PREVALENCE, KNOWLEDGE AND PRACTICES OF MALARIA PREVENTION AMONG PRIME GRAVIDAS IN LIRA CITY, NORTHERN UGANDA. A CROSS-SECTIONAL STUDY

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Abstract
Background
Malaria, caused by plasmodium parasites and transmitted by infected female mosquitoes, remains a significant public health issue, particularly in malaria-endemic regions. The study aims to establish the prevalence, knowledge, and practices of malaria prevention among prime gravidas in Lira City, Northern Uganda.

Methodology
A health facility -based cross-sectional study was conducted between April and May 2024, in Lira City. Data was collected among Prime Gravidas Aged 15-49 years using a structured questionnaire. Collected data was coded and entered in to SPSS software version 23 and descriptively analyzed for frequencies and percentages.

Results
Most respondents, 249(59.4%) were in the age bracket (20-29) years, 163(38.9) of the respondents were self-employed, 252(60.1%) were married, Most 275(65.6%) tested positive for malaria and treated it in the past 1 year, 149(35.6%) of the respondents were hospitalized for malaria treatment in the past 1 year, Most 247(58.9%) suffered from malaria during pregnancy, 122(29.1%) suffered once from malaria during the pregnancy, majority 311(74.2%) had attended health education talk on malaria, 125(29.8%) of the respondents were very susceptible to malaria infection during their pregnancy, 96(22.9%) mentioned going late to bed/being exposed to the mosquito as a reason for their perceived susceptibility to malaria, most 379(90.5%) sought for treatment first after feeling for symptoms of malaria from Health workers.

Conclusion
There is a high prevalence of malaria among Prime gravidas. There was a significant association between knowledge, practices, and the prevalence of malaria among Prime Gravidas in Lira City, Northern Uganda.

Recommendation
Health education programs should be implemented to improve PG's knowledge of malaria, and further research should be done to explore the underlying factors influencing malaria prevention among Prime Gravidas.

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Background
Malaria is "a protozoan disease caused by plasmodium species of parasites. It is transmitted by an infected female mosquito as it bites the human host." (Mugoya, 2023). In 2020, there were 247.7 million pregnancies worldwide, of which 156.9 million (63.4%) were in 85 malaria-endemic countries. Of the 247.7 million pregnancies, 121.9 million were at risk of malaria, representing 77.7% of all pregnancies in malaria-endemic countries and 49.2% worldwide. An estimated 70.9 million (58.1%) of these 121.9 million pregnancies at risk of malaria were estimated to have resulted in live births. The remainder (41.9%) was estimated to result in pregnancy loss, with 1.4 million (1.1%) ending in stillbirths, 33.5 million (27.5%) in induced abortions, and 16.1 million (13.2%) in miscarriages (Reddy, Weiss, Rozier, Ter Kuile, & Dellicour, 2023). In 2021, in 38 moderate and high transmission countries in the World Health Organization (WHO) African Region, there were an estimated 40 million pregnancies, of which 13.3 million (32%) were exposed to malaria infection during pregnancy (WHO, 2022). By WHO sub-region, West Africa had the highest prevalence of exposure to malaria during pregnancy (40.7%), closely followed by Central Africa (39.8%), while

prevalence was 20% in east and southern Africa (WHO, 2022).

The prevalence of malaria in pregnancy from population-based studies in Uganda ranged from 8.9% in the country`s low-transmission areas to over 50% in high-transmission settings (Mangusho et al., 2023). The burden of malaria infection during pregnancies is highest in the northern and northeastern regions of Uganda (Mangusho et al., 2023). The prevalence of malaria in pregnancy was 26.1% in northeastern Uganda (Mangusho et al., 2023). The prevalence of malaria among prime gravidas in Eastern Uganda is 54.8% (Mugoya, 2023). The prevalence of asymptomatic malaria among pregnant women in the Lira City/lira district was 25.5% (Acio, Omech, & Oceng, 2022), and the prevalence of placental malaria among pregnant women in the Lira district was 4.4% (Epuitai et al., 2023). Malaria contributes to significant morbidity and mortality in Uganda. In 2019, 152 of the total 3,528 maternal and newborn deaths in Uganda were due to malaria in pregnancy (Mangusho et al., 2023). Studies have been done and found that pregnant women`s knowledge and practices of malaria prevention determine their level of malaria prevention, for example, according to Okafor, Ezekude, Oluwole, and Onigbogi (2019), Nigerian pregnant women`s knowledge and preventive practices for malaria in pregnancy were not satisfactory, therefore they should be educated to correct misconceptions. According to a study done in Lwengo district, southwestern Uganda, it found that even though a significant number of pregnant mothers possessed fairly satisfactory knowledge and practices towards the prevention of malaria in pregnancy, a significant percentage of pregnant mothers were reluctant to uptake ANC and ITNs need extra intervention (Musimenta & Mubangizi, 2022). According to Esomonu, Ossai, Gadzama, Ashikeni, and Uzochukwu (2022), minor proportions of the pregnant women in Nigeria had good knowledge of and good preventive practices against malaria therefore, they should be made aware and motivated to practice malaria prevention during pregnancies. However, there is a dearth of data regarding the knowledge and practices of malaria prevention among prime gravidas in Lira City, northern Uganda. Hence, this study was conducted to assess its level to aid policymakers in better planning interventions to mitigate malaria in pregnancy. The study aims to establish the prevalence, knowledge, and practices of malaria prevention among prime gravidas in Lira City, Northern Uganda.

Methodology
Research design
This study was a health facility-based cross-sectional study in Lira Regional Referral Hospital (LRRH), Lira City, northern Uganda, and a quantitative method was employed among Prime Gravidas attending antenatal care services.

Cross-sectional study is a research design in which you collect data from many different participants at a single point in time (Wang & Cheng, 2020). A cross-sectional study is a better way of determining the prevalence of a disease condition, explaining the association of factors to a disease condition, it saves time and is inexpensive (Wang & Cheng, 2020).

Study site and setting
The study was conducted at the Antenatal care clinic of LRRH located in Lira City West division, Lira City, Northern Uganda. Lira city is about 342.5 km away from Kampala, which is the capital city of Uganda, the coordinates are 2º 14′ 59.6400″ N and 32º 53′ 59.4600″ E. The population of the city is approximately 478,500 people (UBOS, 2022). LRRH serves Lira City and districts in the Lango sub-region like Lira, Oyam, Dokolo, Otuke, Alebtong, Apac, Amolotar, Kole, Kwania, and other people who can have access with an estimated population of 2.2 million people. It is the biggest hospital in the Lango sub-region, with a 350-bed capacity. It is among 13 current regional referral hospitals in Uganda, though with time, development and technology can change the settings above. The facility has many medical personnel found in both general and specialized clinics, offering a variety of services like surgery, dentistry, medicine, orthopedics, obstetric care, and gynecology and well-established outpatient care services such as outpatient department specifically for consultations, immunization of various communicable diseases, HIV testing, counseling and initiation of treatment if positive, family planning. Antenatal care services are offered every Monday to Friday, and they attend to approximately 370 PGs in a month.

Target population
PGs aged 15 - 49 years in Lira City, Northern Uganda.

Accessible population
PGs aged 15 - 49 years who were attending ANC at LRRH during the time of the research study (April 2024 –May 2024).
Eligibility criteria

Inclusion criteria
1. Prime Gravida
2. A resident of Lira City, northern Uganda
3. Aged 15 - 49 years

Exclusion criteria
All PGs from Lira City attending ANC services at LRRH were:

1. Mentally and medically ill during the time of the study. This is because they would not be in a position to comprehend and understand the questions and give authentic answers.
2. Scheduled visits for obstetric complications destined to a special obstetric clinic because they would not have ample time to answer the questions, and also some would be in pain, which would make them uncomfortable to withstand the study procedure.

Sample size calculation

This was calculated using Kish and Leslie formula (Kish, 1965),

$$n = \frac{p \quad (1-p)}{Z^2 \quad d^2}$$

Whereby;

d = margin of error, 5%   p = prevalence of malaria among PGs, which is 54.8% in Eastern Uganda (Mugoya, 2023) = 0.548

Z = standard deviation corresponding to 95% confidence interval, 1.96 from standard normal distribution table   n = the desired sample size   q = 1-p   q = 0.452

$$n = \frac{(0.548)\ (0.452)\ (1.96)^2}{(0.05)^2}$$

n = 380.62 n=381

Considering the 10% non-response rate of n (381), which is 38.

Therefore, the desired sample size, n = 419 PGs

Sampling technique and procedure

The study participants were selected through consecutive sampling methods. Consecutive sampling is a technique where the participants who meet the inclusion criteria are chosen one after the other depending on who was the first to arrive (first come, first served) until the required sample size is achieved (Bujang & Sa'at, 2016).

The pregnant women who had come for the antenatal care were screened by the researcher, researcher assistants, and the midwife on duty; those who met the inclusion criteria were selected. The researcher clearly explained the study's purpose, objectives, and benefits to them, and those who accepted to participate in the study were made to sign an informed consent form.

Recruitment of study participants

Participants were obtained from the Antenatal care clinic of LRRH. The Researcher and the midwives sorted the pregnant women and got those who met the inclusion criteria. The study purpose, objectives, and benefits were clearly explained to the participants, and those who accepted to participate in the study were made to sign an informed consent form.

Data collection
Data collection methods

Interviewer administration of the questionnaires was the data collection method used. The questionnaire was administered through face-to-face interviews by the researcher for participants. Face-to-face interviews have numerous advantages, such as establishing rapport with the participant, allowing immediate clarification, and rephrasing questions in case the participant does not understand it, and it generates higher response rates (Sileyew, 2019).

Data collection instruments

The questionnaire was the data collection instrument. Data on the prevalence of malaria, knowledge, and practices of malaria prevention among PGs was collected using a structured questionnaire written in English and translated into Lango during the data collection process for those participants who never knew English; this was administered by the researcher and the research assistants. The questionnaire comprised five sections: where section A consisted of socio-demographic information (age, marital status, education level, marital status, religion, occupation, among others), section B1 had questions about Health History, Section B2 had questions that determined knowledge of malaria (cause, signs and symptoms, treatment and prevention), section B3: sources of information about malaria, section C: had questions that determined the malaria preventive practices undertaken by the woman (use of ITNs, clearing bushes around the house, draining stagnant water, among others), section D: had questions that determined the malaria prevention status of the PG.

The measure of the malaria prevention status of the participants was based on their malaria status in the past month and during the pregnancy tested by a qualified health worker. Any PG who was without a history of malaria in the past 1 month, was not currently suffering from malaria diagnosed by a qualified health worker, without any of the cardinal symptoms of malaria, and was currently not taking antimalarial drugs was regarded as having prevented malaria.

The measure of knowledge on malaria prevention was classified as good, fair, poor, and does not know of any of the malaria prevention methods. Knowledge was determined based on the participant's number of correct answers to the malaria knowledge questions. The total expected correct answers was 20. Therefore, any PG who scored 15-20, 9-14, 3-8, and 0-2 was regarded to be good, fair, poor, and no malaria knowledge, respectively.

The measure of practices of malaria prevention was classified as good, fair, poor, or does not know the practice of any of the malaria prevention methods. There were seven malaria prevention method methods. Therefore, a PG who practiced 6-7, 3-5, 1 or 2, and 0 of the malaria prevention method was regarded to have good, fair, poor, or no of the malaria prevention practices, respectively.

Data collection procedure
An approval letter was obtained from the Lira University Research Ethics Committee (LUREC) to allow data to be collected from the study site. Permission from the hospital administrator of Lira Regional Referral Hospital was sought.

After sampling, the participants were given adequate information about the study, and those who agreed to take part in the study were made to sign an informed consent form. They were then interviewed by the researcher and the research assistant, and their responses were filled in the questionnaire. The questionnaire was translated into the Lango language for those who didn't understand English, and their responses were recorded. Each questionnaire administration took about 25 minutes. This was repeated consecutively based on the arrival time, that is to say, those who came first were interviewed first, this was done daily until the desired sample size was achieved. This process took place in the LRRH ANC waiting area.

This process of data collection took 4 weeks.

Data management
The data collected was kept under lock and key for safety. The data collected was entered into Microsoft Excel. The data was cleaned by checking for the completeness of the questionnaires, and then necessary corrections were made, coded, and exported to Statistical Package for Social Sciences (SPSS) version 23 for analysis.

Data analysis
The quantitative data collected was analyzed in a descriptive and inferential analysis. Statistical Package for Social Sciences (SPSS) version 23 was used for analysis.

Percentages for the prevalence of malaria, knowledge of malaria, and malaria prevention practice were obtained. The outcome was illustrated using tables, pie charts, and bar graphs. A multivariate analysis was done using binary logistic regression analysis to measure the association/relationship between the prevalence of malaria and knowledge and practices of malaria prevention. The 5% significance level, 95% confidence level, and 95% confidence interval were used for all statistical tests and estimates.

Quality control OR Rigour
Reliability
The data was collected by the researcher using a pre-tested structured questionnaire to ensure reliability. The questionnaire was administered to all prime gravidas found in LRRH seeking antenatal care services following inclusion criteria, and so any variation in the tool was identified and corrected such that relevant data of interest was collected from the study participants.

Validity
The researcher used face validity to assess the validity of the questionnaire. To ensure face validity, the research supervisor reviewed the questionnaire to check whether the items in the questionnaire were a valid measure of the concept that was being measured.

Informed consent
Consent was provided to every participant after thorough explanation of the participant`s rights. The participants were informed about the study, its aims, and benefits, and they were requested to sign the consent forms if they agreed. Therefore, all the participants voluntarily participated in the research study and also were able to withdraw at any time if they felt uncomfortable.

Results
Response rate
Data was collected from 419 participants, which corresponds to a response rate of 100%.

Table 1: Socio-demographic characteristics of the study participants in Lira City (n=419)

Variable		Frequency(f)	Percentage (%)
Age (years)	15-19	140	33.4
	20-29	249	59.4
	30-39	30	7.2
	40-49	0	0
Occupation	Employed	76	18.1
	Self-employed	163	38.9
	Housewife	38	9.1

	Peasant farmer	142	33.9
Marital status	Married	252	60.2
	Divorced	16	3.8
	Single	151	36.0
	Widow	0	0
Level of Education	Primary	158	37.7
	Secondary	165	39.4
	Tertiary	80	19.1
	Never went to school	16	3.8
Religion	Catholic	152	36.3
	Anglican	172	41.1
	Muslim	31	7.4
	Born again	64	15.3
Address within Lira City	Lira City West division	207	49.4
	Lira City East division	212	50.6
Estimated distance (km)	0-5	295	70.4
	6-10	114	27.2
	11-15	10	2.4
Tribe	Lango	354	84.5
	Muganda	16	3.8
	Acholi	16	3.8
	Latest	13	3.1
	Others	28	4.8
Monthly income (UGX)	0 -9,000	122	29.1
	10,000-100,000	90	21.5
	100,100-500,000	181	43.2
	500,100-800,000	26	6.2
Household size	1-4	327	78.0
	5-10	92	22.0
REPRODUCTIVE HISTORY Gravida	1	419	100
Miscarriages or abortion	0	419	100
Number of living children	0	419	100
Weeks of amenorrhea	1-12	125	29.8
13-27		256	61.1
>28		38	9.1

Table 1 shows that most of the respondents, 249(59.4%), were in the age bracket (20-29) years, 163(38.9) of the respondents were self-employed, most of the respondents 252(60.1%) were married, 165(39.4%) of the respondents attained a secondary level of education, 172(41.1%) of the respondents were Anglican, 212(50.6%) resided in Lira City East, most of the respondents 295(70.4%) moved less than 5 kilometers to the nearest health facility, Majority of the respondents 354(84.5%) were Langi, 181(43.2%) of the respondents earned between 100,000-500,000 Uganda shillings, 327(78.0%) of the respondents had a family size of 1-4, all the respondents were prime gravidas, had no miscarriages or abortions and had no living children, majority of the respondents 256(61.1%) were in the second trimester of their pregnancy.

Health history of the respondents
Table 2, Most of the respondents 275(65.6%) tested positive for malaria and treated it in the past 1 year, 149(35.6%) of the respondents were hospitalized for malaria treatment in

the past 1 year, 12(2.9%) of the respondents treated for sickle cell disease in the past 1 year, most of the respondents 247(58.9%) suffered from malaria during the course of pregnancy, 122(29.1%) of the respondents suffered once from malaria during the course of the pregnancy, majority of the respondents 311(74.2%) had attended health education talk on malaria, 125(29.8%) of the respondents were very susceptible to malaria infection during their pregnancy, 96(22.9%) of the respondents mentioned going late to bed/being exposed to mosquito as a reason for their perceive susceptibility to malaria, majority of the respondents 379(90.5%) sought for treatment first after feeling for symptoms of malaria from Health workers, 224(53.5%) of the respondents attributed their first choice of the cadre of health provider to the facility being near to them, majority of the respondents 367(87.6%) mentioned Drug shops or pharmacies as the most available nearest type of health facility where services for malaria treatment or prevention can be sought from in the residential address.

Table 2: Showing the Health history of the participants in Lira City (n=419)

| Variable	Response	Frequency (f)	Percentage (%)
Tested positive for malaria and treated in the past 1 year	Yes No	275 144	65.6 34.4
Hospitalized for malaria treatment in the past 1 year	Yes No	149 270	35.6 64.4
Treated for sickle cell disease in the past 1 year	Yes No	12 407	2.9 97.1
Suffered from malaria during pregnancy	Yes No	247 172	58.9 41.1
If yes, how many times?	1	122	29.1
	2	95	22.7
	3	20	4.8
	4	8	1.9
Attendance of any health education talk on malaria	Yes No	311 108	74.2 25.8
Perceive susceptibility to malaria infection during the course of pregnancy	Extremely susceptible Very susceptible Moderately susceptible Slightly susceptible Not at all susceptible	34 125 110 114 36	8.1 29.8 26.3 27.2 8.6
Reason for perceived susceptibility to malaria	Lives near a swampy area Goes to bed late/exposed to mosquitoes	52 96	12.4 22.9
	Pregnancy	86	20.5
	Lives in a bushy area	34	8.1
	Weak immunity	37	8.8
	Sleeps under a mosquito net	100	23.9
	Don't know	14	3.3
A cadre of health providers from whom the first malaria treatment was sought	VHT Traditional healers Health workers (nurses, midwives, laboratory technicians, pharmacists, or doctors)	34 6 379	8.1 1.4 90.5
Reason for first choice of the cadre of health providers for malaria treatment	Near to her Trusts them Cheap	224 178 17	53.5 42.5 4.1

Available nearest type of health facilities where services for malaria treatment or prevention can be sought from in the residential address	VHT Traditional healers (herbalists) Drug shops or pharmacies Medical clinics or centers (private ones)	50 6 367 182	11.9 1.4 87.6 43.4
	Government health centers (II, III, or IV)	269	64.2
	Private hospitals	121	28.9
	Government hospitals	181	43.2

Prevalence of malaria among the respondents

Figure 1, More than half of the respondents, 225(53.7%), were suffering from malaria diagnosed by a qualified health worker currently or in the past 1 month and had the cardinal symptoms of malaria. Of those who had malaria, 89.3% had headaches as a symptom, 83.6% were of the Lango tribe, 64.9% were in the second trimester of their pregnancy, 59.1% were in the age bracket of 20-29 years, 58.2% lived in Lira City West, 56.0% were married, 45.3% were Anglican, 43.1% attained a secondary level of education, 38.2% were peasant farmers.

Figure 1: Prevalence of malaria among the respondents
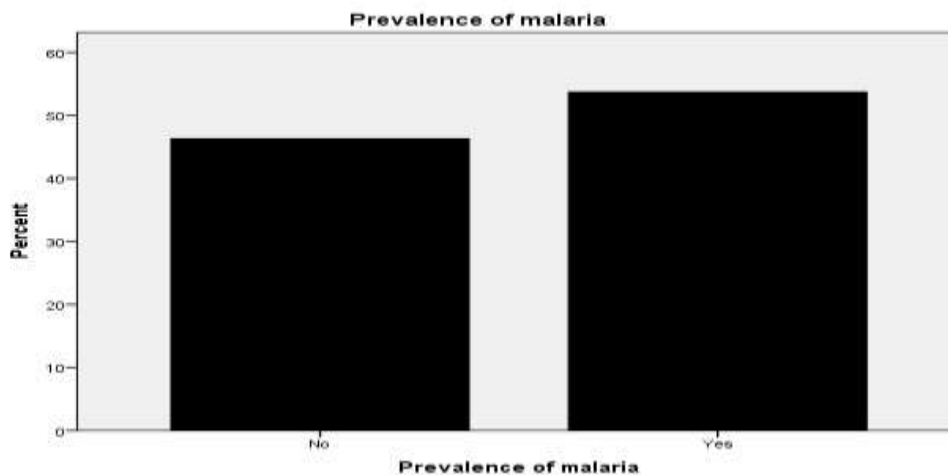
Knowledge about malaria

Table 3 shows that the majority of the respondents, 341(81.4%), had a fair overall knowledge of malaria (shown in Figure 3 below). Most of the respondents 407(97.1%) reported to have heard about malaria, most 381(90.9%) of the respondents heard about malaria from health workers, half 210(50.1%) of the respondents heard that malaria kills/is a killer disease, most of the respondents 405(96.7%) said that malaria is spread by mosquitoes, majority of the respondents 363(86.6%) identified fever with chills and rigors as the signs and symptoms of malaria in pregnancy, majority of the respondents 367(87.6%) identified Artemether-Lumefantrine aka Coartem (ACT) as a treatment for malaria infection, most of the respondents 383(91.4%) said clearing of bushes around the house prevent breeding of mosquitoes, majority of the respondents 371(88.5%) said closing of doors and windows early prevent malaria attack, most of the respondents 383(91.4%) said clearing of stagnant water around the house prevent breeding of mosquitoes, more than half of the respondents 292(69.7%) said taking of antimalarial drug fansidar during pregnancy prevents malaria, more than half of the respondents 254(60.6%) said Indoor residual spray with insecticides prevents malaria attack, 102(24.3%) of the respondents said use of mosquito sprays and lotions prevent mosquito bites, most of the respondents 407(97.1%) said sleeping under insecticide treated net prevent malaria attack.

Table 3: Showing knowledge about malaria of the respondents in Lira city (n=419)

Variable	Response	Frequency (f)	Percentage (%)
Heard about malaria	Yes	407	97.1
	No	12	2.9
Heard about it from	Radio	291	69.8
	Television	103	24.6
	Health workers	381	90.9
	VHTs	70	16.7
	Family members	283	67.5
	Friend	273	65.2
If yes, what exactly have you heard about malaria	It kills/kills disease Signs and symptoms	210 60	50.1 14.3
	Preventive measures	90	21.5
	Spread by mosquitoes	47	11.2
What spreads malaria?	Mosquitoes	405	96.7
	Others	6	1.4
	Don't know	8	1.9
Signs and symptoms of malaria in pregnancy	Fever with chills and rigors Headache	363 375	86.6 89.5
	Fatigue and general body weakness	245	58.5
	Muscle aches and joint pain	191	45.6
	Loss of appetite, abnormal discomfort, nausea or vomiting	255	60.9
	Don't know	18	4.3
Treatment of malaria infection	Artemether-Lumefantrine aka coartem (ACT)	367	87.6
	Artesunate-Amodiaquine	233	55.6
	Dihydroartemisinin-piperaquine (ACT)	82	19.6
	Chloroquine	45	10.7
	Quinine plus clindamycin	78	18.6
	Artemisinin-Mefloquine (ACT)	18	4.3
	Others	2	0.5
	Don't know	4	1.0
Malaria prevention methods Clearing bushes around the house prevents the breeding of mosquitoes.	True False	383 36	91.4 8.6
Closing of doors and windows early to prevent malaria attack?	True False	371 48	88.5 11.5
Clearing stagnant water around the house prevents the breeding of mosquitoes.	True False	383 36	91.4 8.6
Taking the antimalarial drug Fansidar during pregnancy prevents malaria.	True False	292 127	69.7 30.3
Does indoor residual spray with insecticides prevent malaria attack?	True False	254 165	60.6 39.4

Use of mosquito sprays and lotions to prevent mosquito bites	True False	102 317	24.3 75.7
Does sleeping under an insecticide-treated net prevent malaria attack?	True False	407 12	97.1 2.9

Figure 2: Showing Overall knowledge about malaria of the participants in Lira city (n=419)
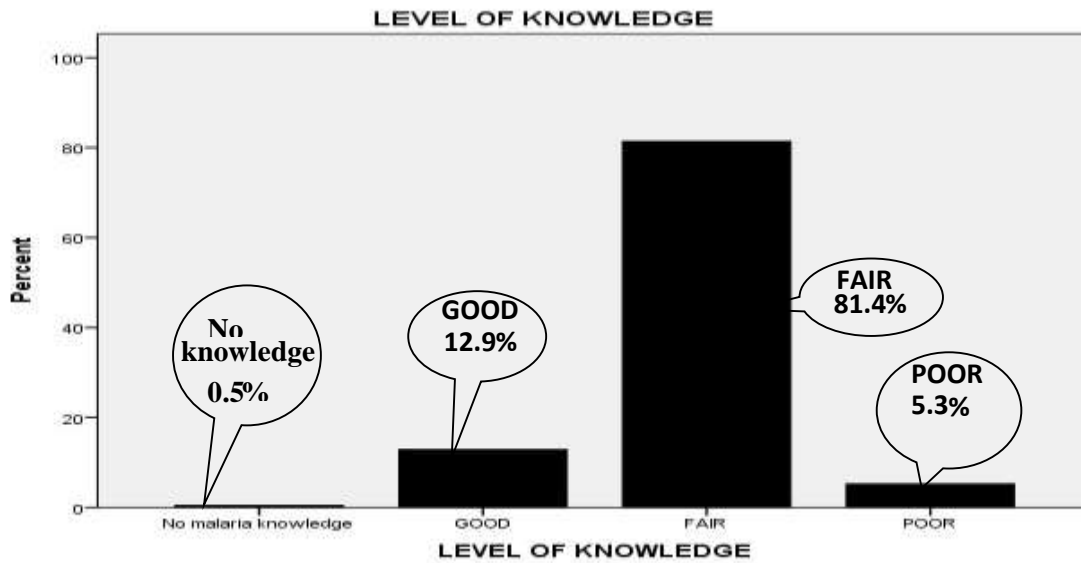
Source of information about malaria

Table 4: Showing Sources of information about malaria of the respondents in Lira city (n=419)

Variable	Response	Frequency (f)	Percentage (%)
Radio	Yes	315	75.2
	No	104	24.8
Television	Yes	119	28.4
	No	300	71.6
Newspapers	Yes	111	26.5
	No	308	73.5
Friends	Yes	315	75.2
	No	104	24.8
Family members	Yes	327	78.0
	No	92	22.0
Relatives	Yes	203	48.4
	No	216	51.6
Social media like WhatsApp, Twitter	Yes	81	19.3
	No	338	80.7
Village health teams	Yes	118	28.2
	No	301	71.8

Health workers (doctors, nurses, midwives, laboratory workers)	Yes	389	92.8
	No	30	7.2
Others		10	2.4

Table 4: This study found that Health workers (doctors, nurses, midwives, laboratory workers) were the commonest source of information about malaria among the 389 respondents (92.8%). Family members were on the second with 327(78.0%) of the respondents, Radio and Friends 315(75.2%), Relatives 203(48.4%), Television 119(28.4%), Village health teams 118(28.2%), Newspapers 111(26.5%), social media like WhatsApp, Twitter 81(19.3%) (shown in table 4 below)

Malaria prevention practices

Table 5 shows that the majority of the respondents, 333(79.5%), had a fair overall malaria prevention practice.

Most of the respondents, 409(97.6%), used insecticide-treated net daily, majority of the respondents 361(86.2%) practiced closing doors and windows daily, 34(8.1%) the respondents used mosquito sprays, 58(13.8%) of the respondents used mosquito lotions, majority of the respondents 361(86.2%) cleared bushes around their houses, more than three-quarters of the respondents 319(76.1%) drained stagnant water around their houses, 128(30.5%) of the respondents practiced indoor residual spray, 101(24.1%) of the respondents took antimalarial tablets (Sulfadoxine-Pyrimethamine) when feeling feverish, 14(3.3%) of the respondents burnt anti-mosquito candle smoke.

Table 5: Showing Malaria prevention practices of the respondents

Variable	Response	Frequency (f)	Percentage (%)
Use of insecticide-treated net	Yes	409	97.6
	No	10	2.4
Frequency of use of insecticide-treated net	Daily	409	97.6
Closing of doors and windows early	Yes No	361 58	86.2 13.8
Frequency of closing doors and windows	Daily	361	86.2
Use of mosquito sprays	Yes	34	8.1
	No	385	91.9
Frequency of mosquito spray use	Daily Weekly	12 10	2.9 2.4
	Whenever need be	12	2.9
Use of poor knowledge	Yes	58	13.8
	No	361	86.2
Frequency of mosquito lotion use	Daily	48	11.5
	Whenever need be	10	2.4
Clearing bushes around the house	Yes No	361 58	86.2 13.8
Frequency of clearing bushes around the house	Weekly	111	26.5
	Monthly	94	22.4
	Whenever bushes grow	156	37.2
Draining stagnant water around the house	Yes No	319 100	76.1 23.9
Frequency of draining stagnant water around the house	Daily Weekly	26 12	6.2 2.9
	Whenever water collects	281	67.1
Indoor residual spray	Yes	128	30.5
	No	291	69.5

Frequency of indoor residual spray	Weekly Whenever government offers	2 126	0.5 30.1
Taking antimalarial tablets (Sulfadoxine-pyrimethamine) when feeling feverish	Yes No	101 318	24.1 75.9
Frequency of taking antimalarial tablet (Sulfadoxine pyrimethamine)	Monthly Whenever feeling feverish	12 89	2.9 21.2
Burning anti-mosquito candle smoke	Yes No	14 405	3.3 96.7
Frequency of burning anti-mosquito candle smoke	Daily Weekly	6 8	1.4 1.9
	Whenever need be	2	0.5

Figure 3: Showing Overall malaria prevention practices of the respondents.
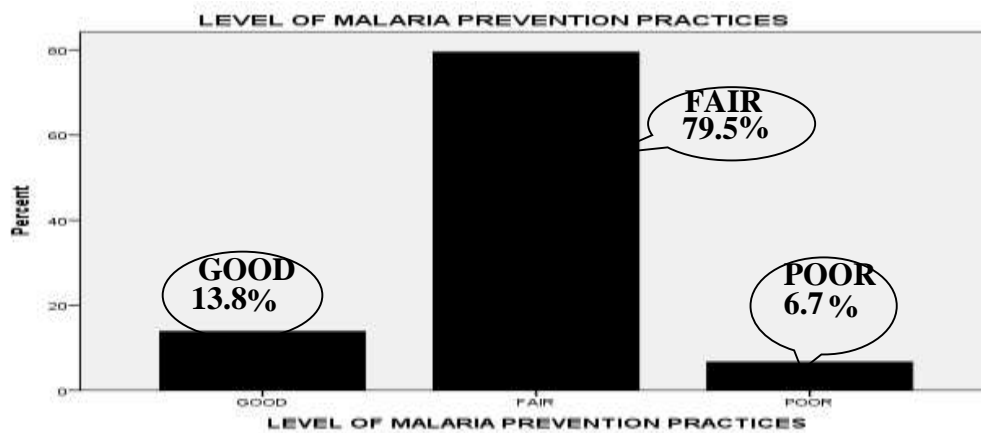
Association between the knowledge, malaria prevention practice, and prevalence of malaria among PGs

Table 6, There was a significant association between the level of knowledge about malaria among PGs and the prevalence of malaria (p-value<0.05). There was no significant association between the prevalence of malaria and the level of malaria prevention practices.
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Table 6: Showing the association between the level of knowledge about malaria and the level of malaria prevention practice with the prevalence of malaria

Variable	Prevalence of malaria: Freq (%)		X2	df	p-value
	Yes	**No**			
Level of Knowledge					
Good	28(12.4%)	26(13.4%)			
Fair	189(84.0%)	152(78.4%)			
Poor	6(2.7%)	16(8.2%)	8.387	3	0.039*
No malaria knowledge	2(0.9%)	0(0.0%)			
Level of Practice					
Good	28(12.4%)	30(15.5%)			
Fair	185(82.2%)	148(76.3%)	2.471	2	0.291
Poor	12(5.3%)	16(8.2%)			

*Legend: X² -Pearson Chi square value   *significant p-value*

There was an association between the knowledge of taking the antimalaria drug Fansidar during pregnancy, Indoor residual spray with insecticides, and fever with chills and rigors with the prevalence of malaria among PGs. However, there was no significant association between the knowledge of sleeping under an insecticide-treated mosquito net and the use of Artemether Lumefantrine aka coartem (ACT) as a drug for treating malaria infection with the prevalence of malaria among PGs.

Table 7: Showing association between Knowledge of taking antimalarial drug Fansidar during pregnancy, sleeping under an insecticide-treated mosquito net, indoor residual spray, use of Artemether-Lumefantrine, and Fever with chills and rigors with the prevalence of malaria

Variable	Prevalence of malaria: Freq (%)		X2	Df	COR (95% CI)	p-value
	Yes	**No**				
Taking Fansidar prevents malaria						
True	140(62.2%)	152(78.4%)	12.829		0.455(0.295-0.703)	
False	85(37.8%%)	42(21.6%)		1		<0.001*
Sleeping under a treated net prevents malaria						
True	217(96.4%)	190(97.9%)	0.836		0.571(0.169-1.926)	
False	8(3.6%)	4(2.1%)		1		0.361
Indoor residual spray prevents malaria						
True	130(57.8%)	124(63.9%)	1.645		0.772(0.521-1.146)	
False	95(42.2%)	70(36.1%)		1		0.200
Artemether-Lumefantrine aka Coartem Treats malaria						
Yes	203(90.2%)	164(84.5%)	3.099	1	1.688(0.938-3.037)	
No	22(9.8%)	30(15.5%)				0.078
Fever with chills and rigors are signs and symptoms of malaria						0.020*

Yes	203(90.2%)	160(82.5%)			1.961(1.103-
			5.401	1	
No	22(9.8%)	34(17.5%)			3.484)

*Legend: CI- confidence interval COR- Crude odds ratio   *significant p-value*

Table 7, There was an association between the practice of taking Fansidar (Sulfadoxine-pyrimethamine) and the prevalence of malaria. However, no significant association was found between the use of insecticide-treated mosquito nets and indoor residual spray and the prevalence of malaria.

Table 8: Showing the association between the practice of taking Fansidar, use of mosquito net, and indoor residual spray with the prevalence of malaria

Variable	Prevalence of malaria: Freq (%)		df	COR (95% CI)	p-value
	Yes	No			
Takes Fansidar to prevent malaria					
Yes	63(28.0%)	38(19.6%)	1	1.596(1.009-2.526)	0.045*
No	162(72.0%)	156(80.4%)			
Uses of insecticide-treated net					
Yes	219(97.3%)	190(97.9%)	1	0.768(0.214-2.764)	0.686
No	6(2.7%)	4(2.1%)			
Uses Indoor residual spray to prevent malaria					
Yes	60(26.7%)	68(35.1%)	1		
No	165(73.3%)	126(64.9%)		0.674(0.444-1.023)	0.063

*Legend: CI- confidence interval COR- Crude odds ratio   *significant p-value*

There was a strong association between the overall level of knowledge about malaria and the overall malaria prevention practice.

Table 9: Showing the association between knowledge about malaria and malaria prevention practice

Variable	Level of Practice: Freq (%)			X2	df	p-value
	Good	Fair	Poor			
Level of Knowledge e						
Good	26(44.8%)	28(8.4%)	0(0%)			
Fair	32(55.2%)	289(86.8%)	20(71.4%)			
Poor	0(0%)	14(4.2%)	8(28.6%)	94.393	6	<0.001*
No malaria knowledge	0(0%)	2(0.6%)	0(0%)			

*Legend: X^2 -Pearson chi-square value   *significant p-value*

Multivariate analysis of the level of knowledge and practice with prevalence of malaria

Results from multivariate analysis show that a PG with poor knowledge about malaria (AOR at 95% CI:3.117) was more likely to suffer from malaria (p<0.05). Complete results from the multivariate analysis are shown in Table 10.

Table 10: Showing multivariate analysis for Association between knowledge and practice with malaria prevalence

Variable	COR (95% CI)	AOR at 95% CI	p-value
Level of knowledge Good			0.999
Fair	3.6(1.071-12.062)	3.064(0.970-9.676)	0.056
Poor	4.121(1.366-12.430)	3.117(1.179-8.560)	0.022*
No malaria knowledge	1.00	1.00	
Level of practice Good	0.889(0.509-1.554)	0.936(0.347-2.523)	0.896
Fair	0.804(0.324-1.993)	1.283(0.563-2.926)	0.553
Poor	1.00	1.00	

*Legend: CI- confidence interval   AOR- Adjusted odds ratio   *significant p-value*

DISCUSSION
Prevalence of malaria
Of the 419 participants, 53.7% were suffering from malaria diagnosed by a qualified health worker currently or in the past 1 month and had the cardinal symptoms of malaria. This implies that approximately 5 out of 10 Prime gravidas in Lira city have malaria, with 59.1% being in the age bracket of 20-29 years. This is a high prevalence of malaria. The results of this study are consistent with that of Eastern Uganda-54.8% (Mugoya, 2023). This could be attributed to the syndromic approach used via history taking in the past month, thus prone to false positives, reduced immunity during pregnancy, and exposure to mosquitoes as some of them live in bushy and swampy areas since these places favor breeding of mosquitoes thus their increased numbers. It could also be due to the rainy season during the period of data collection, as mosquitoes are much during this period. This high prevalence is a clear indication that prevention and control measures have to be put in place to combat these high numbers.

Much as this study revealed a higher prevalence, a similar study conducted at Large Referral Hospitals in Northeastern Uganda showed a lower prevalence of 24.8% (Mangusho et al., 2023), This could be due to the use of the Rapid Diagnostic Test used in the study to detect malaria parasites in the blood of PGs since it is more accurate. Also, it could be due to the regional variation in the climate. In Ghana17.1% (Dwumfour et al., 2023), 12.72% in Ethiopia (Tegegne et al., 2019),11.4% in India (Jain et al., 2022). These could be attributed to different geographic locations, good malaria preventive practices, and advanced health care in these countries in comparison with Northern Uganda.

Association between the knowledge and practices of malaria prevention among PGs
This study found a significant association between the knowledge about malaria and the prevalence of malaria among the respondents(p-value<0.05), where prime gravidas, with a good level of knowledge, demonstrated a lower prevalence of malaria compared to those with fair or poor knowledge. This suggests that empowering PGs with accurate information about malaria transmission, signs, symptoms, prevention, and treatment could contribute to reducing the malaria burden in this population. However, no related studies were done to determine the association between knowledge, practice, and the prevalence of malaria among Prime Gravidas.

Further analysis revealed specific aspects of knowledge that were significantly associated with malaria prevalence. PGs who were knowledgeable about taking the antimalarial drug Fansidar during pregnancy, indoor residual spray with insecticides, and fever with chills and rigors demonstrated a lower prevalence of malaria. These findings underscore the importance of targeted health education on specific malaria preventive measures in the fight against malaria.

Interestingly, the practice of taking Fansidar was strongly associated with malaria prevalence, suggesting that adherence to preventive medication (Fansidar) could be an effective strategy in reducing the malaria burden among PGs. There was a strong association between the overall level of knowledge about malaria and malaria prevention practice; PGs with good knowledge were more likely to engage in malaria prevention practices. This emphasizes comprehensive education about malaria in promoting preventive practices. Results from multivariate analysis showed that a PG with poor knowledge about malaria (AOR 3.117, 95% CI 1.179-8.560, p<0.05) was 3 times more likely to suffer from malaria. This is because poor knowledge about malaria may lead to inadequate use of malaria preventive measures such as Insecticide-treated nets, indoor residual spraying, and prophylactic antimalarial medication, delayed health-seeking behavior as might not recognize early signs and symptoms. However, there were no related studies done.

Conclusion

This study highlights a high prevalence of malaria and a significant association between knowledge, practices, and the prevalence of malaria among Prime Gravidas in Lira City, Northern Uganda. The findings emphasize the importance of education in malaria control efforts, as PGs with better knowledge demonstrated lower malaria prevalence rates. However, this study also reveals gaps between knowledge and practice, indicating the complexity of behavior change in adopting malaria prevention measures. Targeted interventions aimed at improving specific knowledge areas and promoting adherence to preventive practices could contribute to reducing the malaria burden in this vulnerable population.

Recommendations

The health team should implement targeted health education programs to improve PGs' knowledge about malaria transmission, prevention, and treatment, with a focus on specific preventive measures such as taking antimalarial medication during pregnancy and recognizing malaria symptoms.

The health team should develop interventions to address barriers to practicing malaria prevention measures, such as promoting adherence to antimalarial medication, increasing access to insecticide-treated mosquito nets, and encouraging indoor residual spraying.

The community health workers and the local leaders should be engaged to disseminate malariarelated information, conduct community outreach activities, and facilitate behavior change communication sessions.

The MoH should integrate malaria prevention education and services into routine antenatal care visits to reach PGs and the pregnant women effectively.

Further research should be conducted to explore the underlying factors influencing knowledge, attitudes, and practices related to malaria prevention among PGs in Northern Uganda.

The MoH should monitor the impact of interventions on malaria prevalence rates to inform future programming.

Study Limitations

The cross-sectional nature of the study limits the ability to establish causality between knowledge, practices, and malaria prevalence.

The reliance on self-reported data for prevalence, knowledge and practices may introduce recall bias leading to overestimation or underestimation of true positives for prevalence, true knowledge and practices. This was mitigated by not using medical jargons, clarifying, rephrasing and paraphrasing the questions.

Use of face-to-face interviews could cause social desirability bias, leading to overestimation or underestimation of true knowledge levels and practices. This was mitigated by establishing good rapport with the participants.

The study sample was drawn from Prime Gravidas attending LRRH in Lira city, which may not be representative of all PGs in Northern Uganda, the findings may not generalize to PGs in rural or remote areas.

Abbreviations

ACT: Artemisinin-based Combination Therapy
ANC: Antenatal care
HIV: Human Immunodeficiency Virus
ITN: Insecticide Treated Net
LRRH: Lira Regional Referral Hospital
MoH: Ministry of Health
PG: Prime Gravida
UBOS: Uganda Bureau of Statistics
VHT: Village Health Team
WHO: World Health Organization

Conflict of interest

The author did not declare any conflict of interest.

Author contributions

Emmanuel Ojok Obura collected data and drafted the manuscript of the study

Edward Kumakech (Ph.D.) supervised all the processes of the study, including manuscript writing

Data availability

Use of this data may be granted after written authorization from the corresponding author.
Ethical approval
This research was approved by the Faculty of Nursing and midwifery and the Research Ethics Committee, Lira University and a letter to allow the researcher carry out data collection was obtained. Administrative clearance was obtained from the Hospital Administrator of LRRH.

Author Biography

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PUBLISHER DETAILS:

Burundi Publishing

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