Original Article

Prevalence of Intestinal Parasitosis and Malaria Among Children in Selected Orphanages in Ibadan, Oyo State, Nigeria: A Descriptive Study

[1]Obebe O. O., [1]Awojide M. M., [2]Oluwatobi O. B., *[3]Olagunju P.M.

[1]Department of Medical Laboratory Science, College of Medicine, University of Ibadan
[2]Department of Medical Laboratory Science, Faculty of Health Sciences, Atiba University Oyo
[3]Department of Community Health, College of Health Sciences, Obafemi Awolowo University, Ile-Ife

ABSTRACT

Introduction: Intestinal parasitic infections (IPIs) and malaria are common infections, in children living in developing countries, especially children in orphanages. This study assesses the prevalence of IPIs and malaria among children in selected orphanages in the study area.

Methodology: A cross-sectional study was conducted from December 2023 to April 2024, and 150 children were recruited. Blood and stool samples were aseptically collected from assented children, and the coordinators of the orphanages consented to the study. Malaria parasites were detected using a rapid diagnostic test (RDT) and a Giemsa-stained blood film, and intestinal parasitic infections (IPIs) were detected using saline/iodine, formol-ether concentration, and Modified Ziehl Nelseen staining techniques.

Results: The prevalence of intestinal parasitic infections (IPIs) and malaria was 9.0% and 7.0%, respectively. For identifying intestinal parasites, the concentration method detected more parasites. However, for detecting *Plasmodium falciparum*, microscopy showed a higher detectable rate than RDT. Among the positive cases of parasitosis, the majority (90%) of the children had monoparasitism. Out of them, 6 (25%), 2 (20%), and 9 (45.0%) revealed monoparasitism of *A. lumbricoides, T. trichiura*, and *Plasmodium falciparum,* respectively, Of the two children with mixed infections, one was found to have *A. lumbricoides* and *T. trichiura i*nfection, and the other with *A. lumbricoides* and *P. falciparum* infection

Conclusion: The study detected the presence of parasitosis among children in selected orphanages in Ibadan . These findings may aid in developing and implementing initiatives to eliminate malaria and helminth infections in the study areas.

Keywords: Intestinal parasites, Malaria, Orphanages, Nigeria.

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INTRODUCTION

Intestinal parasitic infections (IPIs) and malaria are among the most prevalent parasitic diseases in Sub-Saharan Africa (SSA). Although the global frequency of these diseases has reduced over the last ten years due to an increase in the number of funding agencies contributing to the campaign against them, a large number of people continue to die each year, with children being the most at risk[1]. Intestinal parasitic infections (IPIs), caused by helminths such as *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms, and protozoa including *Entamoeba histolytica*, *Giardia duodenalis*, and *Cryptosporidium* [2,3], remain a major public health problem worldwide. The World Health Organization estimates that approximately 1.5 billion people (about 24% of the global population) are infected with soil-transmitted helminths, with the greatest burden occurring in tropical and

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Address for Correspondence: Olagunju P.M
Department of Community Health, College of Health Sciences, Obafemi Awolowo University, Ile-Ife. Email: pmolagunju@oauife.edu.ng; Tel: +234 814 294 6318

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subtropical regions where sanitation and hygiene are inadequate.

However, its prevalence has been found to increase to about 95% in underdeveloped countries, with SSA bearing the highest burden of this disease. The number of overall malaria cases has also increased internationally, with *Plasmodium falciparum* being the most virulent and responsible for most malaria mortality in Africa [4, 5]. The effects of intestinal parasites and *P. falciparum* infection differ by host, and children's development and capacity to learn have been shown to be negatively affected by parasitic infections [6, 7]. In addition, infections have been linked to stunted growth, impaired nutrient utilisation, diminished physical fitness, anorexia, diarrhoea, anaemia, loss of fluid and electrolytes and a higher risk of developing opportunistic infections [6, 8].

Malaria and intestinal parasitic infections are not limited to illnesses that primarily affect pregnant women, school children, and people with compromised immune systems; research from developing nations, such as Nigeria, indicates that they may also affect some marginalised members of society, such as children living in orphanages [9]. According to the 2008 Situation Assessment and Analysis (SAA) on Orphans and Vulnerable Children (OVC) in Nigeria, an estimated 17.5 million children (24.5% of all Nigerian children) were classified as OVC [10, 11]. This population is particularly vulnerable to a range of health problems, including infectious diseases such as intestinal parasitic infections, owing to poverty, inadequate sanitation, and poor access.

Orphans and vulnerable children often experience multiple social and health challenges, including psychological distress, inadequate parental care, poor nutrition, and limited access to healthcare services, which may increase their susceptibility to infectious diseases [12]. In many low- and middle-income countries, some institutional care settings face challenges related to overcrowding, inadequate water, sanitation and hygiene (WASH) facilities, and insufficient healthcare resources, all of which may facilitate the transmission of intestinal parasitic infections and malaria among resident children [12]. Children living in orphanages may also have limited control over their living environment and hygiene practices, further increasing their vulnerability to these infections. In Nigeria, studies conducted among children residing in orphanages and other institutional care settings have reported the occurrence of intestinal parasitic infections and malaria, particularly in Lagos, Anambra, and other parts of the country [13–16]. However, there is limited evidence on the burden of these infections among children living in orphanage facilities in Oyo State, Nigeria. Generating such evidence is important for informing targeted infection prevention and control strategies within institutional childcare settings. Therefore, this study investigated the frequency of intestinal parasitic infections and malaria among children living in orphanages in Ibadan, Oyo State, Nigeria.

This study aimed to investigate the frequency of intestinal parasitic infections and malaria in children in orphanages in Ibadan, Nigeria. The outcome of this research will help orphanage management develop appropriate intervention programmes to combat these infections.

MATERIALS AND METHODS

Study design and duration

This was a descriptive cross-sectional study conducted between January and May 2024 in four orphanages (HC, JK, IB, TB) within the Ibadan metropolis. The study participants were children in selected orphanages in Ibadan metropolis, Ibadan, Oyo State, Nigeria.

Study area

Ibadan is the capital and most populous city in Oyo State, Nigeria. It is Nigeria's third-largest city by population, behind Lagos and Kano, with a total population of 3,649,000 as of 2021 and more than 6 million people living in its metropolitan region. It is the country's largest city in terms of geographical area. [17] (https://artsandculture.google.com). There are eleven Local Government Areas (LGAs) for administrative purposes: six surround the city, and five are within it. The city is roughly located at latitude 7° 23′ north of the equator and longitude 3° 56′ east of the Greenwich meridian. The Yoruba people are the city's primary inhabitants, along with different communities from other regions of the country

Ethical consideration

Ethical approval (NHREC/OYOSHIEC/10/11/12) was obtained from the Oyo State Ministry of Health ethical review committee. Permission was obtained from the coordinators of the orphanages while assent was also obtained from each participant. All data were handled with strict confidentiality, ensuring that no identifiable patients and orphanage homes names disclosed.

Eligibility Criteria

Inclusion and exclusion criteria

The study included children age 0-20 years, who had stayed in the selected orphanages for a period of six month and above. Those who provided informed consent were also included, while participants who were unwilling or unable to provide stool and blood samples were excluded.

Sampling Technique

The children in the orphanages were selected using convenience sampling approach.

Sample size

The minimum sample size required for the study was derived from Thrusfield (2005) for estimating a single proportion in cross-sectional studies:

$$n=1.96^2 \times Pexp\ (1\text{-}Pexp)/\ d^2$$

P=the proportion in the target population estimated to have a particular characteristic, and a prevalence of 9.2% for intestinal helminthiasis in orphanages reported by Hadiza et al. [18] was used to derive *p*. The degree of accuracy was set at 0.05 (proportion of the sampling error tolerated), and the final value for *n* was 128. Subsequently, 150 children were sampled using purposive sampling.

Specimen collection and processing

Once participants gave assent, their stool and blood samples were collected. Teachers in the orphanages were instructed to put a teaspoon of stool into sterile, leak-proof, wide-neck stool containers. An experienced medical laboratory scientist also collected about 2 mL of whole blood into EDTA anticoagulated tubes. The specimens were labelled and transported to the Department of Medical Microbiology and Parasitology at University College Hospital, Ibadan, where they were stored at 4 °C for microscopic analysis. Relevant socio-demographic data were obtained using a pre-tested questionnaire.

Parasitological analysis

1. Stool processing and detection of intestinal parasites were done using saline/iodine, the formol-ether concentration technique and the modified Ziehl Nelseen techniques described by Cheesbrough [19]. A trained medical laboratory scientist examined the samples microscopically, while another senior laboratory scientist validated the results.
2. To detect malaria parasites by microscopy, thick blood films were prepared, stained and examined under the microscope by two experienced medical laboratory scientists as described by Cheesbrough [19]. A third expert scientist also crosschecked randomly selected slides. The malaria rapid diagnostic test kit was performed in situ during the survey to detect malaria infection using the Biocheck RDT according to the manufacturer's instructions.

Statistical analysis

The data were entered into a Microsoft Excel spreadsheet (Microsoft Corporation), and statistical analysis was conducted using SPSS version 23. Descriptive statistics were used to summarise the results, while assessment of association was performed using chi-square at 95% confidence interval (CI). Results were considered significant at $p<0.05$

RESULTS

Socio-demographic Characteristics of Children in the Orphanages

In this study, 150 children from four orphanages participated: (HC) 25 (16.7%), IB 30 (20.0%), JK 49 (32.7%), and TB 46 (30.6%). Ninety-four children (62.7%) were females, while

Table 1: Socio-demographic Characteristics of Children from Selected Orphanages in Ibadan

Variables	Categories	Frequency	Percentage (%)
Age (Years)	0-5 years	37	24.7
	>5 years	113	75.3
Sex	Female	94	62.7
	Male	56	37.3
Orphanage homes code	HC	25	16.7
	IB	30	20.0
	JK	49	32.7
	TB	46	30.6

Table 2: Prevalence of intestinal parasitic infections by sedimentation and saline/iodine methods

Variable	Sedimentation *n* (%)	Saline/iodine *n* (%)	X^2	P. Value
Positive	9 (6.0)	4 (2.7.)	2.0035	0.1569
Negative	141(94.0)	146 (97.3)		
Total	**150 (100)**	**150 (100)**		

Table 3: Prevalence of Malaria by RDT and Microscopy

Variable	Microscopy *N* (%)	RDT *n* (%)	X^2	P. Value
Positive	9 (6.0)	2 (1.3.)	4.6087	0.0318
Negative	141(94.0)	148 (98.7)		
Total	**150 (100)**	**150 (100)**		

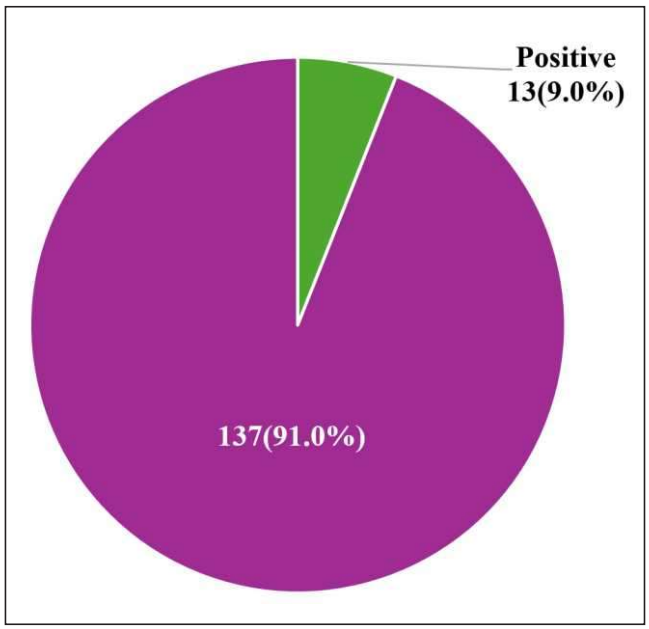


Figure 1: Overall Prevalence of Intestinal Parasitic Infections from Children in Selected Orphanages

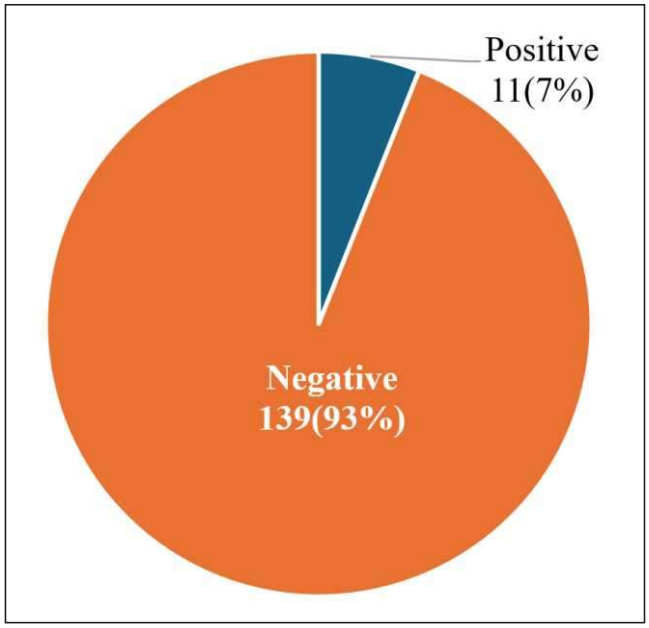


Figure 2: Overall Prevalence of Malaria from Children from Selected Orphanage

56 (37.3%) were males. 37 (24.7%) were below five years old, while the remaining children, 113 (75.3%),were above five years old (Table 1).

Prevalence and Pattern of Intestinal Parasitic Infections Among the Children

Figure 1 shows an overall prevalence of 9.0% of intestinal parasitic infections. A total of nine (6.0%) and four (2.7%) participants had intestinal parasitic infections using the concentration by sedimentation and saline/iodine methods, respectively. Though not significant, (P = 0.1569), concentration by sedimentation detected more intestinal parasitic infections than the saline/iodine method (Table 2).

Prevalence and Pattern of Malaria in Children in Selected Orphanages

The two diagnostic methods used in this study detected an overall prevalence of 11 malaria cases (7.3%). (Figure 2). The prevalence rates using RDT and microscopy showed that a total of two (1.3%) and 9 (6.0%) children were infected with malaria using RDT and microscopy methods, respectively. The microscopy method significantly (P = 0.0318) detected more malaria parasite than the RDT method in this study (Table 3)

Pattern of parasitosis among infected children

Table 4 summarises the socio-demographic characteristics of the 20 positive parasitic cases among the children investigated. The children's mean age was 9.7 ± 4.7 years, and the infection rate was the same for male and female participants. The majority [(18/20 (90%) (90%) of the children with parasitic infection had monoparasitism. Of these, 6 (25 %), 2 (20%), and 9 (45%) had monoparasitism with *A. lumbricoides, T. trichiura*, and *Plasmodium falciparum,* respectively. Of the two children with mixed infections, one with *A. lumbricoides* and *T. trichiura infection*, and the other with *A. lumbricoides* and *P. falciparum* mixed infection. Parasitosis cases were significantly (p=0.0206) higher in the JK orphanage than in the other three orphanages under investigation.

Table 4: Distribution of Positive Cases of Intestinal Parasitic Infections and Malaria Among Children in Selected Orphanages in Ibadan

Orphanage/ Subject code	Sex	Age	Intestinal Parasitic Infections	Malaria
TB80	F	7	*T. trichiura*	-
Jk102	M	11	*A. lumbricoides & T. trichuria*	-
JK105	M	16	*T. trichiura*	-
JK107	M	16	*A. lumbricoides*	-
JK108	M	10	*T. trichiura*	-
JK109	M	11	*T. trichiura*	-
JK111	M	14	*A. lumbricoides*	-
JK115	F	8	*A. lumbricoides*	
JK121	F	8	*A. lumbricoides*	*P. falciparum*
JK128	F	4	*A. lumbricoides*	-
JK150	F	9	*A. lumbricoides*	-
HC1	F	4	-	*P. falciparum*
HC13	M	3	-	*P. falciparum*
HC18	F	2	-	*P. falciparum*
TB75	F	5	-	*P. falciparum*
TB82	M	8	-	*P. falciparum*
TB92	F	17	-	*P. falciparum*
JK121	F	8	-	*P. falciparum*
JK136	M	15	-	*P. falciparum*
JK137	M	17	-	*P. falciparum*

Table 5: Analysis of Associated Risk Factors and Intestinal Parasitic Infections Among Children in Selected Orphanages in Ibadan

Variables	No. examined n (%)	No. positive n (%)	X^2	P-value
Age (Years)				
0-5 years	37 (24.7)	5 (13.5)	0.0010	0.9742
>5 years	113 (75.3)	15 (13.3)		
Sex				
Female	94 (62.7)	10 (10.6)	1.1851	0.2763
Male	56 (37.3)	10 (17.9)		
Orphanage homes code				
HC	25 (16.7)	**3 (12.0)**	9.7710	0.0206
IB	30 (20.0)	**0(0.0)**		
JK	49 (32.7)	**13 (26.5)**		
TB	46 (30.6)	**4 (8.7)**		

DISCUSSION

Intestinal parasitic infections and malaria parasites are not just a disease peculiar to pregnant women, school children and immunocompromised individuals; some evidence in developing countries, including Nigeria, suggests that they are also associated with some neglected societal populations, such as children living in orphanages [1,12].

This study showed an overall prevalence of 9% of intestinal parasitic infections among children from four selected orphanages in Ibadan, Nigeria. The prevalence obtained in this study is comparable with those of other investigators in Nigeria [18, 20, 21]; however, Ogbe and Adu [13] in Lagos, Inabo and John [14] in Anambra, and Anumba et al. [16] in Kaduna reported higher prevalence of intestinal parasitic infection among children in orphanages than this present study. The discrepancies may be due to sampling techniques and sample size, as well as variation in sanitation and hygiene practices. Improved sanitary conditions might also have accounted for the low prevalence observed among the children in this study.

Observations made during the survey showed that the personnel/staff in most homes have acquired tertiary-level education, and that periodic seminars are usually organised for staff members on personal hygiene and environmental sanitation.

The intestinal helminths found in this investigation were *A. lumbricoides* and *T. trichiura*. The findings are consistent with Nwaneri and Omuemu [22], who reported the same helminth species in their institutional investigation, but differ from Ezeagwuna *et al*. [23] and Ugbomoiko *et al*. [24], who detected various species, including hookworm. This discrepancy in the detected parasite could be explained by Ezeagwuna and Ugbomoiko [24], who conducted their studies in typical settings in which children could move freely and go barefoot in faeces-contaminated environments. In contrast, this study and that of Nwaneri and Omuemu [22] were conducted in an environment where children had limited access to contaminated areas. Comparable to studies conducted in Ethiopia by Molla *et al*. [25] and Tsegaye *et al*. [26], the overall prevalence of *Plasmodium falciparum* in this study is lower than the global malaria prevalence among children [27] and studies carried out in East Shewa [28], Sudan [29], and Uganda [30]

The accurate diagnosis of stool samples is challenging and depends on skilled microscopists and on quality assurance from collection through processing. Thus, diagnosis is vital for preventing morbidity and complications and for active surveillance in control programmes. In the current survey, the concentration method showed a higher recovery rate of intestinal parasites than the saline/iodine method. It has been suggested that when parasite load was very low and/or missed, the concentration methods enabled the detection of intestinal parasites [31]. In the current survey, microscopy demonstrated a higher diagnostic recovery rate for *P. falciparum* infection than RDT. The increased microscopy recovery rate over RDT observed in this study is thought to be influenced by parasite density, although we did not measure parasite densities in this investigation. Studies have shown that most RDTs are less sensitive at low parasite densities (<200 parasites/μL), missing chronic latent infections in asymptomatic populations, especially in low-transmission settings. However, microscopy has a detection limit of 50-500 parasites/μL of blood [32], while expert microscopists may detect ten parasites/μL of blood [33].

It was found that the JK orphanage home accounted for the majority of the parasitosis cases found in this investigation. The degree of cleanliness and attention in the orphanages under investigation may cause this discrepancy. Based on survey observations, it appears that the kids living in this house have autism and mobility restrictions. Furthermore, the home exhibits inadequate environmental cleanliness, personal hygiene, and access to potable drinking water (observed). This was not available in any of the other orphanages surveyed, which all had functional boreholes and taps that provided water to the children.

Other GI parasites of public health concern, especially protozoa such as *Cryptosporidium parvum*, *Giardia duodenalis*, and *Entamoeba histolytica*, which are typically found in children, were not found in the present study. The reasons could be due to varying ecological and climatic conditions, differences in detection methods, and disparities in parasite endemicity from one region to the other.

Study limitations

There are several limitations to this study. First, the study's sample size was small at 150. Secondly, no comprehensive evaluation of the children's water, sanitation, and hygiene (WASH) was conducted. Third, the study may have underestimated the prevalence of IPIs because it used only one faecal sample and less-sensitive diagnostic tools.

CONCLUSION

In conclusion, this study found that the frequency of intestinal parasites and malaria parasites among children in selected orphanages in Ibadan, Nigeria, was 9.0% and 7.0%, respectively. Parasites found in the youngsters included *A. lumbricoides, T. trichiura*, and *P. falciparum*. Furthermore, incidences of parasitosis were greater in JK orphanage than in other orphanages under study. These findings may aid in developing and implementing initiatives to eliminate malaria and helminth infections in the study areas.

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Declarations

Author's Contribution

OOO, AMM, OOB and OPM conceptualized this study. OOO, AMM, and OOB designed this study. OOB and AMM participated in the fieldwork and data collection. OOO and AMM performed the data analysis and interpreted the data. OOO prepared the first draft of the manuscript, which was reviewed by OOO, OOB and OPM. All the authors contributed to the development of the final manuscript and approved its submission.

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REFERENCES

1. Centers for Disease Control and Prevention. Malaria worldwide [Internet]. 2014 [cited 2015 Jul 13]. Available from: http://www.cdc.gov/malaria/malaria_worldwide/index.html
2. Harhay M, Horton J, Olliro P. Epidemiology and control of human gastrointestinal parasites in children. Expert Rev Anti

Infect Ther. 2010;8(2):219-34.

3. Odo GE, Agwu JE, Ekeh FN, Ezea CO, Aguoru GC, Anya C, et al. Prevalence of intestinal parasites among school children in Uzo-Uwani Local Government Area of Enugu State. Int J Res Stud Microbiol Biotechnol. 2016;2(2):7-14.
4. Bhatt S, Weiss DJ, Cameron E, Bisanzio D, Mappin B, Dalrymple U, et al. The effect of malaria control on Plasmodium falciparum in Africa between 2000 and 2015. Nature. 2015;526:207-11.
5. World Health Organization. World malaria report 2015. Geneva: World Health Organization; 2015.
6. Makoge VD, Mbah GA, Nkengazong L, Sahfe NE, Moyou RS. Falciparum malaria, helminth infection, and anaemia in asymptomatic pupils in four villages in Cameroon. Eur J Zool Res. 2012;1(2):54-9.
7. Njunda AL, Fon SG, Assob JCN, et al. Coinfection with malaria and intestinal parasites, and its association with anaemia in children in Cameroon. Infect Dis Poverty. 2015;4:43. doi:10.1186/s40249-015-0078-5.
8. Hotez PJ, Kamath A. Neglected tropical diseases in sub-Saharan Africa: a review of their prevalence, distribution, and disease burden. PLoS Negl Trop Dis. 2009;3(8).
9. Spiegel PB. HIV/AIDS among conflict-affected and displaced populations: dispelling myths and taking action. Disasters. 2004;28(3):322-39.
10. Orphans in Nigeria [Internet]. 2009 Aug 17 [cited 2012 Sep 10]. Available from: http://allafrica.com/stories/200908170747.html
11. Nwaneri DU, Omuemu VO. Intestinal helminthiasis and nutritional status of children living in orphanages in Benin City, Nigeria. Niger J Clin Pract. 2013;16(2):214-9.
12. World Health Organization. Water, sanitation and hygiene (WASH) [Internet]. Geneva: World Health Organization; 2023 [cited 2026 Sep 6]. Available from: https://www.who.int
13. Inabo HI, John HD. Intestinal helminths among children in orphanages in some parts of Kaduna State, Nigeria. Cont J Microbiol. 2010;4:31-6.
14. Oluboyo O, Enweani IB, Ekejindu I, Oluboyo AO. Prevalence of some intestinal parasitic infections in relation to body mass index of children resident in orphanages in Anambra State, Nigeria. Eur Sci J. 2014;10(36):1857-7881.
15. Anumba JU, Onyido AE, Eneanya CI, Umeaneto PU, Iwueze MO, Okafor EN, et al. Gastro-intestinal parasites among children in some orphanages of Anambra State, Nigeria. Niger J Parasitol. 2016;37(2):135-41.
16. Google Arts & Culture [Internet]. Available from: https://artsandculture.google.com
17. Hadiza MK, Maikaje DB, Ijah UJJ. Prevalence of intestinal parasites among children attending daycare and orphanage centers in Kaduna metropolis, Kaduna. Sci World J. 2019;14(3).
18. Cheesbrough M. District laboratory practice in tropical countries. 2nd ed. Cambridge: Cambridge University Press; 2005. p. 191-205.
19. Okpala HO, Josiah SJ, Oranekwulu MU, Ovie EG. Prevalence of intestinal parasites among children in day care centres in Esan West Local Government Area, Edo State, Nigeria. Asian J Med Sci. 2014;6(4):34-9.
20. Achi EC, Njoku OO, Nnachi AU, Efunshile AM, Mbah JO, Aghanya IN, et al. Prevalence of intestinal parasitic infections among under-five children in Abakaliki Local Government Area of Ebonyi State. Eur J Pharm Med Res. 2017;4(4):218-22.
21. Nwaneri DU, Omuemu VO. Prevalence and intensity of intestinal helminthiasis in children living in orphanages in Benin City, Nigeria. J Prev Med Hyg. 2012;53:146-51.
22. Ezeagwuna D, Okwelagu I, Ekejindu I, Ogbuagu C. The prevalence and socioeconomic factors of intestinal helminth infections among primary school pupils in Ozubulu, Anambra State, Nigeria. Intern Epidemiol. 2009;9:1-4.
23. Ugbomoiko US, Onajole AT, Edugbola LD. Prevalence and intensity of geohelminth infections in Oba-Ile communities of Osun State, Nigeria. Niger J Parasitol. 2002;80:783-9.
24. Molla E, Ayele B. Prevalence of malaria and associated factors in Dilla Town and the surrounding rural areas, Gedeo Zone, Southern Ethiopia. J Bacteriol Parasitol. 2015;6:242. doi:10.4172/2155-9597.1000242.
25. Tsegaye AT, Ayele A, Birhanu S. Prevalence and associated factors of malaria in children under the age of five years in Wogera district, northwest Ethiopia: a cross-sectional study. PLoS One. 2021;16(10). doi:10.1371/journal.pone.0257944.
26. World Health Organization. World malaria report 2016 [Internet]. Geneva: World Health Organization; 2016 [cited 2026 Sep 6]. Available from: https://www.who.int/malaria/publications/world-malaria-report-2016/report/en/
27. Haji Y, Fogarty AW, Deressa W. Prevalence and associated factors of malaria among febrile children in Ethiopia: a cross-sectional health facility-based study. Acta Trop. 2016;155:63-70. doi:10.1016/j.actatropica.2015.12.009.
28. Gulam TBEMH. The prevalence rate and risk factors of malaria among under 5 years children at Elguneid Hospital, Elgezira State. 2015;7.
29. Roberts D, Matthews G. Risk factors of malaria in children under the age of five years old in Uganda. Malar J. 2016;15:246. doi:10.1186/s12936-016-1290.
30. Ricciardi A, Momar N. Diagnosis of parasitic infections: what's going on? J Biomol Screen. 2015;20:6-21.
31. Moody A. Rapid diagnostic tests for malaria parasites. Clin Microbiol Rev. 2002;15:66-78.
32. Varo R, Balanza N, Mayor A, Bassat Q. Diagnosis of clinical malaria in endemic settings. Expert Rev Anti Infect Ther. 2021;19:79-9