SJ Pediatrics and Child Health Africa
Vol. 3 No. 3 (2026): August 2026 Issue
https://doi.org/10.51168/nwg2r478
Original Article

Prevalence rates of giardiasis among different age groups of children attending Kiwoko C/U Primary school in Nakaseke District. A cross-sectional study.

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ABSTRACT

Background:

The study aimed to assess the prevalence rates of giardiasis among different age groups of children attending Kiwoko C/U Primary school in Nakaseke District.

Methodology:

This descriptive cross-sectional study at Kiwoko C/U Primary School, Nakaseke District, Uganda, included children aged 3–15 years to assess the prevalence and predisposing factors of giardiasis. A sample of 114 participants was selected via simple random sampling. Data were collected using pretested questionnaires for demographic and predisposing factors, while stool samples underwent macroscopy, direct saline, and iodine preparations to identify *Giardia lamblia*. Standard operating procedures ensured quality control, risk management, and safe sample handling. Data were analyzed in Excel and presented in tables, graphs, and charts. Ethical approval and informed consent were obtained.

Results:

The prevalence of giardiasis among the 114 children was 9.6% (11/114), with the majority testing negative (103, 90.4%). Age group 3–6 years had the highest prevalence (5/11, 45.5%), followed by 7–10 years (4/11, 36.4%) and 11–15 years (2/11, 18.2%). Males were slightly more affected (6/11, 54.5%) than females (5/11, 45.5%). The study included children aged 3–15 years, with most aged 7–10 years (44, 38.6%). Males (61, 53.5%) slightly outnumbered females (53, 46.5%). Most parents had primary education (43, 37.7%), borehole water was the main drinking source (49, 43%), and improved latrines were most common (81, 71%).

Conclusion:

The study found a low prevalence of giardiasis among children, with the majority of cases in ages 3–6 and slightly more common in males.

Recommendation:

Routine screening of all intestinal parasites, at least in public schools, to identify and curb the spread of giardiasis in communities.

Keywords: *Routine screening, intestinal parasites, prevalence of Giardiasis.*
Submitted: *December 02, 2025* ***Accepted:*** *June 11, 2026* ***Published:*** *August 05, 2026*

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BACKGROUND OF THE STUDY

Giardiasis remains a significant public health concern among school-aged children globally, with prevalence varying widely across countries and settings. In Nepal, a study of elementary school children reported an overall Giardia lamblia infection rate of 27.1%, with 72.9% testing negative; the mean age of participants was 10.4 years, and the response rate was 97% (Hajare et al., 2022).

In Zambia, microscopic analysis of faecal samples from 329 asymptomatic schoolchildren revealed a 10% prevalence, with the majority of infections classified as high-level (51.5%) (Tembo et al., 2020).

In Ethiopia, real-time PCR analysis of 393 stool samples from rural schools in Bahir Dar district showed a 55% infection rate, ranging from 38.8-70% across schools (de Lucio et al., 2016).

In Uganda, molecular assays on 254 samples revealed 87% prevalence by 18S rDNA, 52.3% positivity with TPI assemblage-specific probes, and a 41.6% prevalence by QuikChek RDT, with mixed assemblage infections also observed (Al-Shehri et al., 2019). These findings highlight the widespread distribution of giardiasis and variability in infection intensity across different regions.

The study aimed to assess the prevalence rates of giardiasis among different age groups of children attending Kiwoko C/U Primary school in Nakaseke District.

METHODOLOGY

Study design.

This research was a descriptive cross-sectional study. Both qualitative and quantitative study strategies were used to determine the prevalence and predisposing factors of

https://doi.org/10.51168/nwg2r478

giardiasis among children attending Kiwoko C/U Primary School. This was chosen because it provides reliable results in the shortest time and with minimal resources, as in the case of this study.

Study Area.

The study took place at Kiwoko Church of Uganda (C/U) Primary School, situated in Nakaseke.
District, Central Uganda.

Study Population.

The population under study included children between the ages of 3 and 15 years enrolled at
Kiwoko C/U Primary School.

Inclusion Criteria.

Children aged 3 to 15 years attending Kiwoko C/U Primary School are able to provide stool samples.

Exclusion Criteria.

Children who have been treated with antiparasitic medication within the past two weeks.
Children who are unwell and unable to provide stool samples during the study period.

Sample Size Determination.

The sample size was calculated using the formula for a single population proportion

$$n = \frac{Z^2pq}{d^2}$$

Where n = the desired sample size. z = the standard normal deviation (1.96) at 95% confidence level, d = error of margin. (0.04) p = estimated prevalence of giardiasis, where p = 0.05 (Hajare *et al.,* 2020).
q= 1-p
Therefore, $n=\frac{z2pq}{d^2}$

$$= \frac{1.96^2x0.05x(1-0.05)}{0.04}$$

n= 114
Therefore, the number of participants is 114

Sampling Technique.

A simple random sampling method was used, where a subset of the statistical population in which each member had an equal chance of being chosen to participate was used to obtain study subjects who met the inclusion criteria. The technique was used aiming to reduce the bias of representing the entire population.

Sampling procedure.

The study participants were selected using a simple random sampling technique.
114 papers were rolled, which is the sample size, and were assigned numbers 1-114; an extra 10 papers were added and labelled with letters.
The researcher explained to the participants that there will be 124 pieces of papers which will be in the box of which some have numbers and others with letters and informed them that each one of them will pick only one paper without replacing and whoever will pick a paper with number will participate during the study and those who will pick the papers with letters will not participate.
The papers were shuffled in the box, and thereafter the participants were requested to pick one piece of paper without replacing it and follow the instructions as guided.

Data collection method.

Qualitative data were used, such as demographic factors and predisposing factors, which were collected using self-administered questionnaire forms and researcher-guided questionnaires for those who could not read and write. The questionnaires were administered to participants after obtaining consent from their teachers. Laboratory tests, such as direct saline stool wet preparation and iodine preparation, were performed to diagnose Giardia lamblia.

Data collection tools.

A pretested questionnaire was used to collect social demographic factors and predisposing factors to giardiasis, stool containers, and laboratory request forms.

Data collection procedure.

The stool was analysed by the standard method of stool analysis, which includes stool macroscopy, direct saline wet preparations, and iodine preparations for cysts and trophozoites of Giardia lamblia. Stool macroscopy.
Observe the colour and consistency of stool.
Stools infested with Giardia lamblia may appear watery, sometimes foul-smelling for trophozoites or semi-formed to formed stools for cysts of Giardia lamblia.
Direct wet saline preparations.
A microscope slide was obtained and labelled with the patient's code number.
A small amount of the specimen was placed on a microscope slide.
A drop of saline was added to the specimen and mixed well.
The preparation was covered with a cover slip.
It was examined systematically using X10 and X40, looking for cysts and oocysts of Giardia lamblia.

Principle of iodine staining.

In staining, iodine solution stains certain cellular components like glycogen in parasitic cysts by forming a complex that enhances their visibility under a microscope.
Procedure of staining
A microscope slide was obtained and labelled with the patient's code number.

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A small amount of the specimen was placed on a microscope slide.
A drop of iodine was added to the specimen and mixed well.
The preparation was covered with a cover slip.
It was examined systematically using X10 and X40, looking for cysts and trophozoites of Giardia lamblia.

Quality control of the study

The questionnaire was pretested before use to make sure it's reliable.
I ensured that the questionnaire was fully filled out by the respondents and coded with the respondents' unique numbers.
Standard operating procedures were strictly followed during the study by the participants and in the laboratory.
All materials used were checked for expiry dates.
Reference Parasitological charts were placed on the working bench to guide during the study for morphological comparison.
Stool samples were examined several times before reporting any result.
The researcher used a parallel check by different technicians to control results.

Risk management plan

Risk management plan for the "Prevalence and predisposing factors of giardiasis among children aged 3-15 years attending Kiwoko C/U primary school included the following;

Safe waste management.

All the waste during the study was disposed of appropriately into the different waste bins that were provided during the study to avoid and prevent cross-infections.

Handwashing/Sanitization.

All the study staff and participants washed and sanitized their hands before and after handling stool samples.

Use of personal protective equipment.

The staff who helped in the collection of samples put on medical face masks to cover the nose, mouth, and chin. A disinfectant for cleaning surfaces in the area where the respondents collected samples from. Each staff member participating in the study was entitled to a separate pair of disposable examination gloves. The research assistants were encouraged to always wash their hands before and after handling a participant and to follow the steps of putting on and removing gloves.

Maintaining social distance.

While consenting and collecting samples from participants, chairs were placed at least 2 meters apart to maintain social distance between the study staff and the participant. Both the staff and the participant maintained a distance throughout the whole session and put on a face mask.

Maintaining the working area clean.

The area was kept clean through mopping the floor, sanitizing the tables plus chairs, door locks, and filing cabinets using alcohol-based solutions daily before and after working. A constant supply of disinfectants was ensured in the examination room. Proper ventilation of the room was ensured by keeping the windows and ventilators wide open.

Safe transportation to the laboratory for examination.

Triple packaging of the stool samples was ensured for safe transportation to Kiwoko Hospital.

Laboratory for examination.

Transportation under a cold chain was also ensured.

Data analysis and presentation.

All data collected during the study were analysed and entered into Excel, where the results were used to generate tables, graphs, and pie-charts for the study.

Ethical considerations.

An introductory letter was given by the principal tutor to the researcher (student).
Permission was given by Kiwoko C/U Primary School after giving them the introductory letter.
The benefits and purpose of the study were explained to the participants, after which they chose whether to participate or not.
Privacy and confidentiality were paramount during the study.

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RESULTS

Table 1: A table showing respondents' demographic characteristics.

VARIABLE	DEMOGRAPHIC CHARACTERISTIC	FREQUENCY	PERCENTAGE (%)
Age group	3-6 7-10 11-15	35 44 35	30.7 38.6 30.7
Total		**114**	**100**
Gender	Male Female	61 53	53.5 46.5
Total		**114**	**100**
Parents level education	Illiterate Primary Secondary Tertiary	9 43 27 35	7.9 37.7 23.7 30.7
Drinking water source	Tap water Borehole water Well water	41 49 24	36 43 21
Total		**114**	**100**
Human waste disposal facilities at home	Toilets Improved latrines Unimproved latrines	25 81 7	21.9 71 6.1
Total		**114**	**100**

From the table, age group of 7-10 had the highest number of participants,44 participants (38.6%), age groups of 3-6 years, 11-15years had equal number of participants,35 participants(30.7%), The gender that participated most are males with 61 participants (53.5%) and females with 53 participants (46.5%), most parents education level was primary level making 43 parents(37.7%), followed by tertiary level with 35 parents(30.7%), followed by secondary level with 27 parents(23.7%) and lastly illiterate with 9 parents(7.9%). Borehole water was the most used drinking water source with 49 participants (43%), followed by tap water with 41 participants (36%), well water with 24 participants (21%), Most homesteads used improved latrines as their waste disposal facilities that is 81 participants (71%), followed by those using toilets with 25 participants (21.9%) and lastly those using un improved latrines giving 7 participants (6.1%).

The prevalence of giardiasis in children

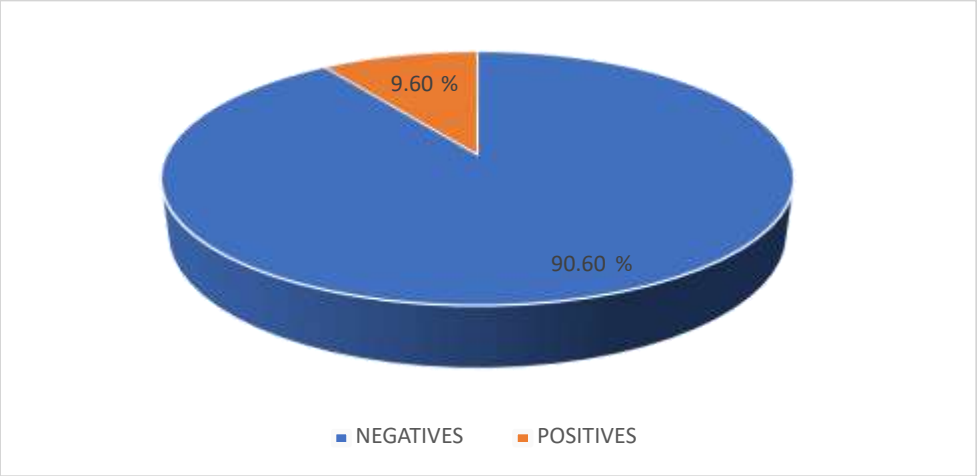
Table 2: The prevalence of Giardiasis in children.

RESULTS WITH SALINE AND IODINE PREPARATIONS	FREQUENCY	PREVALENCE PERCENTAGE
NEGATIVE	103	90.4%
POSITIVE	11	9.6%
TOTAL	**114**	**100%**

https://doi.org/10.51168/nwg2r478

From the above table, 11 children (9.6%) had cysts/trophozoites in their stools, while 103 children (90.4%) did not have trophozoites or cysts in their stool samples.

Figure 1: A Pie chart showing the prevalence of giardiasis



The most affected gender among the children

Table 3: A table showing the results of the most affected gender among the children.

GENDER	FREQUENCY	POSITIVE	PERCENTAGE	NEGATIVE	PERCENTAGE
FEMALES	53	05	45.5	55	53.4
MALES	61	06	54.5	48	46.6
TOTAL	114	11	100	103	100

From the table, the most affected gender is males with 61 participants, 06 positive cases.
(54.5%) and 48 negative cases (46.6%), while females had 53 participants, 05 positive cases (45.5%), and 55 negative cases (53.4%).

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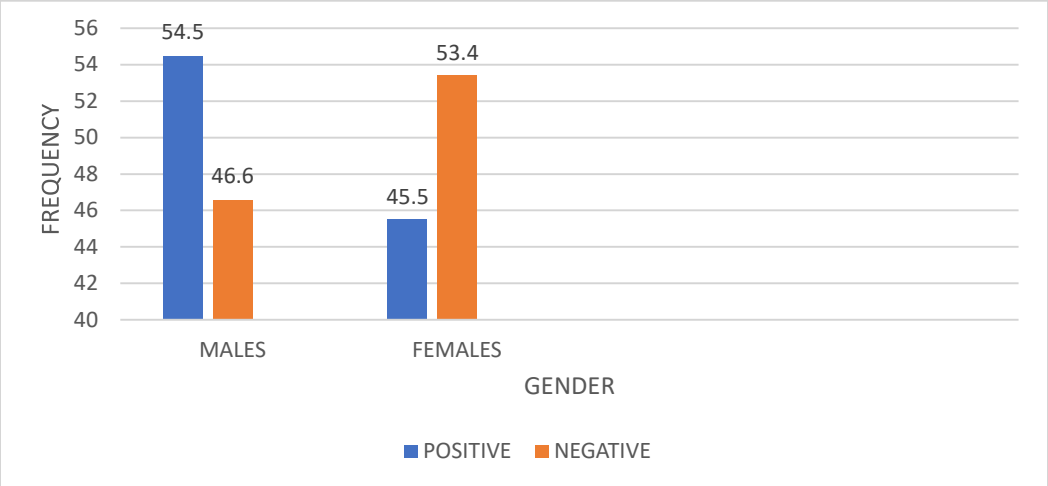
Figure 2: A bar graph showing the most affected gender among children



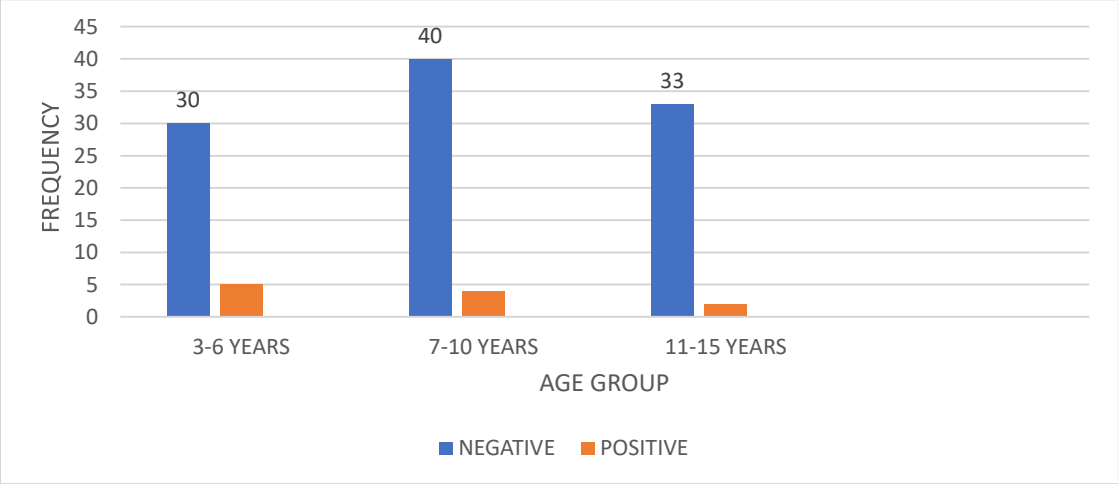
Most affected age group

Table 4: A table showing prevalence rates of giardiasis according to age groups.

AGE GROUP	FREQUENCY	NEGATIVE	POSITIVE	POSITIVE PERCENTAGE
3-6	35	30	05	45.5
7-10	44	40	04	36.4
11-15	35	33	02	18.2
TOTAL	114	103	11	100

From the above table, age group 3-6 had 35 participants,30 negative cases and 05 positive cases giving it the highest prevalence of 45.5%, followed by age group of 7-10 with 44 participants,40 negative cases and 04 positives cases (36.4%), lastly 11-15 years age group had 35 participants, 33 negative cases and 02 positive cases hence giving it the lowest prevalence of 18.2%.

Figure 3: A bar graph showing the most affected age group among children.



DISCUSSION

General prevalence of Giardiasis among children

In this study, the overall prevalence of giardiasis was found to be 9.6%. This was in agreement with a study done in Zambia, where the prevalence of giardiasis was 10% (Tembo *et al.,* 2020). This is probably because of the same demographic factors, such as poor education standards. However, it differs from a similar study done in Nepal, where the overall prevalence was 27.1% (Hajare *et al.,* 2022) because the number of participants enrolled was much higher than that in this study.

Assessment of prevalence rates of Giardiasis among different age groups of children

This study revealed that the age group of (3-6) years was the most affected age group, with a prevalence of 5/11 (45.5%). This agreed with a study done in Uganda where children aged 1 to 4 years had the highest prevalence of 26..8% (Ntulume *et al.,* 2017), this could be probably because of the same technique used that is to say saline and iodine preparations but disagreed with a similar study done in Zambia where the age group of 10-16 years had the highest prevalence of 11.2% (Tembo, S *et al.,* 2017) and this is probably because of the concentration techniques used like ethyl acetate/formalin that were not applied in this study.

Most affected gender

In this study, the most affected gender was males, 6/11 (54.5%), and this is in agreement with a study carried out in Yemen, where the prevalence of giardiasis was highest in males (AlMekhlafi *et al.,* 2017), as well as most of the similar studies conducted. This was because there was a large number of male participants enrolled in the study as compared to the females.

CONCLUSION

The study revealed that the majority of children enrolled were negative for *Giardia lamblia*, with only a small proportion testing positive. The prevalence of giardiasis was highest among younger children, particularly those aged 3–6 years, followed by children aged 7–10 years, and lowest among those aged 11–15 years. In terms of gender, males were slightly more affected than females. These findings suggest that younger children and male children may be at a higher risk of giardiasis. Overall, giardiasis prevalence in this population was relatively low, indicating that most children attending Kiwoko C/U Primary School were not infected. This highlights the need for continued preventive measures, especially targeting younger children, to further reduce infection rates and protect child health.

Limitations of the study

The time duration given for this study was limited, hence it does not give the real picture of the intensity of giardiasis in children.

The sample size of 114 is not a true representation of the whole school, and hence, the study might be biased.

Material resources limited the study to a molecular assay, which could have assisted in the accurate diagnosis of the infection.

Children, even with guidance from their teachers, feared participating in the study.

RECOMMENDATION

Routine screening of all intestinal parasites, at least in public schools, to identify and curb the spread of giardiasis in communities.

Putting sanitation measures like proper and adequate hand washing facilities at schools to prevent transmission of Giardia from infected individuals.

ACKNOWLEDGEMENT

I would like to appreciate the staff committee of Kiwoko C/U Primary School and the laboratory department of Kiwoko Hospital for their great support rendered to me during the process of data collection. May the almighty God bless them abundantly.

I also appreciate my supervisor, Mr. Ssekitoleko Anthony, for his guidance throughout the entire research process. May God bless you.

Lastly, I extend my sincere thanks to all my tutors and classmates who have always been with me throughout this journey and worked hard for me to achieve my goal. I pray that God rewards you for your efforts.

LIST OF ABBREVIATIONS

C/U	Church of Uganda
DNA	Deoxyribonucleic Acid
PCR	Polymerase Chain Reaction
RDT	Rapid Diagnostic Test
TPI	Triose Phosphate Isomerase (gene used for Giardia genotyping)
USA	United States of America

n	Sample size / Number of participants
%	Percentage
SOP	Standard Operating Procedure
PPE	Personal Protective Equipment
mL	Milliliters
min	Minutes
GI	Gastrointestinal

SOURCE OF FUNDING
The study received no external funding.

CONFLICT OF INTEREST
The authors declare no conflict of interest.

DATA AVAILABILITY
Data is available upon request from the author.

Jane Frank Nalubega: research supervisor at Mildmay School of Allied Health Sciences

AUTHOR CONTRIBUTIONS
DN: collected the data.
AS: supervised the study.
FS: supervised the study.
HN: supervised the study.
JFN: supervised the study

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Vol. 3 No. 3 (2026): August 2026 Issue
https://doi.org/10.51168/nwg2r478
Original Article

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