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Original Article

Prevalence and factors contributing to hookworm infection among patients attending Kajjansi health centre IV in Wakiso district. A cross-sectional study.

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ABSTRACT

Background:

Hookworm infection poses a considerable public health challenge, especially in rural areas where sanitation and hygiene are inadequate. It can cause anaemia and impaired cognitive development, with children and pregnant women being vulnerable. The study sought to assess the prevalence, level of knowledge, and contributing factors of hookworm infection among patients attending Kajjansi Health Centre IV.

Methods:

The study adopted a health facility-based cross-sectional design involving 63 patients. Stool samples were collected from the study participants, wet saline preparations made, and examined for the presence of hookworm ova. Data was cleaned to ensure completeness, consistency, and accuracy, then entered and analysed by a computer package known as SPSS (version 23.0).

Results:

The overall prevalence of hookworm infection was 15/63(23.8%). The study involved 31 males and 32 females. The age range was 17 to 51 years, and the mean age was 34years. Among the participants, 60% had poor knowledge of hookworm infection, and 40% had good knowledge. Among the respondents who were involved in the study, the highest rate of prevalence of hookworm infection was seen among participants who had no toilet or pit latrine with 6/8(75%), practiced gardening with 14/21(66.7%), never took deworming drugs with 13/20(65%), didn't put on shoes with 12/27(44.4%), those who did not drink boiled water with 4/34(11.8%) and there was no association between hookworm infection and the participants who washed hands after visiting the toilet and before eating food.

Conclusions:

The most affected individuals were those without pit latrines or toilets. The majority were not aware of the existence of hookworms. There is continuous exposure to predisposing factors, like being in contact with domestic animals and drinking unsafe water.

Recommendations:

There is a need for mass community awareness of hookworm infection to help curb the spread, and this makes them susceptible to hookworm infection.

Keywords: *Prevalence, Level of knowledge, Hookworm infection, Kajjansi Health Centre IV, Wakiso.*
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Background

Hookworms are intestinal parasites classified among the soil-transmitted helminths (STH), a group of nematode pathogens that affect millions of individuals globally, especially in low- and middle-income nations. Among the STH infections, hookworm is linked to the greatest global disease burden, accounting for an estimated 2.2 million disability-adjusted life years lost in 2013 (Clements *et al.*, 2022). Human hookworm, a type of soil-transmitted

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helminth (STH) infection caused by either *Necator americanus* or *Ancylostoma duodenale*, is a significant contributor to global morbidity and primarily impacts the poorest populations worldwide (Haldeman *et al.*, 2020). Global and national assessments of the soil-transmitted helminth burden, using data collected up to 2010, estimated that the prevalence of hookworm in sub-Saharan Africa was 13.6% (Sartorius *et al.*, 2021).

The prevalence of hookworm infection is influenced by climatic and socioeconomic factors, posing a major public health challenge in tropical and subtropical regions. In total, nearly 472 million people in rural developing countries are infected, with the majority of cases found in South-East Asia and Sub-Saharan Africa (Umbrello *et al.*, 2021). In East Africa, more than five million school-age children (SAC) are estimated to be at risk of soil-transmitted helminthiasis (STH) and hookworm infections in Kenya (Okoyo *et al.*, 2020). In Uganda, previous studies have shown that the prevalence of hookworm infection is fairly consistent across various geographical areas. For example, 45% of the population in Entebbe, 40.5% in Mayuge, and 51% in Tororo are infected (Tinkitina *et al.*, 2023). Humans become infected with hookworms when third-stage (L3) larvae, found in soil or on grass, penetrate exposed skin. The larvae of *Ancylostoma duodenale* can also be transmitted orally and, though rare, through transplacental and transmammary routes. Once inside the human host, L3 larvae travel via the bloodstream to the lungs, where they enter the alveolar spaces, are expelled in mucus, swallowed, and ultimately develop into adult worms in the small intestine.

Hookworms establish and sustain infection in humans through several virulence strategies, including penetrating and migrating through the skin, acquiring nutrients, and evading or modulating the host's immune response. The skin penetration and migration process occur when larvae are introduced via contact with soil contaminated with faecal matter containing the parasite's infective eggs. Once inside the host, adult hookworms thrive in the intestinal tract by extracting essential proteins, macromolecules, and minerals through hematophagy. Throughout the infection, immune evasion and modulation help hookworms bypass the host's immune defences, ensuring their survival (Cassar *et al.*, 2023). Protozoans are one-celled microscopic organisms, able to multiply in humans, contribute to their survival, permits serious infections, use one of the four main modes of transmission (direct, faecal-oral, vector-borne, and predator-prey). Helminthes are multicelled organisms, referred to as intestinal worms, even though not all helminthes reside in the intestines. However, in their adult form, helminths cannot multiply in humans and are able to survive in mammalian hosts for many years due to their ability to manipulate immune response (Hailu *et al.*, 2020). The study aims to determine the prevalence, level of knowledge, and factors contributing to hookworm infection among patients attending Kajjansi Health Centre IV in Wakiso district.

METHODOLOGY

Study design

Across sectional study design will be used. Both qualitative and quantitative study strategies will be used to establish the prevalence of hookworm infection among patients attending Kajjansi Health Centre. This has been 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 will be carried out at Kajjansi Health Centre 1V in Wakiso district. Wakiso district is located in central Uganda, encircling Kampala, the capital city. Specifically, it lies 20km northwest of Kampala along the highway to Hoima. It borders districts like Nakasero and Luwero to the north, Mukono to the east, Kalangala to the south, Mpigi to the southwest, and Mityana district to the northwest. The facility has both medical and non-medical departments; thus, medical officers, clinical officers, pharmacists, sonographers, dentists, laboratory technicians, midwives, enrolled nurses, and the non-medical department, including the cleaners and security guards. The facility is fully private with different services offered, including the following: antennal services, family planning, general treatment, dental services, post-abortion services, maternity services, pediatric services, and diagnostic services.

Study population

Sample size determination

According to Mugenda & Mugenda's formula (2003), the sample size, n, was determined by: $n = N/ (1 + Ne^2)$,

n= the sample size determined N =the total estimated population e = the level of significance assumed to be 0.05

$n = 75/ (1 + 75 \times 0.05^2)$ n = 63.15 n = 63 respondents

Therefore, 63 respondents will be needed for this study.

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Sampling Technique
Random sampling will be used because it will make the study easy, fast, and inexpensive to carry out.

Sampling procedure
I approached the patients who had come to Kajjansi Health Centre 1V in Wakiso District, and the positive ones were identified. A simple random sampling technique was used, where 63 papers having yes and 37 having no were folded, and respondents were asked to pick randomly without replacement, and those who picked papers having yes were included in the study.

Research variables
Dependent variable
Prevalence of hookworm infection

Independent variable
Factors influencing the prevalence of hookworm infestation.

Quality control
The questionnaire forms were checked thoroughly by the study for their completeness before the respondent left to ensure they met the qualities of attributes of a good data collection tool.

The report development was supervised by a supervisor who was technical in the study to ensure that an accurate and goal-oriented report was developed with an appropriate methodology.

In the study, questionnaires were checked for completeness, consistency, accuracy, and clarity of questions and answers at the end of each day.

Training of research assistants
Research assistants were trained in data collection techniques and the interpretation of questions. Respondents consented so that they were free and fully accepted to participate in the study.

Adherence to standard operating procedures
During the study, respondents were encouraged to put on face masks to prevent the spread of different airborne diseases.

Giving ample time for data collection
The study area was first visited before data collection. Data was collected for enough time, as this enabled the reduction of bias and provided reliable results.

Pre-testing
A pre-test study was done only on hookworm infection-positive patients attending Kajjansi Health Centre, and modifications were made. This enabled the study to make necessary adjustments in the tool to ensure validity, clarity, application, and completeness of the tool. The findings from this study were not included in the main study.

Data collection procedure
The first thing was obtaining permission from the facility administration. After signing the consent form and fulfilling the inclusion criteria, convenience sampling was applied to patients until the estimated sample size was reached. The respondents were interviewed in the most appropriate language, and their responses were recorded on their respective questionnaires. Challenges were shared on a daily basis, and strategies were made to ease data collection on subsequent days.

Piloting the study
An oral interview was carried out on 6 patients attending Kajjansi Health Centre, evaluating their knowledge and awareness about hookworm infection. This was done for a period of 3 days and enabled the study to have a full experience of the study before it started. The study also obtained real data, such that the questionnaires and certain operating procedures were adjusted to fit the situation at the study area.

Data analysis and presentation
Data was cleaned to ensure completeness, consistency, and accuracy, then entered and analysed by a computer package known as SPSS (version 23.0). The findings were then presented in tables, charts, graphs, and narratives. During the interpretation of data, the study explained and discussed the results thoroughly, depending on the information presented.

Ethical considerations
Permission to carry out the study was sought from the school by the research & ethics committee of Mildmay Institute of

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Health Sciences, Wakiso. Written informed consent was obtained from each participant before participation in the study.

The purpose of the study and the right of the respondents not to participate and not to answer the question, for which one does not want to participate, were carefully explained before asking for consent. The study endeavoured to avoid harm of any kind to respondents.

For confidentiality, the names of the respondents were included on the questionnaires, but instead of codes were used. The respondents were informed that they are not obliged to participate in the study, and they were free to withdraw from the study at any time of their choice.

RESULTS

Socio-demographic data

Table 1: A table showing demographic characteristics of the respondents

Characteristic	Frequency	Prevalence (%)
Age group		
17 and below	20	31.7
18-35	23	36.5
36-50	11	17.5
51 and above	09	14.3
Marital status		
Single	33	52.4
Married	30	47.6
Gender		
Female	31	49.2
Male	32	50.8
Level of education		
Primary	15	23.8
Secondary	38	60.3
Tertiary	10	15.9
Religion		
Catholics	25	39.7
Protestants	20	31.7
Muslims	18	28.6
Occupation		
Businessman/woman	28	44.4
Civil servant	07	11.1
Peasants	20	31.7
Unemployed	08	12.7

The majority of the respondents were in the age group of 18-35, with a prevalence of 36.5%, secondly, 17 and below (31.7%), followed by 36-50 (17.5%), and then lastly 51 and above (14.3%). Most of the respondents were single, with a prevalence of 52.4%, and 47.6% were married. The majority of the population had a low education level, with 60.3% secondary, 23.8% primary, and 15.9% tertiary level.

According to religion, most of the respondents were Catholics (39.7%), followed by protestants (31.7%) and then Muslims (28.6%). 44.4% of the population were

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businessmen and women, 31.7% peasants, 12.7% unemployed, and 11.1% were civil servants.

The general prevalence of hookworm infection

Table 2: A table showing the prevalence of hookworm infection

Result	Frequency	Prevalence (%)
Positive	**15**	**23.8**
Negative	**48**	**76.2**
Total	**63**	**100**

Table 2: Out of 63 samples that were examined, a prevalence of 23.8% (15) was discovered to be suffering from hookworm infection; however, 76.2% (48) of the samples were found to be negative, as illustrated in the pie chart below.

Level of knowledge about hookworm infection

Table 3: Table showing the level of knowledge about hookworm infection

factor	Option	frequency	negative results	positive results	prevalence
EVER HEARD OF HOOKWORM IFECTION	YES	20	20	06	40%
	NO	43	28	09	60%

Table 3 shows that most of the respondents demonstrated poor knowledge about hookworm infection, with a prevalence of 60%. 40% of the respondents had good knowledge about hookworm infection, which could have caused the positive results.

Factors contributing to hookworm infection

Table 4: Table showing factors contributing to hookworm infection among patients

FACTOR	OPTION	FREQUENCY	NEGATIVE RESULTS	POSITIVE RESULTS
Ever taken deworming drugs?	YES	22	30	00
	NO	41	20	13
Perform gardening	NO	28	28	00
	YES	35	21	14
Put on shoes	NO	35	27	12
	YES	28	24	00
Wash hands	NO	08	01	00

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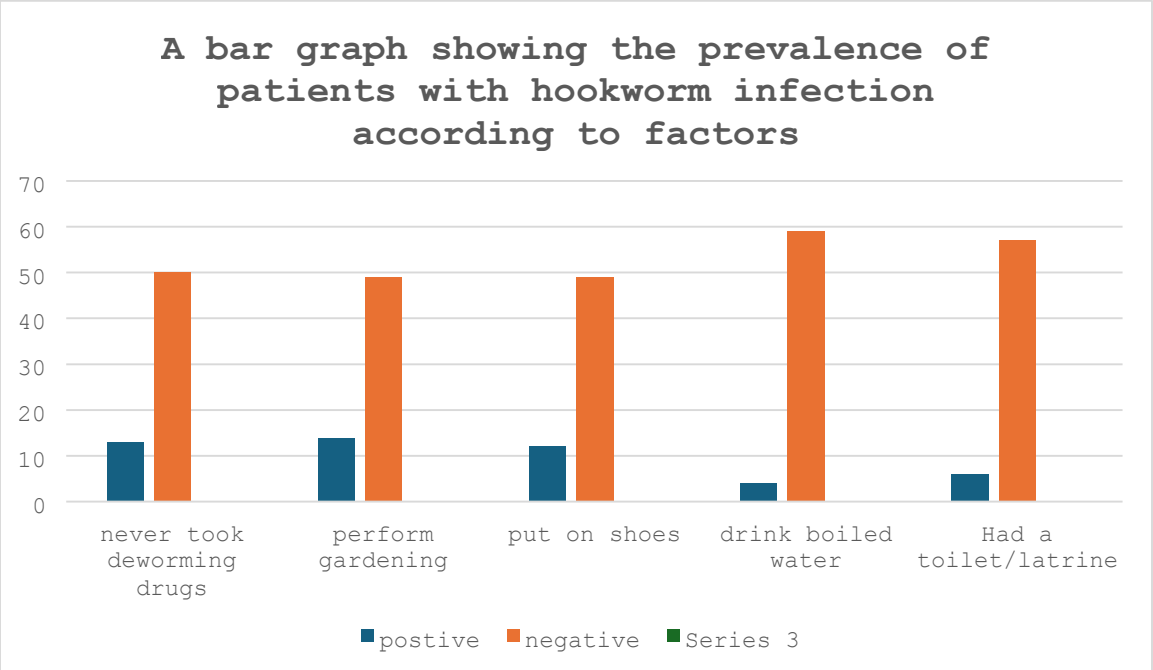
after visiting the toilet	YES	55	62	00
Washed hands before eating food	YES	50	56	00
	NO	13	07	00
Drink boiled water	YES	25	25	00
	NO	38	34	04
Had a toilet/latrine	YES	57	57	00
	NO	06	00	06

Table 4, out of 63 respondents who were involved in the study, the highest rate of prevalence of hookworm infection was seen among participants who had no toilet or pit latrine with 6/8(75%), practiced gardening with 14/21(66.7%), never took deworming drugs with 13/20(65%), didn't put on shoes with 12/27(44.4%), those who did not drink boiled water with 4/34(11.8%) and none of the participants among washed hands after visiting the toilet and before eating food were positive of hookworm infection.

Figure 1



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Discussions

Prevalence of hookworm infection among patients attending Kajjansi Health Centre 1V in Wakiso district

Out of the 63 respondents that took part in the study conducted at Kajjansi Health Centre 1V with their responses and samples collected and analysed, 23.8% tested positive and 76.2% were confirmed negative for hookworm infection using direct stool wet preparation, as shown in Table 2. In this study, the overall prevalence of hookworm infection was found to be 23.8%%. Conversely, a study done in Uganda from Entebbe showed that the prevalence of hookworm infection was 45% (Tinkitina *et al.*, 2023). The low prevalence (23.8%) in this study is probably justified by the fact that the method used (direct stool wet preparation) is less sensitive, and the small sample size used can be the cause of the low prevalence.

Prevalence of hookworm infection according to level of knowledge

Results showed that most of the respondents demonstrated poor knowledge about hookworm infection, with a prevalence of 60%. 40% of the respondents had good knowledge about hookworm infection, which could have caused the positive results.

Prevalence of hookworm according to factors

Out of 63 respondents who were involved in the study, the highest rate of prevalence of hookworm infection was seen among participants who had no toilet or pit latrine with 6/8(75%), practiced gardening with 14/21(66.7%), never took deworming drugs with 13/20(65%), didn't put on shoes with 12/27(44.4%), those who did not drink boiled water with 4/34(11.8%) and none of the participants among washed hands after visiting the toilet and before eating food were positive of hookworm infection. In contrast, a study carried out in m Univariable analyses identified significant associations across all ecological variables, and five of these remained significant in the final multivariable model. This included population density, mean annual vegetation density, mean annual land surface temperature (LST) during the day, mean annual LST during the night, and latrine coverage in household surroundings. Further analysis revealed significant interactions, indicating variations in the relationship between hookworm infection and factors such as population density, mean annual vegetation index, and latrine coverage in areas with the highest prevalence of infection (Riess et al., 2013).

Conclusions

Most of the respondents had poor knowledge (60%), and a few (40%) had good knowledge about hookworm infection. Most affected individuals were those without pit latrines or toilets.

The majority of the patients attending Kajjansi Health Centre 1V are not aware of the existence of hookworm, and that only indicates that it continues to be transmitted without being diagnosed, as most of them do not seek medical attention whenever they suffer from diarrhoea. They also continue to interface with many predisposing factors, like being in contact with domestic animals, drinking unsafe water.

Study limitations

The study was expected to face participants' nonresponse, which would affect the collection of information from the field, and participants would give wrong information on the questionnaires, which would affect the results. The possibility of an interviewer's bias could easily occur because the research tools were given to the respondents. There was a limitation of time compared to what was demanded, balancing the research with other demanding work. The data obtained was not generalised to all hospitals in Uganda; however, it would give an insight into what is happening to hospitals in other areas. Some respondents estated to giving information when approached.

Recommendations

There is a need for mass community awareness of hookworm infection to help curb the spread, and this makes them susceptible to hookworm infection.

There is a need for further research to examine the prevalence of hookworm infection and contributing factors with bigger sample sizes, and even in other regions of the country, to conclude.

Routine screening of hookworm infection should be done using more sensitive methods, such as sedimentation methods, other than just microscopy.

Policy makers need to plan and give emphasis to allocate resources for improving the health care of infected individuals.

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List of abbreviations and acronyms
L3 Third Larvae Stage
STH Soil Transmitted Helminths

Source of funding
The study was not funded.

Conflict of interest
The author did not declare any conflict of interest.

Data availability
Data is available upon request.

Author contribution
Richard Kafunike collected data and drafted the manuscript of the study
Francisco Ssemuwemba supervised the study
Hasifa Nansereko supervised the study
Jane Frank Nalubega supervised the study
Anthony Ssekitoleko supervised the study

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Richard Kafunike is a student at Mildmay Institute of Health Sciences.
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Anthony Ssekitoleko is a supervisor at Mildmay Institute of Health Sciences

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Original Article

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