بسم الله الرحمن الرحيم

UNIVERSITY OF Dongola

Faculty of Medicine and Health Sciences

Department of Community Medicine

Research proposal

Title:

Prevalence and Treatment Adherence of Giardiasis Among Pediatric at Dongola Specialty Hospital 2026_2027

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1. Introduction

1.1 Background

Giardiasis is an intestinal infection caused by the flagellate protozoan Giardia lamblia (syn. Giardia duodenalis, Giardia intestinalis), one of the most common causes of parasitic diarrhoeal illness in children worldwide, with a recent global systematic review and meta-analysis estimating that protozoan pathogens are detected in about 7.5% of diarrhoeal cases worldwide, with Giardia duodenalis and Cryptosporidium the most frequently identified. (1,2) Transmission occurs mainly through the faecal–oral route, by ingestion of Giardia cysts in contaminated water or food, or by direct person-to-person contact under conditions of poor sanitation and hygiene. Children under five years of age are particularly vulnerable because of close contact with caregivers, unsupervised hand-to-mouth behaviour, and immature immunity, and infection in this age group has been linked to diarrhoea, abdominal pain, malabsorption, growth faltering, and cognitive impairment when it becomes chronic or recurrent.

The burden of giardiasis is disproportionately high in low- and middle-income settings with limited access to safe water and sanitation. A recent systematic review and meta-analysis pooling 114 studies from 29 African countries estimated the prevalence of Giardia duodenalis among African children at 18.3% (95% CI: 16.5–20.2%), with wide country-to-country variation driven largely by differences in sanitation, water access, and hygiene practices. (3) Within this broader African picture, a Sudanese school-based study reported a Giardia prevalence of 7.3% among children in Shendi, River Nile State. (4)

In Sudan, several hospital- and community-based studies have documented Giardia infection among children presenting with diarrhoea. A molecular survey of children under five years hospitalized with acute diarrhoea in Khartoum found a substantial burden of Giardia and other protozoan pathogens, with the highest prevalence of diarrhoeal illness occurring in children aged two years and younger. (5) Similarly, school-based surveys in Khartoum State have found Giardia infection, including subclinical (asymptomatic) infection, among primary school children, underscoring that the parasite circulates widely even among children who are not overtly symptomatic. (6)

Beyond diagnosis, successful control of giardiasis depends on completion of the prescribed antiparasitic regimen. Metronidazole remains the most widely used first-line drug, but multi-day, multiple-daily-dose regimens combined with side effects such as a metallic taste, nausea, and abdominal discomfort are recognized causes of poor adherence in children, which in turn contributes to treatment failure, prolonged symptoms, and continued transmission within households and communities. (7,8) Shorter, single-dose alternatives such as tinidazole have been reported to achieve both higher parasitological cure rates and better compliance than standard metronidazole courses. (9) Despite this recognized link between regimen characteristics and adherence, adherence itself is rarely measured directly

alongside prevalence in local studies, leaving a gap in understanding why treatment sometimes fails even when the correct drug is prescribed.

Dongola Specialty Hospital, located in Sudan's Northern State, serves as a referral facility for children from Dongola town and the surrounding River Nile agricultural communities, where reliance on Nile water and traditional water-storage practices may increase exposure to waterborne parasites. However, locally generated data on the burden of giardiasis among children attending this hospital, and on how well caregivers adhere to prescribed treatment, are lacking. This proposal seeks to address that gap.

1.2 Problem Statement

Giardiasis remains a major, preventable cause of diarrheal illness among children in Sudan, yet routine clinical data on its prevalence and treatment adherence are scarce—especially outside Khartoum. Regional studies report a Giardia prevalence of about 7.3% among school children in Shendi, River Nile State, with molecular surveillance in Khartoum confirming it as a leading protozoan pathogen among hospitalized under-five children with diarrhea, alongside Entamoeba histolytica and Cryptosporidium parvum. (4,5)

Despite this evidence from other parts of Sudan, no published data characterize giardiasis prevalence among children at Dongola Specialty Hospital, no caregivers' adherence to prescribed antiparasitic treatment.

This gap matters clinically: poor adherence to metronidazole and similar regimens is a well-documented driver of treatment failure and recurrent infection, particularly given side effects and multi-day dosing schedules. (7,8) Without local data on disease burden and adherence patterns—and the reasons reported for non-adherence—clinicians and public-health planners in Dongola lack the evidence needed to guide diagnosis, prescribing, and caregiver education.

This study therefore asks: What is the prevalence of giardiasis among pediatric patients at Dongola Specialty Hospital, and to what extent do their caregivers adhere to prescribed anti-giardial treatment, and what reasons do they report for non-adherence?

1.3 Justification

Giardiasis remains a prevalent yet underdiagnosed cause of pediatric diarrhea and growth faltering in Sudan. Currently, clinical decision-making and disease management at Dongola Specialty Hospital rely largely on outdated or extrapolated data from Khartoum and other regions, which may not reflect the local epidemiological context. Furthermore, while treatment failure and recurrent infections are frequently observed in clinical practice, there is a lack of localized data on whether these outcomes stem from treatment non-adherence, socio-economic factors, or therapy duration. Addressing these immediate knowledge gaps is essential to understand the current burden of the disease and identify existing barriers to effective treatment adherence in this specific setting.

1.4 Objectives

General Objective

To determine the prevalence of giardiasis and the level of treatment adherence among pediatric patients attending Dongola Specialty Hospital.

Specific Objectives

1. To determine the prevalence of Giardia lamblia infection among children attending Dongola Specialty Hospital, confirmed by stool examination or clinically.
2. To describe the socio-demographic, environmental, and clinical characteristics of children diagnosed with giardiasis.
3. To describe the environmental and behavioural exposures (e.g., source of drinking water, hand-washing practice, sanitation, contact with animals) reported among children with giardiasis.
4. To assess the level of caregiver/patient adherence to the prescribed anti-giardial treatment regimen.
5. To describe the reasons reported by caregivers for adherence or non-adherence to anti-giardial treatment among study participants.

1.5 Research Questions

As this is a descriptive study, no hypotheses will be tested. The study aims to answer the following research questions:

1. What is the prevalence of giardiasis among children attending Dongola Specialty Hospital?
2. What are the socio-demographic, environmental, behavioural, and clinical characteristics of children with giardiasis?
3. What is the level of adherence to the prescribed anti-giardial treatment, and what reasons do caregivers report for non-adherence?

2. Literature Review — Summary of Three Related Published Studies:

2.1 Suleiman&Azlan (2025) — Burden and Distribution of Protozoan Pathogens in Diarrhea Cases Worldwide: A Systematic Review and Meta-Analysis, 1999–2024 (Cureus) (2)

This global systematic review and meta-analysis, conducted following PRISMA guidelines, searched five databases (PubMed, Scopus, Google Scholar, Web of Science, and ScienceDirect) for studies published between 1999 and 2024 that reported the prevalence of protozoan pathogens — Giardia duodenalis, Entamoeba histolytica, Cryptosporidium spp., Blastocystis hominis, and Cyclospora cayetanensis — among diarrhoeal cases. Pooling data from 73 studies using random-effects models, with subgroup analysis by region, age, diagnostic method, and socioeconomic indicators, the review estimated a global pooled protozoan prevalence of 7.5% (95% CI: 5.6–10.0%) among diarrhoeal cases, with the highest regional rates recorded in the Americas and Africa, and Giardia duodenalis and Cryptosporidium identified as the most frequently detected pathogens worldwide. Relevance to this proposal: this global synthesis confirms Giardia as one of the two leading

protozoan causes of diarrhoeal illness worldwide and shows that its burden is disproportionately concentrated in low-resource regions such as Africa, providing the global benchmark against which the more localized African and Sudanese prevalence estimates used later in this proposal can be interpreted, and reinforcing the need for facility-specific data such as that proposed for Dongola Specialty Hospital.

2.2 Kalavani et al. (2024) — Prevalence of Giardia duodenalis Among African Children: A Systematic Review and Meta-Analysis (Parasite Epidemiology and Control) (3)

This systematic review and meta-analysis searched PubMed, Scopus, Web of Science, and Google Scholar for studies published between January 2000 and March 2022 that reported Giardia duodenalis prevalence among African children. Using a random-effects model to pool data from 114 studies conducted across 29 African countries, the review estimated the pooled prevalence of G. duodenalis infection among African children at 18.3% (95% CI: 16.5–20.2%), with substantial country-level variation ranging from a high of 65.1% in Niger to a low of 0.08% in Cameroon, reflecting differences in sanitation, water access, and hygiene practices across the continent. Relevance to this proposal: this continental-level estimate situates Sudan's expected Giardia burden within the wider sub-Saharan African picture, showing that prevalence among African children is both high and highly setting-dependent, which supports the rationale for generating facility-specific prevalence data for Dongola rather than relying on continental or non-Sudanese averages, and reinforces the water-, sanitation-, and hygiene-related risk factors that this proposal's questionnaire will also assess.

2.3 Osman et al. (2026) — Intestinal Parasitic Infections Among School Children in Shendi, Sudan (2021–2024): Prevalence, Risk Factors, and Diagnostic Comparison (Scientific Reports) (4)

This school-based cross-sectional study was conducted in Shendi locality, River Nile State, Sudan, between January 2021 and April 2024. Stool specimens from 1,200 basic-school children, selected by simple random sampling, were examined using wet preparation, formol–ether concentration, and flotation techniques, and a pretested questionnaire was used to collect risk-factor data. The overall prevalence of intestinal parasitic infection was 35.3%, and Giardia duodenalis was detected in 7.3% of the children (95% CI: 5.8–8.9), with protozoan infections, including Giardia, more frequent in rural areas than in the city centre. Infection was significantly associated with age, residential area, handwashing practices, and awareness of transmission, and formol–ether concentration showed higher diagnostic sensitivity than flotation.
Relevance to this proposal: this paper provides the closest existing River Nile State benchmark for Giardia prevalence (7.3%), which is used as the expected prevalence in this study's sample-size calculation, and it identifies hygiene-related risk factors that the present study will also describe, while extending the work to children attending Dongola Specialty Hospital and additionally measuring treatment adherence, which the Shendi study did not assess.

3. Materials and Methods

3.1 Study Design

A descriptive, cross-sectional, questionnaire-based study.

3.2 Study Area

The study will be at Dongola Specialty Hospital.

3.3 Study Population

include all children aged 6 months to 15 years attending the pediatric outpatient and inpatient departments of Dongola Specialty Hospital during the study period.

Inclusion criteria (Prevalence):

- Children aged 6 months to 15 years attending the hospital's pediatric department during the study period .
- Medical record documenting a diagnosis of giardiasis (based on prior stool examination or clinical assessment) during the study period.
- informed consent obtained from participants.

Exclusion criteria:

- Children with incomplete or inaccessible medical records regarding diagnosis or treatment.
- Children with chronic underlying gastrointestinal disease unrelated to parasitic infection (e.g., inflammatory bowel disease).
- children less than 6 months .

3.4 Sample Size

The minimum sample size will be calculated using the single-population proportion formula, $n = Z^2P(1-P)/d^2$, taking Z = 1.96 (95% confidence level), an expected prevalence (P) of 7.3% (0.073) based on the Giardia duodenalis prevalence reported among school children in Shendi, River Nile State (4), and a margin of error (d) of 5% (0.05). Calculation: $n = (1.96)^2 \times 0.073 \times (1 - 0.073) \div (0.05)^2 = 103.99$, which yields a minimum requirement of approximately 104 children. This will be increased by 10% (≈11 children) to allow for non-response, giving a target sample of about 115 children.

3.5 Sampling Technique

Simple Random sampling technique

3.6 Methods of Data Collection

- Data will be collected using a questionnaire, with reference to the child's medical records to confirm the diagnosis and prescribed treatment. No biological or stool samples will be taken. The questionnaire includes:

☆ Socio-demographic data
☆ Environmental and behavioral factors: such as water source, personal hygiene, and exposure to Nile water
☆ Medical history as reported by the caregiver

- ☆ Treatment adherence: number of doses taken compared to those prescribed, reasons for missed doses, and symptom improvement
- For the treatment adherence , children will be included if they have:
- ☆ A documented diagnosis of giardiasis
- ☆ A documented prescription for an antiparasitic drug (e.g., metronidazole or tinidazole).

3.7Study Variables

Main outcome variables:

- Giardia lamblia infection status (as documented in medical records).
- Level of adherence to prescribed anti-giardial treatment (adherent / non-adherent).

Characteristics and exposures to be described:

- Socio-demographic factors: Age; sex; residence (urban/rural); parental education and occupation; household income; family size
- Environmental :behavioural variables Source of drinking water; water treatment practice; sanitation and latrine type; hand-washing practice; waste disposal method; contact with animals;history of eating unwashed vegetables/street food.
- Clinical variables:Presenting symptoms (diarrhoea, abdominal pain, bloating, vomiting, failure to thrive); nutritional status (weight-for-age); previous history of giardiasis.
- Treatment-adherence variables: Drug prescribed and dosage; completion of full course; missed doses; reasons for non-adherence (side effects, taste, forgetfulness, symptom resolution, cost); caregiver's knowledge about the illness and its treatment.

3.8 Data Analysis

Data will be entered into Microsoft Excel and analysed using SPSS (or an equivalent statistical package). As this is a descriptive study, only descriptive statistics will be used. Categorical variables (e.g., sex, residence, source of drinking water, hand-washing practice, drug prescribed) will be summarized as frequencies and percentages, and continuous variables (e.g., age, family size, duration of symptoms) as means and standard deviations (or medians and interquartile ranges if the data are not normally distributed). The prevalence of giardiasis will be calculated as the number of children with documented giardiasis divided by the total number of children studied, and reported with its 95% confidence interval. Treatment adherence will be calculated from the number of doses taken compared with the number prescribed, participants will be classified as adherent or non-adherent, and the proportion in each group and the frequency of the reasons reported for missed doses will be described. No inferential tests or hypothesis testing will be performed. Results will be presented in tables, charts, and narrative text.

4. Ethical Clearance

- Research Ethics Committee of the Faculty of Medicine, Dongola University
- Dongola Specialty Hospital and the Ministry of Health
- Informed Consent from participants.

- Participants (or their caregivers on their behalf) have the right to withdraw from the study at any time, without giving any reason and without any effect on the care provided to the child.

5. Research Plan

The research will proceed through the following stages:

No.	Research stage / activity
1	Finalization and pre-testing of study tools.
2	Submission for ethical clearance and administrative permission.
3	Recruitment of participants and questionnaire administration with reference to medical records.
4	Data entry, cleaning, and analysis.
5	Report writing, group seminar presentation, and dissemination of findings to the hospital administration.

Time-line

Task to be performed	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16
Proposal submission (20–24 Sep 2026)	■															
Proposal presentation (27 Sep–1 Oct)		■														
Data collection (4–22 Oct)			■	■	■											
Data analysis (25 Oct–5 Nov)						■	■									
Writing results&discussion (8–19 Nov)								■	■							
Writing final report (22 Nov–3 Dec)										■	■					
Electronic submission to Dept. of Community Medicine (6–10 Dec)												■				
Research refereeing (13–24 Dec)													■	■		
Revisions / modifications (27–31 Dec)															■	
Research defense (3–4 Jan 2027)																■

W = week (Sunday–Thursday). W1: 20–24 Sep 2026 · W2: 27 Sep–1 Oct · W3: 4–8 Oct · W4: 11–15 Oct · W5: 18–22 Oct · W6: 25–29 Oct · W7: 1–5 Nov · W8: 8–12 Nov · W9: 15–19 Nov · W10: 22–26 Nov · W11: 29 Nov–3 Dec · W12: 6–10 Dec · W13: 13–17 Dec · W14: 20–24 Dec · W15: 27–31 Dec · W16: 3–4 Jan 2027.

6. Budget Breakdown

Item	Unit cost (SDG)	Quantity	Total (SDG)
Data collectors / research assistants allowances (3 persons, 3 weeks)	35,000	3	105,000
Printing of questionnaires, consent forms&stationery			60,000
Statistician / data analysis support			100,000
Transport within Dongola locality			70,000
Communication&data entry (software, airtime)			40,000
Report printing, binding&dissemination / seminar			80,000
Contingency (≈10%)			45,000
Estimated Total			**500,000**

Note: figures above are indicative planning estimates in Sudanese Pounds (SDG) and will be refined once staffing arrangements are confirmed with the hospital and university administration.

Reference

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