the observed low prevalence rate of the parasite in Nsukka and its environs. Though the prevalence was not statistically significant, its presence in the population could also signify the possibility of immunosuppression, probably as a result of anaemia and malnutrition; the hallmark of low income groups, thus suggesting that the incidence of this parasites is no longer restricted to immunosuppression resulting from HIV/AIDS or chemotherapy as earlier reported by several researchers including (Wiwanitkit, 2001; Lindo *et al.*, 1998). This further calls for alertness and the urgent need for inclusion of this parasite in routine laboratory screening for intestinal parasites especially in the rural areas as indicated by Hunter and Nicols (2002).

Gender distribution of the parasites in both the rural and urban centers showed no significant statistical difference inspite of the recorded higher prevalence of

Ascaris and Hookworm among the females (Table 3). This trend might suggest similarity in the lifestyle of both sexes in terms of sanitary and/or hygienic standards, as well as the reported habit of self-medication. It might further be attributed to the nature of the people's daily activities rather than their sexes as also indicated by Ikeh (2001).

While infestation by Ascaris was prevalent among the males in the inland town of Nsukka (19), there was an observed prevalence of *G. lamblia* among the females in the town (17 people infected). Least prevalence rates occurred in the infestation by *C. parvum* (Table 4). However, analysis of the gender profile of parasitoses within the University environment showed a peculiar pattern of infectivity: prevalence rates of *Ascaris*, *E. coli* and *Hookworm* were statistically significant ($p<0.05$) (Table 5) among the males, while *E. coli* infestation was higher among the females. This profile might suggest a bad or indiscriminate eating habit by the males on campus. These individuals unlike their female counterparts who prefer to cook their food, readily eat in bukas or mini-hotels managed by the local people with very low standard of hygiene as well as no adequate catering experience.

Intestinal parasitoses were not found to be age dependent: All sampled age groups were infected (Table 6 and 7). This observation indicates an almost equal chance of exposure of these parasites, in consonance with the findings of Okodua *et al.* (2003). However, the observed higher prevalence among those aged 0-10 to 11-20 years might indicate a tendency of faecal-oral transmission of the parasites among these age groups who have the habit of either going bare-footed or indulging in indiscriminate eating and not washing hands after defecation. The distribution of parasitic infections among different occupational groups in showed highest prevalence among the traders (73%) and the drivers (61%) and least among the civil servants (31%). This result however further confirms earlier report cited above on the dependence of parasitoses on life activities rather than gender. Traders and drivers constitute individuals of low income groups, characterized by unhygienic living standards, consequently the tendency of ease of acquisition of parasitic infections.

Increased prevalence of diarrhea, weight loss and abdominal craps or pains was the major identified clinical evidence of parasitic infestations from the case study. Ascaris and Hookworm had higher prevalence among children, thus incriminating them as major health hazards of children: associated with high morbidity and mortality rates in children in both rural and peri-rural areas. The available result further suggests a close association and involvement of these parasites in much of the enteritis and related problems frequently encountered in the locality by children who suffer the brunt of parasitaemia: Stunted growth and underweight, iron deficiency and severe anaemia typical of hookworm and Ascaris infestations. This view is supported by the findings of Adekunle (2002) who investigated the intestinal parasites and nutritional status of Nigerian children similar observation was also made by Karasi and Afdhal (1995). Young children are remarkable for going bare-footed (an easy means of contacting hookworm), eating with unwashed hands, indiscriminate defecation and patronizing local food hawkers (most of who are carriers of parasitic diseases). Such bad habits have been identified to further compromise the health status of children in the locality with the associated increased morbidity and mortality rates.

CONCLUSION

This study, carried out among the rural and urban residents of Nsukka has identified the prevalence of parasitic infections and the enhancing sociocultural and economic factors in the area studied. Parasitoses were also identified as one of the major causes of diarrhea, dysentery, malnutrition, weight loss, anaemia and several degrees of abdominal disorder among the rural and urban residents studied. The observed ultimate effect therefore, is increased morbidity and mortality rates, a view supported by the reports of Adekunle (2002) and Ikeh *et al.* (2001). The presence of *Cryptosporidium parvum* in the population calls for clinical alertness as this may progress to disseminated Cryptosporidiosis for which there is no effective therapy and for which patients may succumb to overwhelming gastrointestinal disorder. There is then the need for clinicians and laboratory personnel in these areas to include the screening of this parasite in their daily or routine laboratory checks. Result of this study indicates an urgent need for appropriate control measures directed on parasitic infestations by adequate sanitary and heath education programmes geared towards better understanding of the principles of hygiene and the consequences of unsanitary conditions and environment. Such programmes should also emphasize the dangers of self-medication and appraise improved personal and environmental hygiene, routine periodic screening to ensure early detection of parasites, prompt therapy and interruption of parasitic transmission by appropriate de-worming programmes. Poverty and lack of potable water supply are serious problems in most Nigerian rural communities, which necessitate the continued use of pit toilets and surface latrines as well as other unhygienic practices, which enhance the spread of

ova, cysts and larvae of parasites. Nsukka faces the problem of water scarcity and very poor drainage system. This study further advocates practicable poverty alleviation programmes, provision of potable water and other social amenities in the area studied. These efforts will greatly reduce the high mortality and morbidity rates associated with parasitic infestations in the area.

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