

Full Length Research Paper

Epidemiological Survey of Blood and Gastrointestinal Parasites in Edo State

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A four-year study to determine the prevalence of both blood and gastro-intestinal parasites of man was done in all the eighteen local government areas of Edo State, Nigeria. The study, which commenced in January of 2000, ended in December of 2004. Of the 136,360 samples examined, 1000 that is 0.7% had parasites. A total of eleven parasites species were identified. A seasonal pattern of parasitic infection was noted with a high prevalence in the rainy (wet) season months of April to November and a low prevalence in the dry season months of December to March. The prevalence was significantly higher in September, October and November at 22, 10 and 10% respectively ($P<0.05$); than other months of the year. February had the least prevalence of 10%. The local government areas in the rain-forest zone, south of the state had significantly higher prevalence than the local government areas in the grassland, north of the state ($P<0.05$). Of the eleven parasite species observed in the study, *Ascaris lumbricoides* and *Plasmodium falciparum* had the highest prevalence of 30 and 35%, respectively. Hookworm parasites, *Trichuris trichiura* and *Strongyloides stercoralis* had the prevalence of 10, 7 and 1%, respectively. The protozoans, *Entamoeba coli*, *Entamoeba histolytica*, and *Giardia lamblia* had prevalence of 6, 4 and 3% respectively. *Schistosoma haematobium*, *Loa loa* and *Enterobius vermicularis* had the least prevalence of 2, 1 and 1%, respectively. With the exception of *S. haematobium*, *E. vermicularis*, and *L. loa*, which occurred in few local government areas, the other eight parasite species were encountered in all the local government areas. There was a higher prevalence of parasitic infections in this study than in the hospital records in the state.

Key words: Blood, gastro-intestinal, parasites, and infection in Edo state.

INTRODUCTION

Parasitic diseases of blood and gastro-intestine of human are rampant in the tropics because there are favourable climatic, environmental and sociocultural factors which permit transmission of these parasitic diseases for greater part of the year (Obiamiwe and Nmorsi, 1990). These parasitic diseases, whether water-borne, vector-borne, soil transmitted or those that result from some poor sanitary or social habits provide some of the many public health problems in the tropics (Woodruff, 1965; Odutan, 1974). The disease process which emanates may be the consequences of the reactions of human host to the parasites invading the host's tissue, causing destruction

and damage to the tissues, or the result of the parasites depriving the human host of some essential nutrients (Woodruff, 1965). Parasitic diseases create morbidity and sometimes mortality. Estimates of these parasitic diseases thus become a matter of necessity for the surveillance of public health, proper health-care delivery and people's welfare.

There is paucity of information as regards parasitic diseases in Edo State, Nigeria. What exists is hospital reports and is fragmented, uncoordinated and because the documentation is often on referred patients, it fails to give clues as regards the prevalence, geographical and seasonal distribution and pattern of infection. Some of the hospital reports are sometimes questionable. Thus the authenticity and validity of such reports for the surveillance of public health become doubtful. Therefore, the

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Table 1. Show the various parasite species and their prevalence in Edo State, Nigeria.

Parasite	No of parasite	% Isolates
<i>Entamoeba histolytica</i>	40	4
<i>Entamoeba coli</i>	60	6
<i>Giardia lamblia</i>	30	3
<i>Plasmodium</i> species	350	35
<i>Ascaris lumbricoides</i>	300	30
Hookworm species	100	10
<i>Trichuris trichuria</i>	70	7
<i>Strongyloides stercoralis</i>	10	1
<i>Enterobius vermicularis</i>	10	1
<i>Loa loa</i>	10	1
<i>Schistosoma haematobium</i>	20	2
Total isolates	1000	

need to have accurate, comprehensive, valid, and reliably documented information on parasitic diseases cannot be overemphasized. Elsewhere in Nigeria there have been studies along these lines. Among such studies are those of Fasuyi (1981), Okonji and Okaka (1992), Mafiana (1993), Okon and Boco (1992), Ukpai and Ajaku (1998), Elekwa and Ikeh (1996), Obiamiwe and Nmorsi (1990) and Awogun (1985).

Despite the fact that some community studies of some parts of Edo state is known, the actual pattern of infection among the population through epidemiological studies of the community is not known for the greater part of the state. The paucity of information available as regards the pattern of transmission, distribution and prevalence of these parasitic diseases necessitated this study. The study not only provides information on the various parasitic diseases associated with blood and gastro-intestine of man in the state, but also provides data for the understanding of the community and the epidemiological status of the human blood and gastro-intestinal parasites in the state. Other aspects of the study were to determine the prevalence of parasitic diseases according to seasonal variations and geographical locations.

MATERIALS AND METHODS

Collection of samples

This study, which lasted four years, was conducted from April 2000 to March 2004. A total of 136,360 samples were processed. This study covered all the eighteen local government areas of Edo State. Edo State has a population of about 2.3 million people. The state comprises two ecological zones. There is savannah grassland with very high hills in the northern part of the state while the southern part of the state comprises rain forest type of vegetation. The state is mainly a civil service state with very few industries. Petty traders and peasant farmer are found everywhere especially in the rural areas.

A letter seeking permission was sent to Headmasters, Principals of schools and Community Heads to allow us to carryout the project. The aim of the survey was explained and this was thought to be necessary in order to get their co-operation and active participation.

Urine and stool containers were distributed to individuals in schools and households in each local government area to provide stool and urine. Stool samples were collected in stool containers while urine containers were collected in 20 ml stirring plastic containers. Blood was collected with a sterile lancet. Thick and thin blood films were made for each individual.

Examination of samples

Each stool sample was examined macroscopically for the presence of blood, mucus, segments of adult worm and consistency (loose, formed, unformed or watery). A match- stick head of stool was emulsified in 8.5% saline on a slide. A coverslip (22 x 22 mm) was placed on the suspension and examined with the light microscope, first with x10 objective and again with x40 objective.

The same matchstick head size of faeces was emulsified in lugols iodine, covered with a coverslip and examined with a light microscope (Blacklock and Southwell, 1977). The iodine preparation is particularly suitable for the identification of protozoan cysts. Iodine stains the nuclei and makes them quite visible. The 8.5% saline and iodine wet mount allow for the detection and identification of both protozoan and helminthic human gut parasites.

Urine was concentrated by spinning at 2500 rpm for 5 min (Hamlin et al., 1974). The supernatant was decanted and the sediments were placed on a slide, covered with a coverslip (22 x 22 mm) and examined with a light microscope using x40 objective.

Blood examination was done by thin and thick films. These were examined with a light microscope, using immersion oil. The thin film was prepared as described by Leishman (1901) while the thick film was prepared as described by Giemsa (1902a).

The thin film- Leishman's method allows for the identification of the plasmodium species and filarial worms. The drawback is that in light infections parasites may not be detected because of the small quantity of blood used. In thick preparation it allows for easy detection of parasites because of the increased quantity of blood used. Except for *Plasmodium falciparum* no other species of plasmodium can be identified by the thick film method.

Samples were collected from each of the eighteen local government areas on a monthly basis to determine the months of highest infection rate. The study seeks to know both the seasonal and geographical distribution of parasites in the state. Data were statistically analysed by (ANOVA).

RESULTS

Over-all prevalence

A total of eleven parasite species were observed in the study (Table 1). They are as follows: *Entamoeba histolytica*, *Entamoeba coli*, *Giardia lamblia*, *Plasmodium falciparum*, *Ascaris lumbricoides*, Hookworm species, *Trichuris trichuria*, *Strongyloides stercoralis*, *Enterobius vermicularis*, *Loa loa* and *Schistosoma haematobium*. *P. falciparum* and *L. loa* were found in blood while *S. haematobium* was found in urine. The other parasite species were found in stool. Results showed that there was

Table 2. Shows the monthly prevalence of parasitic infections in Edo State, Nigeria.

Month	Number of parasite	% Infection
January	30	2
February	10	1
March	20	2
April	100	10
May	40	4
June	30	3
July	130	13
August	120	12
September	220	22
October	100	10
November	100	10
December	100	10

no significant difference in the prevalence values and number of parasites species between the four years of Study ($P>0.05$). Of the eleven parasites species observed in the study, *A. lumbricoides* and the *Plasmodium* species had the highest prevalence of 30 and 35%, respectively. Hookworm parasites, *T. tricurua*, *S. stercoralis* had prevalence of (10%), (7%), and (1%) respectively.

Monthly/seasonal prevalence

The monthly prevalence of parasites observed in each of the four years – 2000, 2001, 2002, 2003, and 2004 followed the same pattern (Table 2). The months of September, October, and November showed a higher infection rate while February and March showed a lower infection rate. The infection rate for September, October, and November was 22, 10 and 10% respectively. June July and August had 3, 13 and 12% respectively. April, May and December recorded 10, 4 and 10% respectively while January, February and March showed 2.0, 1 and 2.0% respectively. By statistical analysis (ANOVA), there was no difference in the infection rate in the four years of study ($P>0.05$). However by the same statistical analysis there was significant difference in the infection rate recorded in the months of the rainy seasons and those of the dry seasons ($P<0.05$). It was also observed that the pattern of the rainy and dry season remained the same in the four years of the study.

Infection rate according to geographical location

Infection rates in the local government areas of Edo State are documented in Table 3. A statistical analysis (ANOVA), showed a significant difference in the infection rate according to geographical locations ($P<0.05$). The general pattern is that prevalence of parasitic infections

Table 3. Shows parasitic prevalence according to geographical locations in Edo State, Nigeria.

Local Government Area	% Infection	No. of Parasite
Esan South East	5%	50
Orhionmwon	5%	50
Oredo	5%	50
Esan NorthEast	5%	50
Igueben	8%	80
Esan Central	8%	80
Esan West	6%	60
Uhunmwode	6%	60
Ikpoba Okha	7%	70
Egor	9%	90
Ovia North East	6%	60
Ovia South	5%	50
Etsako East	5%	50
Akoko Edo	7%	70
Etsako West	3%	30
Etsako Central	4%	40
Owan East	3%	30
Owan West	3%	30

It is pertinent to note that all the values in the tables are the averages for the four-year study.

decreases as one goes from South to the North according to rainfall and climatic changes.

DISCUSSION

Ascaris lumbricoides was found in all eighteen local government areas that were investigated. The prevalence was however, very low when compared with results obtained in other areas by different workers. Eguwunyenga et al. (2004) reported a prevalence of 55% in Eku Delta State of Nigeria. Shitta and Akogun (2004) reported a prevalence of 48% among the nomadic Fulanis of Northern Nigeria. Nwosu et al. (2004) reported a prevalence of 52% in school children in Abia and Imo States of Nigeria. Omudu et al. (2004) reported a prevalence of 1.8% in Murkurdi, Benue State of Nigeria. While Odikamnoro and Ikeh (2004), reported a prevalence of 51.5% among the Kpiri-kpiri community of Abaki-liki of Ebony State, Nigeria. Obiamiwe (1977) reported a prevalence value of 19.3% and Obiamiwe and Nmorsi (1990) reported a value of 46.7% in the defunct Bendel State of Nigeria. Okpala (1956) reported a value of 73.4%. Oyerinde (1978) reported a value of 15.2%, Ducan (1967) reported a value of 19.6% and Fisk (1939) reported a value of 90%. Fashuyi (1981) reported a value of 43.1%, while Elekwa and Ikeh (1996) reported a prevalence of 10.4% in Jos metropolis in Plateau State, Niger-

ria.

Human ascariasis is spread through faecal pollution of soil, and so the intensity of infection depends on the degree of soil pollution (Giles, 1967). Infection is spread through eggs, which are swallowed as a result of ingestion of contaminated soil or contact between the mouth and the various objects carrying the adherent eggs. Contamination of food or drink by dust or handling is another source of infection. *Ascaris* ova are spread through the agents of flood and coprophagous animals, and can thus be transported to locations far from the defecation sites (Obiamiwe and Nmorsi, 1990). The eggs are passed unaltered through the intestine of coprophagous animals. The well-protected eggs can withstand drying and can survive for very lengthy periods. Soil pollution is thus a major factor in the epidemiology of human ascariasis.

The prevalence of 35% for plasmodium is also considered to be low when compared with the prevalent values from else where. Bruce-Chwatt (1952) reported a value of 90%, while Ukpai and Ajaku (1998) reported a value of 80.25%. Onyido et al. (2002) reported a value of 59.5% among the inhabitants of Amaechi-Idodo community in Nkanu East local government area of Enugu State, South-eastern Nigeria. Mbanugo and Okorudo (2002) reported 60% prevalence among antenatal women attending clinics in Aguata local government area of Anambra State, Nigeria. So the value reported in this study in Edo State is very low compared with these various values reported from various parts of the country. It is an indication that Edo State maintains appropriate environmental sanitation.

Malaria constitutes one of the most important groups of infection in tropical countries. In 1960, the number of cases of malaria in the world was 140 million with 980,000 deaths (Bruce-Chwatt 1952). Human malaria is a disease of wide distribution and transmitted by certain species of anopheles mosquitoes. The most predominant malaria vector world-wide is *Anopheles gambiae* (Gordon and Lavoipierre, 1962). The availability of suitable arthropod vector and infected blood are major factors in the epidemiology of human malaria. Bushes and little pockets of stagnant water form suitable habitat for the arthropod vectors. The various species of the arthropod vectors are specialised in using various water sources for breeding. In some localities of malaria endemicity, a condition known as premonition exists. This is the presence of paracetamia without the disease. Exposure to repeated infections is necessary for this condition to continue (Bruce-Chwatt, 1995). In such endemic areas the asymptomatic carrier rate is high and such carriers constitute the reservoir of infection.

The cause of the low prevalence of malaria in this study is a consequence of many factors, some of which are not unconnected with public enlightenment programmes on hygiene, waste disposal and environment sanitation. In the last two decades there has been a lot of emphasis on

environmental sanitation in Edo State. For the adult population, immunity acquired over the years as a result of repeated clinical and sub clinical infections give some degree of protection against malaria (Soulsby, 1982). For the neonates, transplanted acquisition of humoral immunity from mother, low levels of para amino benzoic acid which is found exclusively in maternal milk diets and also the presence of foetal haemoglobin provide protection against malaria (Gilles, 1957).

Hookworm was relatively the third most common parasite species identified in the study. The prevalence value was 10%. This value is very low when compared with the value from other studies in various parts of the country both now and in the past. Egwunyega et al. (2004) reported infection rate of 22.5% at Eku in Delta State of Nigeria. Nwosu et al (2004) reported 25.8% in Aba, Abia State, Nigeria. Azomiwu et al. (2002) reported a prevalence value of 8.17% in Enugu State, Nigeria. Cowper and Woodward (1961) reported infection rate of 25.9% in the Western State of Nigeria while Gilles (1964) reported a prevalence value of 71%.

Hookworm infections occur by skin penetration of the L3 stage infective larvae. Poor sanitary disposal of human faeces and indiscriminate defecation are the principal factors in the aetiology of hookworm infections. Prevalence is high in agricultural communities where human faeces are used as fertilizers and also where people go about bare-footed. In many tropical countries, it is an occupational disease of the farming community. (Gilles 1964; Collard 1962; Adams and Meagraith, 1976; Onaedeko and Ladipo 1989). The two species, which cause hookworm disease – *Necator americana* and *Ancylostoma duodenale*, used to have geographical demarcation in the past. However, in the recent past the two parasites have become so widely distributed throughout the tropics and subtropics that the rigid demarcation is no longer tenable.

In the study *T. trichiura* had a prevalence value of 7%. This value is quite low when compared with the reports of both past and current studies in other parts of the country and in the world. Anosike et al. (2002) reported a value of 14.0% amongst post primary school children in Owerri, Imo State, Nigeria. Oyindo et al. (2002) reported a value of 5.3% among the inhabitant of Amaechi-Idodo community in Nkanu East local government area of Enugu State. Egwuyenga et al. (2004) reported a value of 20.8% in Eku, Delta State of Nigeria while Nwosu et al. (2004) reported a prevalence value of 19.4% among children in Aba, Abia State. Ejerie (1981) reported a value of 75.8% while Oyerinde (1978) reported 12.8%. Nnochiri (1965) reported 52% while Cowper and Woodward (1961) reported 18.5%. Obiamiwe and Nmorsi (1990) reported 77.6% while Alakija (1986) reported a value of 1.7% and Ramsay (1934) reported 2.8%. *T. trichuria* popularly known as whipworm because of the whip like form of the adult worm has a cosmopolitan distribution. It is however,

prevalent in the warm humid tropics.

Soil pollution is a major factor in the transmission of the infection in a community. Transmission occurs through poor sanitary habits of indiscriminate defecation. Infections usually occur through ingestion of infective ova from contaminated hands, food or drinks. Flood and coprophagous animals play some part in the transportation of the ova to locations other than the defecation site. The low value recorded in this study is a clear manifestation of the high hygienic standard in Edo State.

In this study, *S. stercoralis* was recorded as 1.0%. This however is close to the values recorded in the past in the country. Recently other workers reported varying values from various part of the country. Egwuyenga et al. (2004) reported a prevalence value of 0.2% while Shitta and Akagun (2004) reported a value of 25.3% among the nomadic Fulani in Adamawa State, Nigeria. Nwosu et al. (2004) reported a value of 2.5% while Anosike et al (2002) reported a value of 6.0%. Obiamiwe (1977) reported a value of 1.8% while Akoh (1980) reported 2.8%. Onaedeko and Ladipo (1989) reported 1.0% while Nwosu (1981) reported 0.4%. This helminth generally has low prevalence as observed in most studies. This reason for low prevalence may not be unconnected to its vulnerability to adverse environmental conditions hence its alternate mode of infection, auto-infection. This parasite was found in all the local government areas of Edo State.

In this study *E. vermicularis* had a prevalence value of 1% in Edo State. This infection is distributed throughout the world but less common in the tropics than in the countries of the Temperate Zone. Most previous studies recorded low prevalence values in the country. Ogunba (1977) reported a value of 0.2%. Cowper and Woodward (1961) reported 0.06% in Ibadan while Okpala (1961) reported 0.8% among government workers in Lagos, Nigeria. Odikamnoru and Ikeh (2004) reported a value of 2.3% among children in Kpiri-kpiri community in Abakiliki in Ebonyi State while Egwuyenga et al. (2004) reported a value of 0.13%. The low prevalence value generally recorded for this organism supports the claim that it is less common in the tropics than in the temperate regions. The very low value recorded in this study attests to the good sanitary conditions in Edo State.

In this study *E. histolytica* had a prevalence value of 4%. Studies done elsewhere in Nigeria had much higher prevalence values. Nnochiri (1965) reported a value of 94.0% while Obiamwe and Nmorsi (1990) reported a value of 3.9%. Ogunbi, (1971) reported 5.7% while Cowper and Woodward (1961) reported a value of 4.2%. Onyido et al. (2002) reported 5.6% while Anosike et al. (2002) reported 5.5%. Omudu et al. (2004) reported a value of 20.3%. Amoebiasis occurs throughout both tropi-cal and temperate climates, but infections are more ram-pant in the tropics. This parasite though low in prevalence was found in all the local government areas of Edo State. Infection occurs through transmission of viable cysts by

direct contact with contaminated foods such as raw vegetables fertilised with human faeces and also through the intermediary of filthy flies and contaminated hands of human cyst carriers.

Another protozoon that was observed in this study was *G. lamblia*. Infection rate was 3%. The organism was observed in all local government areas of the State. Elsewhere in his country the prevalence values were much higher than in the study. Edungbola and Obi (1992) recorded a value of 68.0% while Obiamwe and Nmorsi (1991) recorded 37.5%. Infection results as a result of ingestion of the viable cysts as a result of poor sanitary habits or contaminated foods. *G. lambila* may be harboured by animals but they play little or no part in the Epidemiology of human infections (Yardley, 1964).

Loiasis in this study recorded 1% in the state. Airauhi et al. (2000) recorded 17.1% prevalence in the towns of Orhuoka, Obeti, and Umuaja of Delta State. Loiasis is found in the equatorial rain forest belt of Africa and the infective microfilarial worms are transmitted by the various species of Chrysops. The presence of Chrysops species and breeding habitat is important factors in the Epidemiology of Loiasis. The parasite has limited distribution in Edo State as it was found only in four local government areas of the state.

In Edo State *S. haematobium* recorded a prevalence value of 2% as observed in this study. This value is very low compared with values obtained elsewhere in previous studies. Abolarinwa (1998) reported a value of 30.06% while Idris (1998) reported 12.0%. Ekejindu et al. (1999) reported a value of 9.9% in Agulu, Anambra State while Egwunyeiga et al. (1994) reported 17.4%. Fajewonyomi and Afolabi (1994) reported 20.5%. Adeonye and Ipeyeda (1994) reported 36.7%. This parasite is widely distributed throughout the tropical and subtropical Africa. It is the cause of the disease, which is characterised by haematuria. There are some factors that enhance the spread of this disease and some of these factors include poor sanitary habits, urinating into large bodies of water and the availability of suitable moluscan intermediate hosts. The pattern of transmission varies from place to place since the influencing factors are not constant (Oliver and Ansari, 1967).

The results of this study clearly showed a pattern of prevalence. The months of the highest prevalence of the parasitic infections were also the periods of heavy rainfall which were the months of September, October and November. Floods and runs-off after heavy rains favourably influence embryonation, proliferation and dissemination of parasitic organisms in the tropics (Obiamiwe and Nmorsi, 1990) . This explains the high prevalence values observed in the wet months of the year and also the low prevalence values recorded in the dry months—December, January, February, and March (Table 2).

This study successfully achieved the objective for which it was set. The study identified eleven parasite spe-

cies and their prevalence in the State. The study also determined the pattern of distribution of these parasite species. This was clearly demonstrated in both the seasonal and geographical distribution of the parasite species. The data obtained from this study provides information on the various parasitic diseases associated with blood and gastrointestinal of man in the state. The study also provides data for understanding the community and the epidemiological status of the human blood and gastrointestinal parasites in the state. The information on the seasonal and geographical distribution of these parasites is very useful in the control strategy.

This study recommends that government provide basic social amenities to enhance the quality of life of the inhabitant of Edo State. There should be toilet facilities to discourage indiscriminate defecation and urination in public places. There should be good drinking water, drugs, and diagnostic facilities in the hospitals for the diagnosis and treatment of infected individuals. Social amenities in form of recreation centres, amusement parks, schools, and commercial establishments should be provided with toilet facilities and water to improve the quality of life for the people of Edo State.

REFERENCES

- Abolarinwa SO (1998). Man- water contact and urinary schistosomiasis among school children in tourist community, Kwara State, Nigeria. Abstract from 22nd annual conference. Niger. Soc. Parasitol. 5: 9.
- Adams EB, Meagraith BG (1976). Clinical tropical diseases. 6th edition Blackwell Scientific Publications Edinburgh.
- Adeonye GO, Ipeyeda M (1994). Schistosomiasis haematobium infection among children in Owana Army Barracks, Akure Nigeria. Niger. J. Parasitol 15: 43-50.
- Alakija W (1986). The prevalence of intestinal parasites in rural areas of Nigeria. Ann Trop. Med. Parasit. 80(5): 545-547.
- Airauhi LU, Enosolase MF, Wemambu SNC, Ibadin MO, Omoigberale AI, Halim NKD (2000). Some aspects of the Epidemiology of loiasis in three village communities within the Niger Delta area of Nigeria. Niger. Postgrad. Med. J. 7(1): 33-37.
- Akoh JI (1980) Strongyloidiasis in Nigeria. Niger. J. Parasitol. 1: 158-169.
- Anosike JC, Chighana JI, Nwoke BED, Ezike MN, Dike MU, Ukaga CN, Okere MSC, Ajero CMU (2002). A survey of intestinal parasite among students of post primary institutions in Imo State, Nigeria. 28th annual conference Abstract (63) Niger. Soc. Parasitol. 20: 74.
- Awogun IA (1985). The prevalence of intestinal parasite infection in children living in Ilorin, Kwara State. West Afr. J. Med. 3: 29-33.
- Azomiwu MA, Adibua SN, Oyibo AE (2002). (Prevalence of intestinal parasites among handlers (hawkers/bukers) around the University of Nigeria Teaching Hospital (UNTH) Enugu, South Eastern Nigeria. 28th annual conference. Abstract (51) from the Niger. Soc. Parasitol. 20: 62
- Blacklock C, Southwell J (1977). A guide to human parasitology, 10th edition. London Ark. Lewis and Co. Ltd.
- Bruce CLJ (1995). Malaria in African infants and children in Southern Nigeria. Ann Trop. Med. Parasit. 46: 173-200.
- Bruce CLJ (1952). Malaria in African infants and children in Southern Nigeria. Ann Trop. Med. Parasit. 46: 475-478.
- Collard PA (1962). Sample review to estimate the prevalence of communicable diseases in Katsina Province, Nigeria. West Afr. Med. J. 11:3-32.
- Cowper SO, Woodward SF (1961). Parasitic infections recorded at the University College Hospital, Ibadan Nigeria over a period of three years (1957-1960). West Afr. Med. J. 10: 366-382.
- Edungbola LD, Obi AA (1992). A review of human intestinal parasites in Nigeria. Challenges and prospect for integrated control. Niger. J. Parasitol. 13: 27-37.
- Egwuyenga OA, Ataikiru DP, Nmorsi QPG (2004). Studies on intestinal helminthes infection in Eku, Delta State, Nigeria. 28th annual conference Abstract (20) from the Nig. Soc. Parasitol. 20: 24.
- Ejezie GC (1981). The parasitic diseases of school children in Lagos State, Nigeria, Acta Trop. 38: 79-84.
- Ekejindu IM, Onyali IO, O'zumba NA, Ibe CC (1999). Prevalence and intensity of urinary schistosomiasis in Agulu, Anambra State and the impact of health education on knowledge and the practices in relation to disease transmission. Niger. J. Parasitol. 20: 17-76.
- Elekwa DE, Ikeh EIA (1996). A survey of the incidence of intestinal parasites among primary school children in relation to socio-economic factors in Jos, Nigeria. Nig. Med. Pract. 31(4): 60-62.
- Fajewonyomi BA, Afolabi JS (1994). Schistosomiasis haematobium infection among children in a primary school, Ile-Ife, Nigeria. Niger. J. Parasitol. 1: 25-29.
- Fashuyi SA (1981). A comparison of morphometric character of two geographically isolated populations of *Ascaris lumbricoides*. Indian J. Hel. 13: 87-94.
- Fisk GH (1939). Helminthiasis in Lagos, Nigeria. Roy. Soc. Tro. Hyg. 32: 645-652.
- Giemsa G (1902a) Technique for thick blood film Zbl Bakt Ref. 32: 307.
- Gilles HM (1957). The development of malaria infection in breast fed Gambian infants. Ann Trop. Med. Parasit. 51: 58.
- Gilles HM (1964). An environmental study of a Nigerian village community. Ibadan University Press, Ibadan Nigeria.
- Gordon RM, Lavoipierre (1962). Entomology for students of medicine Blackwell Scientific Publications Oxford.
- Hamlin WB, Duckworth JK, Gilmen PR, Stevens MV (1974). Laboratory instrument maintenance and function verification. College of American Pathologists, 230 North Michigan Avenue, Chicago Illinois.
- Idris HS (1998) Schistosomiasis among pupils in some local government areas in Katsina State, Nigeria. Abstract from the 22nd annual conference. Niger. Soc. Parasitol. 5: 9.
- Leishman WB (1901). Thin blood film preparation technique, Br. Med. J. 2: 751.
- Mafiana CF (1993). Ascariasis among school children in Ilewo Orile, Ogun State, Nigeria. 17th annual conference Niger. Soc. Parasitol. pp. 18.
- Mbanugo JI, Okoroudo ON (2002). Prevalence of plasmodium infections in pregnant women attending ante-natal clinics in Aguata Local Government Area, Anambra State, Nigeria. Abstract from the Nig Soc Parasitol. 28th annual Conference. September 22nd –25th . 20: 13.
- Nnochiri E (1965). Observations on childhood amoebiasis in urban family unit in Nigeria outpatients. J. Trop. Med. Hyg. 68: 231.
- Nwosu DC, Nwoke BED, Anosike JC (2004). Aspects of sanitation and intestinal helminth infection in children in Aba, Abia State, Nigeria. . 28th annual conference Abstract (47) Niger. Soc. Parasitol. 20: 53.
- Nwosu ABC (1981) Community ecology of soil transmitted helminth infections in Southern Nigeria. Ann Trop. Med. Parasitol. 80(5): 545-547.
- Ogunba EO (1977). The prevalence of human intestinal protozoa in Ibadan, Nigeria, Am. J. Tropical. Med Hyg. 15: 180-182.
- Obiamiwe BA, Nmorsi P (1990). Human gastro-intestinal parasites in Bendel State, Nigeria, Angew Parasitol. 32: 177-183.
- Obiamiwe BA (1977). The pattern of parasitic infections in human gut at the specialist hospital, Benin- City, Nigeria. Am. Trop Med. Parasit. 71(1): 35-43.
- Odikamnoru OO, Ikeh IM (2004). The prevalence of common intestinal nematode infections among primary school children in Kpirikpiri community in Abakiliki. Abstract (71). Niger. Soc. Parasitol. 28th Annu. Conf. 20: 79.
- Odutan SO (1974). Housing and health of Nigerian children. Trop. Geogr. Soc. Med. Parasitol. 25: 402-409.
- Ogunbi O (1971). Intestinal microbial and helminthic infections in Lagos

- University Teaching Hospital (1965-1968). Niger. Med. J. 1: 53-59.
- Okonji GN, Okaka CE (1992). Gastro-intestinal parasites among children Benin City, Edo State, Nigeria. Abstract of the 18th annual conference. Niger. Soc. Parasitol. p. 54.
- Okon OE, Boco VE (1992). Urinary schistosomiasis in Obudu, Cross Rivers State, Nigeria. 16th annual conference. Nig. Soc. Parasitol. p. 2
- Okpala I (1956). The incidence of intestinal parasite among school children in Lagos State, Nigeria. West Afr. Med. J. 5(5): 167-170.
- Okpala IA (1961). Survey of the incidence of intestinal parasites among local government workers in Lagos, Nigeria. West Afr. Med J. 10: 148-157.
- Oliver L, Ansari N (1967). The Epidemiology of bilharziasis. ed. Mostofi FK, Springer-verlag. New York. p. 8.
- Omudu EA, Amuta EU, Feese JI (2004). The prevalence of intestinal helminths in children with different socio-economic background in Markurdi, Nigeria. 28th annual conference Abstract (63) Niger. Soc. Parasitol. 20: 71.
- Onyido AE, Ezeike VI, Ozumba NA, Nwankwo EA (2002). Tree-hole breeding mosquitoes of a gmelina forest reserve in Enugu, Southeastern, Nigeria. Abstr. Niger. Soc. Parasitol. 20: 65.
- Oyerinde JPO (1978). The role of housefly *musca domestica* in the dissemination of hookworm. Am. Trop. Med. Parasitol. 70: 455-462.
- Ramsay GW (1934). A study of Schistosomiasis and certain other Helminthic infections in Northern Nigeria. West Afr. Med. J. 8: 2-7.
- Shitta KB, Akogun OB (2004). The prevalence of intestinal parasite infection among the nomadic Fulani in Adamawa State, Nigeria. . 28th annual conference Abstract (26) Niger. Soc. Parasitol. 20: 30.
- Soulsby EJI (1982). Helminth arthropods and protozoa of domesticated animals. 7th edition London. Elbs and Bailiere Tindall and Carvel Ltd.
- Ukpai OM, Ajaku EI ((1998). The prevalence of malaria in Okigwe and Owerri area of Imo State, Nigeria. Nig. J. Parasitol. 17: 15.
- Woodruff AW (1965). Infection with animal helminthes. Br. Med. J. pp. 1001.
- Yardley JH (1964). Epithelia and other mucosal lesions of the Jejunum in giardiasis. Jejunal biopsy studies. Bull. John Hopk. 115: 389.