**Survey on the Prevalence of Intestinal Parasitic infections among Primary school aged children in Primary schools in Plateau Central Senatorial District, Plateau State, Nigeria**

**ABSTRACT**

Intestinal parasitic infections (IPIs) causes cosmopolitan public health problems in the tropical and sub-tropical regions of the world. This study was conducted to Survey the prevalence of intestinal parasitic infections among primary school aged children in primary schools in Plateau Central Senatorial District, Plateau State, NIgeria. Analytical cross-sectional descriptive research design was used to randomly collect stool samples from 25 random selected schools. All collected samples were immediately transported to Standard Medical Laboratory, Pankshin for analysis. Both direct smear method and concentration technique were used to recover parasite eggs from the stool sample. Out of 500 stool samples collected and analyzed, 355(71%) were positive for intestinal parasite. There was a significant association between the prevalence of specific species of intestinal parasites and primary school pupils in Plateau central senatorial district (χ2 = 659.590, df = 7, P = 0.000). There was a significant difference between the comparism of the occurrence of intestinal parasites and the L.G.As (χ2 = 1447.09, df = 4, P = 0.000). **T**here was also no significant difference between the preventive measures of intestinal parasite infections and the school children in Plateau central senatorial district, Plateau State (χ2= 6.765, df =. 3, P = 0.080). School children should be enlightened on the need for proper WASH practices; personal hygiene and environmental sanitation both in home and at school as well as provision of portable water sources.

**Key words:** Survey, Prevalence, Intestinal Parasitic infections, Plateau Central Senatorial District

1. **INTRODUCTION**

Intestinal parasitic infections (IPIs) remain a significant public health concern worldwide, particularly in developing countries. It is one of the neglected tropical diseases (NTD) that thrive where there is poverty. Those mostly affected are the poorest populations, living in remote, rural areas, in urban slums or in conflict zones.

Intestinal parasitic infections may be acquired in different ways, like consumption of contaminated fruits, vegetables, other food stuffs, soil (geo-helminths), arthropods, molluscan vectors and water (Idahosa, 2011; Al-Binal *et al.,* 2006). Ova of helminths can also be isolated on the underneath of fingernails of these children (Gyang, 2017) and on the surface of the Nigerian currency notes which they handle and also leak (Ekejindu, 2018). These infections are of major public health concerns because factors that predispose man to the infections are bound in the sub-region which include poor environmental hygiene, poverty, malnutrition and ignorance (Ijagbone 2019). Globally, the World Health Organization (WHO, 2016) estimates that over 1.5 billion people are infected. This burden is disproportionately high in Low- and Middle-Income Countries (LMICs), where socio-economic and environmental factors contribute to the spread and persistence of these infections.

In sub-Saharan Africa, including Nigeria, helminth infections are widespread, with children being the most vulnerable group due to their frequent exposure to contaminated environments and their developing immune systems **(Nwosu,** 2020). The World Health Organization (WHO) estimates that approximately 50 million people worldwide suffer from invasive amoebic infection each year, resulting in 40-100 thousand deaths annually (Petri *et al.,* 2000). Cryptosporidiosis is becoming most prevalent in both developed and developing countries among patients with AIDS and among children aged less than five years (Mor and Tzipori, 2008).

The prevalence of intestinal parasite infections varies across different regions in Nigeria and is influenced by factors such as climate, hygiene practices, socio-economic status and pollution, which result in contamination of food and water. In semi-urban and rural communities where the dwellers are generally poor and uneducated and lack basic amenities like potable water supply and good sanitary facilities, intestinal parasitic infections cause major health problems particularly among school children (Chukwu *et al.,* 2023; Ahmed *et al.,* 2023: Ezeagwuna *et al*., 2019; Oblukwu *et al*., 2018; (Ekpenyong and Eyo, 2015; Ugboaja *et al.,* 2014; Nock *et al.,* 2003; Adeyeba and Akinlabi, 2002; Ogbe *et al.,* 2002).

In Nigeria, and specifically in Plateau State, the burden of IPIs is considerable due to inadequate sanitation, poor hygiene practices, and limited access to clean water. Lack of adequate attention to intestinal helminthic disease accounts for the high incidences in children especially in Nigeria where about 70% of school children are enrolled in primary school (WHO, 2023).

This study aims to fill this gap by investigating the prevalence of intestinal parasitic infections among primary school pupils in Plateau Central Senatorial District, Plateau State Nigeria and exploring the socio-economic factors that contribute to these infections.

**2. MATERIALS AND METHODS**

**2.1 Study Area**

This study was conducted in Plateau Central Senatorial District, Plateau state, Nigeria. Plateau Central senatorial district covers five local government areas which consists [Bokkos](https://www.wikiwand.com/en/articles/Bokkos%22%20%5Co%20%22Bokkos), [Mangu](https://www.wikiwand.com/en/articles/Mangu%2C_Nigeria), [Pankshin](https://www.wikiwand.com/en/articles/Pankshin%22%20%5Co%20%22Pankshin), [Kanke](https://www.wikiwand.com/en/articles/Kanke%2C_Nigeria) and [Kanam](https://www.wikiwand.com/en/articles/Kanam%2C_Nigeria). The headquarters of this senate district is Panskhin (Daily Trust, 2019), located within latitude [9.31920N and longitude 9.44170E](https://geohack.toolforge.org/geohack.php?pagename=Plateau_State&params=9_10_N_9_45_E_region:NG_type:adm1st) [coordinates](https://en.wikipedia.org/wiki/Geographic_coordinate_system). Plateau Central Senatorial has a total population of 952,389 people(Census, 2006). The Senatorial District has an area of 8,365km2 with its highest elevation reaching up to 1371m. It consists of various tribes that speaks different languages such as the Mupun, Miship, Fier, Tal, Kadung, Pal, Bijim, Ngas, Pop, Mwaghavul, Kwa, Rom, Boghom, Jhr, Basharawa, Myet, Taroh, and Badawa. The Hausas, Igbos, Yorubas and the Idomas are scarcely represented (NPC, 2006).

The Senatorial District is geographically unique in Nigeria due to its boundaries of elevated hills surrounding the Pankshin town capital, and the entire plateau itself. There are two distinct seasons in Plateau state; the rainy season which is observed between May to October and dry season which comes up from November to April. Pankshin’s average annual temperature is 22 °C (72 °F) and the rainfall here averages 1,150 millimetres (45 in). Most times, smog is formed, making it difficult for vehicles to access the road. Plateau Central is popularly known for its trade hub as most of the people are farmers growing a vast range of food crops and collection of fruits.



Fig 1: Map of Plateau Central Senatorial District (Alao *et al.,* 2014)

**2.2 Research Design**

This study employed an analytical cross-sectional descriptive research design. The cross-sectional nature of the study allowed for the collection of data at a single point in time from a representative sample of the population**.**

**2.3 Study Population**

Male and female pupils from between the ages 4-13years of age were the target population for this study.

**2.4 Sampling Techniques**

A multi-stage sampling technique was employed in this study with the combination of random sampling technique for selection of schools to ensure representation across various schools and pupils from each selected school were randomly chosen for participation.

**2.5 Method of Sample Collection and Investigation**

 The sum total of 500 stool samples were collected from twenty five selected public primary schools, Plateau Central Senatorial District. The study was carried out from December, 2023 - March, 2024 (for dry season) and June to August (for rainy season). Simple random sampling technique was used to select the schools (5 schools per L.G.A; 25 schools per 5 L.G.As) and pupils to be sampled. Clean stool containers with cover and consent forms were given to pupils to collect stool samples and return the next morning with name, age and sex inscribed on the stool containers. Pupils were instructed on how to collect small quantities of their stool into the container using a wooden applicator stick attached to the sample container to avoid contamination of feaces with Urine or any other contaminants. Collected fecal samples were immediately preserved with 2ml 10% formalin. All collected samples were transported in cooler bags to Standard Medical laboratory Pankshin within 2hrs of collection for analysis.

##### Table 1: **Schools for sample collection**

|  |  |  |
| --- | --- | --- |
| **S/N** | **LGAs in Plateau Central** | **No of Samples** |
| 1. | Mangu | 100 |
| 2. | Pankshin L.G.A  |  100 |
| 3. | Kanke L.G.A |  100 |
| 4. | Kanam L.G.A | 100 |
| 5. | Bokkos | 100 |
|  **TOTAL** |  **500** |

 (Field Work, 2024)

**2.6 Methods of stool analysis**

The parasitological techniques used are; direct smear method, sedimentation method, Zinc sulphate floatation method.

**2.6.1 Direct Smear Method**

A drop of normal physiological saline and standard Lugo’s Iodine each was placed on one side of a clean grease-free glass slide and a tiny stool sample of about 2mg was collected using an applicator stick. This was emulsified into the drop of normal saline on the slide and the same way into the drop of Lugo’s iodine with a different applicator stick unto a homogeneous smear is obtained. This was covered with cover slip to avoid trapping air bubbles on the slide. Prior to this, each slide was labelled with pupil’s unique identification number at the edge with masking tape. The preparations were then examined under the microscope using X10 to focus whileX40 objective lens was used to magnify and identify the parasite and eggs.

The laboratory apparatus used for this sedimentation technique are: sieve, beaker, centrifuge, coverslip, glass slide and normal saline, Lugol's iodine and microscope.

Normal saline used for sedimentation was prepared. 2 g of stool sample was added to the beaker and few drops of normal saline were added and mix vigorously. Sieve was used to filter in another beaker and the filtrate was added into the centrifuge tube. The sample was centrifuge at 2500 revolution per minutes for 3 minutes. The supernatant was decanted. A drop of the filtrate was added to the glass slide with a drop of lugol's iodine and was covered with cover slip. It was viewed under the microscope at X10 and X40 objective lens. (Garcia, 2001).

In flotation technique, Zinc sulfate solutions are normally used because they have low specify gravity and these allows egg of parasite to float. Laboratory apparatus used: sieve, cover slip, glass slide, test tube, funnel and microscope.

Zinc sulfate solution was prepared. 2g of stool sample was added to the beaker and 5ml of zinc sulphate were also added and mix vigorously. Sieve was used to filter in another beaker and the filtrate was transferred to a test tube using a funnel. The test tube was filled to the brim with the zinc sulfate and was covered with cover slip. It was allowed to settle for 30 minutes. A drop of lugol's iodine was added to the glass slide and that coverslip was placed in the glass slide. It was viewed under microscope at X10 and X40. (CDC, 2016)

**2.7 Administration of Questionnaires**

A total of 500 well-structured questionnaires were self-administered and returned with help of their school teachers to collect the socio-demographic information on each pupil in their local language and their responses were recorded by underlining the appropriate options provided. Teachers assisted learners whose parents could not read or write in filling the forms and answering the questionnaire.

**2.8 Data Analysis**

Data collected was arranged in tables and analyzed using simple percentage, and Chi-square, and statistical mean. The response collected from the respondents on the research problem was analyzed using statistical mean. Chi-square was used to test the hypothesis and to measure the significant difference between variables. The level of significant was identified as P ≤ 0.05.

**3 RESULT**

Table 2: Prevalence of Specific species of Intestinal parasite infection among primary school pupils in Plateau Central Senatorial District, Plateau State

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type of Helminth** |  **No of Parasites**  **Recovered** | **Percentage** **(%)** | **Chi-Square**  | **Df** | ***P-value***  |
| *Ascaris lumbricoides* | 195 | 11 |  |  |  |
| Hookworm | 406 | 24 |  |  |  |
| *Trichuris trichiura* | 153 | 9 |  |  |  |
| *Strongyloides stercoralis* | 68 | 4 | **659.590** | **7** | **0.000** |
| *Taenia species*  | 410 | 24 |  |  |  |
| *Entamoeba histolytica*  | 248 | 14 |  |  |  |
| *Girdia lamblia*  | 221 | 13 |  |  |  |
| *E. vermicularis*  | 15 | 1 |  |  |  |
| **Total** | **1,716** | 100 |  |  |  |

 (Field work, 2024)

Table 2 above shows the prevalence of specific species of intestinal parasite infections among primary school pupils in Plateau central senatorial district. Out of 500 stool samples collected, 1,716 parasites were recovered which includes *Ascaris lumbricoide* 195(11%), Hookworm 406(24%), *Trichuris trichiura* 153(9%), *Strongyloides stercoralis* 68(4%), *Taenia* species 410(24%), *Entamoeba histolytica* 248(14%), *Girdia lamblia* 221(13%) and *E. vermicularis* 15(1%) respectively. The highest number of parasite observed was *Taenia* specie 410(24%) followed by Hookworm 406(24%) while the least number of parasite observed was *Enterobium vermicularis* 15(1%). However, there was a significant association between the prevalence of specific species of intestinal parasites and primary school pupils in Plateau central senatorial district (χ2 = 659.590, df = 7, P = 0.000).

**Figure 2:** Pie chart representation of the Prevalence of Specific species of Intestinal parasite infections among primary school pupils in Plateau Central Senatorial District, Plateau State

**Table 3: Comparism between the Occurrences of intestinal parasites in the L.G.As in Plateau Central Senatorial District**

 LGAs No of samples collected No of samples +ve (%) Occurrence of parasite eggs (%)

 Mangu 100 60 (16.9) 727 (42.4)

 Pankshin 100 50 (14.1) 731 (42.6)

 Kanke 100 80 (22.5) 89 (5.2)

 Kanan 100 75 (21.1) 69 (4.0)

 Bokkos 100 90 (25.3) 100 (5.8)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Total 500 355 (71) 1,716 (100)

 (χ2 = 1447.09 df = 4, P = 0.000)

Table 3 above shows the comparism between the occurrences of intestinal parasites in the L.GA’s in Plateau senatorial district. Out of 500 stool samples collected from the 5 L.G.As, 355(71%) were positive for intestinal parasite. The prevalence of intestinal parasite was highest in Mangu 727(42.4%) followed by Pankshin 731 (42.6%) while the least was Kanan at the rate of 69(4.0%). Out of 60 soil samples positive for intestinal parasite in Mangu, 727(42.4%) eggs were observed, out of 50 sampes positive for intestinal parasite in Pankshin, 731(42.6%) eggs were observed, out of 80 stool samples positive for intestinal parasites in Kanke, 89(5.2%) eggs were observed, out of 75 stool samples positive for intestinal parasite in Kanan, 69(4.0%) eggs were observed while out of 90 samples positive for intestinal parasites in Bokkos, 100(5.8%) eggs were observed respectively. However, there was a significant difference between the compa rism of the occurrence of intestinal parasites and the L.G.As in Plateau central senatorial district (χ2 = 1447.09 df = 4, P = 0.000).

**Figure 3. Bar-chart representation of the comparism between the Occurrences of intestinal parasites in the L.G.As in Plateau Central Senatorial District**

**Table 4: Respondent’s response on the preventive measures of intestinal parasites among primary school pupils in Plateau Senatorial District**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Preventive Measures  | YES (%) | NO (%) | Chi-square | Df | *P-value* |
| Regular deworming  | 124(31.0) | 22 (22.0) |  |  |  |
| Wearing of shoes regularly  | 90(22.5) | 17 (17.0) |  |  |  |
| Washing fruits and vegetables properly before consumption |  75(18.8) | 25 (25.0) | 6.765 | 3 | 0.080 |
| Improved sanitation & hygiene  | 111(27.8) | 36 (36.0) |  |  |  |
| TOTAL | 400 (100) | 100 (100) |  |  |  |

Table 4 shows the Respondent’s response on the preventive measures of controlling intestinal parasites amongst primary school pupils in Plateau senatorial district. The total number of respondents was 500. Four respondents had a ‘YES’ response while 100 respondents had ‘NO’ response. Out of 400 respondents that gave a YES response to the preventive measures of intestinal parasite infection, 124(31.0%) said regular deworming, 90(22.5 %) said wearing of shoes regularly, 75(18.8%) said washing of fruits and vegetables before consumption, while 111(27.8%) indicated improved sanitation and hygiene. However, there was no significant difference between the preventive measures of intestinal parasite infections and the school children in Plateau central senatorial district, Plateau State (χ2= 6.765, df =. 3, P = 0.080).

**5 Discussion**

Intestinal parasitic infections (IPIs) causes cosmopolitan public health problems in the tropical and sub-tropical regions of the world.

Result from this study confirms a high prevalence of (71%) of intestinal helminth infections among primary schools pupils in Plateau Central Senatorial District, Plateau State. The prevalence of intestinal parasite observed in this work is higher than that of Ezeagwuna *et al.,* 2009 who noted 48.08% intestinal helminth infections among primary school pupils in Ozubulu, Anambra State Nigeria but lower than that of Chukwudike and Toma, 2025a who noted a high prevalence 76(59.9%) of intestinal parasites in primary schools in Bokkos Local Government Area Plateau State could be due to favourable climate for the survival of the parasites coupled with improper management of organic refuse and inadequate supply of clean water; unavailability of potable water in some schools might drive pupils into other unhygienic sources. Chukwudike *et al.,* 2024a noted a lower prevalence of 59.8% soil-transmitted Helminth eggs in primary and pre-primary school playgrounds in Bwari Area Council, Abuja, and attributed the high rate to be probably due to indiscriminate defecating, urinating & dumping of refuse in the playgrounds. Parasitic contamination (36%) of toilet door handles has been noted by Chukwudike *et al.,* 2024b at Prof. Basil’s Boys Hostel in Nnamdi Azikiwe University, Awka, Anambra State. The high prevalence (71%) of intestinal parasite in this work is as a result of a general improper Environmental sanitation within the school premises, low level of hygiene practices by the pupils as well as poor management of toilet facilities. These infections are most prevalent in tropical and subtropical regions of the developing world where adequate water and sanitation facilities are lacking (Savioli and Albonico, 2004; Cappello, 2004).

Analysis of the prevalence of specific species of intestinal parasite infections among primary school pupils in Plateau central senatorial district revealed an overall prevalence of 71% with 1,716 parasites being recovered which includes *Ascaris lumbricoide* 195(11%), Hookworm 406(24%), *Trichuris trichiura* 153(9%), *Strongyloides stercoralis* 68(4%), *Taenia* species 410(24%), *Entamoeba histolytica* 248(14%), *Girdia lamblia* 221(13%) and *E. vermicularis* 15(1%) respectively. The highest number of parasite observed was *Taenia* specie 410(24%) followed by Hookworm 406(24%) while the least number of parasite observed was *Enterobium vermicularis* 15(1%). However, there was a significant association between the prevalence of specific species of intestinal parasites and primary school pupils in Plateau central senatorial district (χ2 = 659.590, df = 7, P = 0.000) (Table 2). The high prevalence of *Taenia* (24%) observed in this work could be as a result of high consumption of improperly cooked cow meat by people in Plateau Central Senatorial District this is in agreement with Chukwudike *et al.,* 2024a who noted the presence of *Taenia* eggs in a study in Bwari Area Council, Abuja to be as a result of ingestion of improperly cooked beef by people of the Area Council, resulting in the distribution of *Taeniids* and other helminth eggs in the school playgrounds. The least prevalence of *Enterobium vermicularis* (1%) observed in this study could be as a result of general low level of hygiene especially poor toilet training and inability to wash hands by the pupils after playing, after visiting the latrine and before eating. Chukwudike *et al.,* 2024a observed geo-helminth eggs 3596(74.4%) representing *Taenia* 1480(30.6%), hookworm 1260(26.1%), *Toxocara* 863(17.8%) and *Schistosome haematobium* eggs 3(0.1%) respectively in primary and pre-primary school playgrounds in Bwari Area Council, Abuja,

Analysis of the comparism between the occurrences of intestinal parasites in the L.GA’s in Plateau senatorial district shows out of 500 stool samples collected from the 5 L.G.As, 355(71%) were positive for intestinal parasite. The prevalence of intestinal parasite was highest in Mangu 727(42.4%) followed by Pankshin 731 (42.6%), Bokkos 90(25.3%), Kanke 80(22.5%) while the least was Kanan at the rate of 69(4.0%). However, there was a significant difference between the comparism of the occurrence of intestinal parasites and the L.G.As (χ2 = 1447.09 df = 4, P = 0.000) (Table 3). The highest prevalence rate of infection (42.6%) observed in Pankshin L.G.A could be as a result of poor environmental sanitation within the school premises. The high prevalence rate of infection observed in Pankshin L.G.A in this study is lower than that of Chukwudike and Toma 2025a who noted a prevalence of 62.8% of intestinal parasitic infection in Pankshin L.G.A, which could be due to improper management of organic refuse, Poor drainages as well as the use of dumping sites for defaecation. The high prevalence of infection observed in Pankshil L.G.A in this study is also lower than that of Chukwudike and Toma2025b who noted 59.9% rate of infection of human intestinal helminth infections in BOkkos L.G.A, Plateau State and attributed it to be as a result of favourable climate for the survival of the parasites coupled with improper management of organic refuse and inadequate supply of clean water in the L.G.A.

Assessment of the Respondent’s response on the preventive measures of controlling intestinal parasites amongst primary school pupils in Plateau senatorial district show that out of 400 respondents that gave a YES response to the preventive measures of intestinal parasite infection, 124(31.0%) said regular deworming, 90(22.5%) said wearing of shoes regularly, 75(18.8%) said washing of fruits and vegetables before consumption, while 111(27.8%) indicated improved sanitation and hygiene. However, there was no significant difference between the preventive measures of intestinal parasite infections and the school children in Plateau central senatorial district, Plateau State (χ2= 6.765, df =. 3, P = 0.080) (Table 4). The World Health Organization (WHO, 2016) recommends that in areas with high prevalence, deworming should be done twice a year. Encouraging children to wear shoes can protect against soil-transmitted helminths like hookworms, which can penetrate the skin of bare feet. Educating children and families about the importance of washing fruits and vegetables, and properly cooking food can reduce the risk of ingesting helminth eggs (**Okolo and John,** 2019).

**6 Conclusion**

There is a high prevalence of intestinal parasite infections among school children in Plateau Central Senatorial District

There was a significant association between the prevalence of specific species of intestinal parasites and primary school pupils in Plateau central senatorial district. The high prevalence of *Taenia* (24%) observed in this work while the least prevalence of *Enterobium vermicularis* observed in this study. The prevalence of intestinal parasite was highest in Mangu L.G.A 727(42.4%) and least in Kanan L.G.A 69(4.0%).

 Majority of the respondents (31.0%) use regular deworming as a means of preventing intestinal parasites while (27.8%) indicated washing of fruits and vegetables before consumption.

**Consent**

Consent was sought from the different school heads before distributing questionnaires. An introduction letter was gotten from the Head of Department Biology, Federal University of Education Pankshin to the various schools under study. A written note was given to the parents to seek their consent for the questionnaire to be filled by their child/ward.

**FUNDING**

This project was funded by TETFUND Institutional Based Research Grant, 2024

**ACKNOWLEDGEMENT**

With immense gratitude, the authors heartily appreciate the Director, TETFUND and the entire TETFUND family, Nigeria for this golden opportunity. The authors also graciously acknowledge the support of local community leaders, Parents, Head Teachers, Staff and pupils for their cooperation.

**DECLARATIONS CONFLICT OF INTEREST**

##  The authors have no conflicts of interest to declare.

##

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during the writing or editing of this manuscript.

**REFERENCES**

Abubakar, U. and Bashir, I. (2018). Prevalence and associated risk factors for intestinal parasitic infections in Kano, Nigeria. *PLOS ONE*, 13(7), e0200350.

Adams, V.J, Markus M.B, Adams J.F, Jordaan E, Curtis B, Dhansay M.A, *et al.,* (2020). Paradoxical helminthiasis and giardiasis in Cape Town, South Africa: Epidemiology and control. *African Health Science.*5:276–80.

Adeyemi, O. A. (2018). Intestinal parasites and nutritional status of pre-school children in a semi-urban settlement of Ogun State, Nigeria. *Journal of Natural Sciences Research*, 3(7), 102-106.

Al-Binali, A.M, Bello, C.S, El-Shewy, K and Abdulla, S.E (2006) “The prevalence of parasites in commonly used leafy vegetables in South Western Saudi Arabia,” *Saudi Medical Journal*, vol. 27, no. 5, pp. 613–616.

Ahmed, S.A., Kotepui, M., Masangkay, F.R., Milanez, G.D., Karanis, P., (2023). Chapter One - Gastrointestinal parasites in Africa: A review. [*Advances in Parasitology*](https://www.sciencedirect.com/bookseries/advances-in-parasitology)*.* <119>:1-64. Available at <https://doi.org/10.1016/bs.apar.2022.10.001>. Accessed on 25th March, 2025.

Cappello, M (2004). Global health impact of soil-transmitted nematodes. *Pediatric Infectious Disease Journal.*23:663–4. Available at <http://doiorg/10.1097/01.inf.0000132228.00778.e4>. Accessed on 15th March, 2025.

Center for disease control (2016). DPDx- Laboratory identification of parasites of public health concern. <https://www.cdc.gov/dpdx/index.html> . Accessed 12th September, 2024.

Chukwu, H.O., Owhoeli, O and Amuzie, C.C (2023). Intestinal Parasites in School-Aged Children of Rumuodogo, Emohua Local Government Area, Rivers State, Nigeria. *International Journal of Tropical Disease & Health*. 44(4): 7-12. .https://doi.org/10.9734/ijtdh/2023/v44i41400.

Chukwudike, C. O., Ajogi, I., Chikwendu, J. I., Maina, A. T., Nwankwo, B. J., Udeozo, F. N., Joshua, N. N., and Atsuwe, T. S. (2024) Survey of Helminth Eggs in the Playgrounds of Pupils in Bwari Area Council, Abuja, Nigeria. *Nigerian Journal of Parasitology* 45(2) 299-307.

Chukwudike, C.O and Antip, T.M (2025a). Prevalence and Socio-Economic Factors of Human Intestinal Helminth Infections amongst Primary School Pupils in Bokkos, L.G.A, Plateau State. *International Journal of Research and Innovation in Applied Sciences*. X(1): 39-51. Accessed from http//doi.org/:<https://doi.org/10.51584/IJRIAS.2025.1001005>. Accessed 2nd February, 2025.

Chukwudike, C.O and Toma, M.A (2025b). Prevalence of Intestinal Parasites Among School Aged Children In Primary Schools In Pankshin L.G.A Of Plateau State. *Journal of Medical and Dental Science Research.* 12 (2): 83-93. Available at http:/ 10.35629/076X-12028393. Accessed on 21st March, 2025.

Chukwudike, C.O., Udeozo, F.N., Antip, T.M and Ike, R.E (2024b). Analysis of the impacts of soil parameters in the distribution of Geo-Helminth eggs in Pre-primary and Primary school playground soils in Bwari Area Council, Abuja, FCT. *International Journal of Scienece Research and Technology. 4*(4): 37-52.

Daily Trust (2019). .["APC's Dimka wins Plateau Central Senatorial seat, beats Paradang"](https://www.dailytrust.com.ng/apcs-dimka-wins-plateau-central-senatorial-seat-beats-paradang.html). Daily Trust. Retrieved 2020-05-17. Available at <https://dailytrust.com/apcs-dimka-wins-plateau-central-senatorial-seat-beats-paradang/>. Accessed on 17th March, 2025.

Danish, J.S., Vasanth, P and Subramanian, V (2021). Prevalence of Intestinal Parasitic Infestations among Children in a Tertiary Care Centre. Journal of Pharmaceutical Research International 33(47B):882-6. Available from: <https://journaljpri.com/index.php/JPRI/article/view/3987>

Ekejindu(2018). Helminth infections in school children in Ijebu North, Ogun State, Nigeria. Journal of Life Sciences, 5(8), 65-70.

Ekpenyong, T.A and Eyo, U.A (2015). Prevalence of intestinal helminth infections and their associations with socio-economic factors among primary school pupils in Akwa Ibom, Nigeria. Journal of Parasitic Diseases, 40(3), 678-684.

Ezeagwuna, D., Okwelogu, I., Ekejindu, I and Ogbuagu, C (2009). [The Prevalence and Socio-Economic Factors Of Intestinal Helminth Infections Among Primary School Pupils In Ozubulu, Anambra State, Nigeria](https://ispub.com/ije/9/1/3571). [*The Internet Journal of Epidemiology*](https://ispub.com/IJE). 9(1).

Ezeagwuna, T.C., Anozie**, O. T. and Ugwuoke, A. J.** (2019). Intestinal helminthiasis and its socio-economic consequences among children in Ile-Ife, Osun State, Nigeria. Journal of Infection and Public Health, 12(5), 742-747.

Goodman, D., Hajj, H.D., Bickle, Q.D., Stoltzfus, R.J and Tielsch, J.M (2007). A comparison of methods for detecting the eggs of *Ascaris,* *Trichuris* and hookworm in infant stool, and the epidemiology of infection in Zanzibari infants. *American Journal of Tropical Medicine and Hygiene*, 76; pp. 725-731.

**Gyang, P. V.** (2017). Soil-transmitted helminth infections among school children in Plateau State, Nigeria: Prevalence and risk factors. BMC Infectious Diseases, 14, 366.

Idahosa, T (2011) “Parasitic contamination of fresh vegetables sold in Jos Markets,” *Global Journal of Medical Research*, vol. 11, no. 1, pp. 20–25.

Ijagbone**, U. S.** (2019). The prevalence, intensity and risk factors of hookworm infection in a rural community, south-east Nigeria. International Journal of Epidemiology, 35(1), 156-161. Available at <https://doi.org/10.1093/ije/dyi234>. Accessed on 20th March, 2025.

Jiya, N. M., and Yahaya, M. (2015). Prevalence of intestinal helminth parasites among primary school children in Sokoto metropolis, Nigeria. *International Journal of Science and Research*, 4(7), 1324-1327.

 Karshima, S.N (2018). Parasites of importance for human health on edible fruits and vegetables in Nigeria: a systematic review and meta-analysis of published data. *Pathogens and Global Health.* 112(1):47–55. Available at http://doi.org/[10.1080/20477724.2018.1425604](https://doi.org/10.1080/20477724.2018.1425604). Accessed on 25th March, 2025.

[Mohammedaman, G. A (2016). Prevalence and Factors Associated with Intestinal Parasitic Infections Among Food Handlers of Southern Ethiopia: Cross Sectional *Study, BMC Public Health.*](http://refhub.elsevier.com/S2405-8440%2823%2901282-3/sref8)

Mor, S.M and Tzipori, S (2008). Cryptosporidiosis in Children in Sub-Saharan Africa: A Lingering Challenge. *Clinical Infectious Diseases.* 47(7):915–921. Available at https://doi.org/[10.1086/591539](https://doi.org/10.1086/591539). Accessed on 29th March, 2025.

National Population Commission. NPC (2006) National Population Census, Federal Republic of Nigeria official gazette, Lagos, Nigeria. Retrieved from www.population.gov.ng/.

Nock, I.H., Duniya, D and Galadima, M (2003). Geohelminth eggs in soil and stool of pupils of some primary schools in Samaru, Zaria, Nigeria. ***Nigerian Journal of Parasitology.* 24 (2003):115-122.**

**Nwosu, A. B.** (2020). The community ecology of soil-transmitted helminth infections of humans in a hyperendemic area of southern Nigeria. *Annals of Tropical Medicine and Parasitology*. 75(2), 197-203.

Oblukwu, **J. M., Eze, C.J., and Chidoka, B.N.** (2018). The potential of recombinant vaccines to combat the human hookworm infection. Expert Review of Vaccines, 1(3), 407-418.

Ogbe, M.G., Edet, E.E and Ischei, M.N (2002). Intestinal helminth infection in primary school children in areas of operation of Shell Petroleum Development Company of Nigeria (SPDC), western division in delta state. *Nigerian Journal of Parasitology,* 23; pp. 3-10.

**Okolo, M. O. and John, E. O.** (2019). Epidemiological studies of human intestinal parasites in two local government areas of Ebonyi State, Nigeria. African Journal of Biotechnology, 5(17), 1674-1677.

Petri, WA, Jr., Haque, R., Lyerly, D and Vines, R.R (2000). Estimating the impact of amebiasis on health. *Parasitology Today*.16:320–21. Retrieved from http//:doi.org/10.1016/s0169-4758(00)01730-0.  Accessed on 12th January, 2025.

Savioli, L and Albonico, M (2004). Soil-transmitted helminthiasis. *Nature Reviews Microbiology*. 2:618–9. Available at hppt://doi.org/10.1038/nrmicro962. Accessed on 20th March, 2025.

[Ugboaja](https://www.pagepressjournals.org/mm/article/view/11288/12134), F., [Etefia](https://www.pagepressjournals.org/mm/article/view/11288/12134), E., [Akpan](https://www.pagepressjournals.org/mm/article/view/11288/12134), S.S and [Asuquo](https://www.pagepressjournals.org/mm/article/view/11288/12134), B (2014). Prevalence and risk factors of intestinal parasitoses among residents of Ekemkpon and Idim Ita of Cross River State, Nigeria. *Microbiologia Medica*. Retrieved from hhh//:doi.org/[10.4081/mm.2024.11288](http://dx.doi.org/10.4081/mm.2024.11288). Accessed 15th December, 2024.

WHO, (2023). Soil-transmitted helminth infections. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infection>. Accessed on 3rd February, 2025.