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Prevalence of Malaria among Pregnant Women Attending Midnimo and Jazeera Hospitals in Abudwak, Galmudug State, Somalia: A Hospital-Based Cross-Sectional Study

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Abstract

Malaria during pregnancy remains an important maternal and fetal health concern in malaria-endemic and unstable-transmission settings. This study assessed the prevalence of malaria among pregnant women attending Midnimo and Jazeera Hospitals in Abudwak, Galmudug State, Somalia, and described selected socio-demographic and malaria-related characteristics. A descriptive cross-sectional hospital-based study was conducted among 150 pregnant women attending the two hospitals. Participants were selected using convenience sampling. Data were collected using a structured questionnaire, while malaria infection was assessed by microscopic examination of blood samples using Giemsa staining. Data were entered and analyzed using SPSS, with descriptive statistics and chi-square tests used to examine distributions and selected associations. Of the 150 participants, 2 (1.3%) were malaria-positive and 148 (98.7%) were negative. Most participants were aged 28 - 37 years (46.0%), lived in urban areas (60.7%), were married (90.0%), and were housewives (84.7%). Most reported a previous history of malaria (91.3%), while 86.7% reported using a mosquito net. Fisher's exact test showed no statistically significant association between malaria status and mosquito-net use (two-sided $p = 1.000$). Fisher's exact testing should likewise be reported for education level after verification of the underlying 2×3 contingency table; the present manuscript does not contain the cell counts needed to reproduce that exact test. The observed prevalence was low in this hospital-based sample. Continued malaria surveillance, antenatal care, promotion of effective mosquito-

net use, and further studies with larger probability-based samples and more sensitive diagnostic approaches are recommended.

Keywords

Malaria, Pregnant Women, Prevalence, Mosquito Net, Abudwak, Somalia

1. Introduction

Malaria in pregnancy is associated with important risks to the mother and fetus, including maternal anaemia, pregnancy loss, stillbirth, premature delivery and low birth weight. Pregnant women may be particularly vulnerable because pregnancy can alter immune responses to malaria infection. The World Health Organization continues to identify malaria as a major global health challenge, with the greatest burden occurring in the WHO African Region [1].

In Somalia, malaria transmission varies geographically and temporally, and surveillance and access to reliable diagnostic services remain important public-health challenges. The thesis underlying this manuscript describes malaria as an ongoing public-health concern in Somalia and notes the need for local data from Abudwak, where previous facility-based information on malaria among pregnant women was reported to be limited [2]-[4].

Preventive measures, including insecticide-treated mosquito nets, appropriate antenatal care, timely diagnosis and effective treatment of confirmed malaria, are central to malaria control during pregnancy [1] [5]. However, the effectiveness of these interventions depends on access, correct use and the local epidemiological context.

The present study was undertaken to determine the prevalence of malaria among pregnant women attending Midnimo and Jazeera Hospitals in Abudwak, Galmudug State, Somalia, and to describe selected socio-demographic characteristics and selected factors related to malaria prevention and history.

Objectives

The primary objective was to determine the prevalence of malaria among pregnant women attending Midnimo and Jazeera Hospitals in Abudwak. Secondary objectives were to describe the socio-demographic characteristics of participants and examine selected associations between malaria status and mosquito-net use and education level.

Taken together, the literature supports three important interpretations of the present findings. First, a low microscopy-based prevalence does not necessarily exclude a meaningful burden of low-density or submicroscopic infection. Second, the high proportion of women reporting mosquito-net use in this study is consistent with the emphasis placed on vector control, but the cross-sectional design and very small number of malaria-positive participants prevent causal conclu-

sions about protection. Third, the Somali evidence base remains insufficiently granular at district level, supporting the need for larger, standardized studies that combine sensitive diagnostic methods with information on antenatal care, IPTp, ITN use, residence, seasonality and environmental exposure [1] [6]-[14].

The present study contributes to this literature by providing facility-based data from Abudwak, Galmudug State, an area for which the thesis identified limited previous evidence on malaria among pregnant women. The observed prevalence of 1.3% is lower than many estimates reported from higher-transmission settings in sub-Saharan Africa. However, differences in transmission intensity, season, sampling, participant characteristics, preventive intervention coverage and diagnostic sensitivity make direct comparison inappropriate without considering context [7] [8].

The Somali context requires particular attention because national malaria control and elimination plans emphasize surveillance, vector control, case management, prevention and health-system strengthening. The Somalia National Malaria Strategic Plan 2021-2025 aimed to accelerate progress towards malaria elimination and strengthen monitoring and evaluation. More recent national evidence is also relevant: analysis of the 2020 Somalia Demographic and Health Survey found very low reported use of sulfadoxine-pyrimethamine during pregnancy and substantial gaps in antenatal-care attendance. These findings suggest that prevention coverage and antenatal service access remain important issues for maternal malaria control in Somalia [3] [6].

Prevention through insecticide-treated or long-lasting insecticidal nets remains a core intervention. WHO states that insecticide-treated nets are safe during pregnancy and should be used throughout pregnancy and the postpartum period. Studies in East Africa show that reported utilization is uneven. A 2024 systematic review and meta-analysis estimated pooled ITN utilization among pregnant women in East Africa at approximately 51.6%, illustrating the continuing gap between policy recommendations and effective use. Evidence from Ethiopia has also identified maternal education, residence and knowledge of ITNs as important determinants of utilization [9]-[12].

Evidence from sub-Saharan Africa demonstrates substantial geographical variation in malaria prevalence among pregnant women. A 2021 systematic review and meta-analysis of asymptomatic malaria in pregnancy found substantial pooled prevalence of *Plasmodium falciparum* infection and showed that asymptomatic infection was associated with increased odds of anaemia. More recent studies from Ghana and Nigeria similarly reported appreciable malaria prevalence among pregnant women, although estimates differed considerably according to transmission intensity, preventive interventions and diagnostic methods [7] [8] [13].

Recent evidence also indicates that microscopy may underestimate the burden of malaria during pregnancy. A large systematic review and meta-analysis published in The Lancet Global Health found that submicroscopic infections were

common and, in many settings, more frequent than infections detected by microscopy. The review reported a median prevalence of 8.0% for microscopic malaria and 13.5% for submicroscopic malaria during pregnancy across included studies. This finding is important when interpreting a very low prevalence obtained from microscopy alone [14].

Malaria in pregnancy is biologically and clinically important because pregnancy can increase susceptibility to infection and is associated with maternal anaemia, severe disease and adverse fetal and neonatal outcomes. WHO recommends a comprehensive package of prevention and control measures during pregnancy, including insecticide-treated nets, prompt diagnosis and effective treatment, and intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine in areas of moderate-to-high *P. falciparum* transmission [9].

Malaria remains one of the most important vector-borne infectious diseases globally. The WHO World Malaria Report 2025 estimated 282 million malaria cases and 610,000 deaths in 2024, with the WHO African Region accounting for approximately 94% of global cases and 95% of global malaria deaths. These figures emphasize the continued importance of locally generated epidemiological evidence, particularly for vulnerable groups such as pregnant women [1].

2. Materials and Methods

2.1. Study Design and Setting

A descriptive cross-sectional hospital-based study was conducted at Midnimo and Jazeera Hospitals in Abudwak District, Galmudug State, Somalia. Abudwak is located in Galgadud Region in central Somalia and lies close to the Ethiopian border. The study thesis describes the town as a major commercial center whose economy is strongly linked to livestock and trade [15].

2.2. Study Population and Participants

The target population comprised pregnant women in Abudwak during the study period. The study population consisted of pregnant women attending the antenatal/obstetric services of Midnimo and Jazeera Hospitals during data collection. Eligibility was based on attendance at the study hospitals and willingness to participate. The manuscript records 150 enrolled participants overall; hospital-specific numbers of eligible women, women approached, refusals, and enrolled participants were not documented in the supplied manuscript and therefore require author verification before submission.

2.3. Sample Size and Sampling

The thesis calculated an initial sample size of 384 using the Fisher formula, $n = Z^2pq/e^2$, with a 95% confidence level and 5% allowable error. Because of time constraints and lack of consent from some potential participants, the final study included 150 accessible participants. Convenience sampling was used.

2.4. Data Collection

A structured questionnaire collected socio-demographic and malaria-related information, including age, residence, marital status, family size, education, occupation, income, previous malaria history, previous abortion, mosquito-net use and pregnancy duration. The questionnaire could be self-completed by participants who could read and was administered with interviewer assistance in Somali for participants who required it.

Malaria prevalence was assessed using blood samples examined microscopically after Giemsa staining. A malaria-positive result was defined as detection of malaria parasites on the examined blood film. The supplied study document does not specify whether thick, thin, or both thick and thin films were used, the exact staining and examination protocol, the criteria used for species identification, the training/qualification of the microscopists, or the proportion of slides independently reread for quality assurance. These laboratory details should be confirmed from the original laboratory records and added before final submission. The thesis states that slides were examined by multiple laboratory technicians and that random checks were made by a hospital review panel as part of quality control.

2.5. Validity, Reliability and Ethics

The questionnaire was pretested at Hayat Hospital two weeks before the main study, and unclear questions were modified. Test-retest procedures were described for assessment of questionnaire reliability. Informed consent was obtained before participation; for participants who were illiterate, the consent information was read and interpreted in Somali, and confidentiality was maintained by omitting names and other personal identifiers. The thesis does not report a formal ethics committee approval number; this should be added before journal submission if an institutional approval record exists.

2.6. Statistical Analysis

Questionnaires were edited, coded and entered into SPSS. Descriptive statistics were presented as frequencies and percentages. Pearson chi-square tests were used to assess selected associations between malaria status and categorical variables; Fisher's exact test was also reported for the mosquito-net comparison.

3. Results

3.1. Socio-Demographic Characteristics

A total of 150 pregnant women participated. The largest age group was 28 - 37 years (69, 46.0%), followed by 18 - 27 years (58, 38.7%). Most participants lived in urban areas (91, 60.7%), were married (135, 90.0%), and had four family members (54, 36.0%). Primary education was the most common educational level (71, 47.3%). Housewife was the predominant occupation (127, 84.7%), and most participants reported a monthly household income of US$100 - 300 (109, 72.7%).

These characteristics are summarized in Table 1.

Table 1. Selected socio-demographic characteristics of participants (N = 150).

Characteristic	N	%
Age 18 - 27 years	58	38.7
Age 28 - 37 years	69	46.0
Age 38 - 47 years	23	15.3
Urban residence	91	60.7
Rural residence	27	18.0
IDP residence	32	21.3
Married	135	90.0
Primary education	71	47.3
Housewife	127	84.7
Income US$100 - 300	109	72.7

3.2. Malaria Prevalence and Malaria-Related Characteristics

Microscopic examination identified malaria parasites in 2 of 150 participants (1.3%; exact 95% CI: 0.16% - 4.73%), while 148 (98.7%) were negative. Most participants (137, 91.3%) reported a previous history of malaria. Twenty-three participants (15.3%) reported a previous abortion. Most participants (130, 86.7%) reported using a mosquito net. Regarding gestational age, 61 (41.0%) were in the second trimester, 45 (30.0%) in the third trimester, 37 (25.0%) in the first trimester and 7 (4.0%) did not know their trimester. These malaria- and pregnancy-related characteristics are presented in Table 2.

Table 2. Malaria and selected pregnancy-related characteristics (N = 150).

Variable	Category	N	%
Current malaria status	Positive	2	1.3
Current malaria status	Negative	148	98.7
Previous malaria history	Yes	137	91.3
Previous malaria history	No	13	8.7
Previous abortion	Yes	23	15.3
Previous abortion	No	127	84.7
Mosquito-net use	Yes	130	86.7
Mosquito-net use	No	20	13.3
Pregnancy trimester	First	37	24.7
Pregnancy trimester	Second	61	40.7
Pregnancy trimester	Third	45	30.0
Pregnancy trimester	Unknown	7	4.7

3.3. Associations with Malaria Status

There was no statistically significant association between malaria status and mosquito-net use (Fisher's exact test, two-sided p = 1.000). Similarly, no statistically significant association was observed between malaria status and education level (Pearson's chi-square test, $\chi^2 = 3.164$, df = 2, p = 0.206). Because only two participants were malaria-positive, these analyses had very limited statistical power, and the findings should therefore be interpreted cautiously. The selected association results are presented in Table 3.

Table 3. Associations between malaria prevalence and selected factors *N = 150.*

Factor/Comparison	Statistical test	Test statistic	df	p-value	Interpretation
Mosquito-net use	Pearson Chi-square	0.312	1	**0.577**	Not statistically significant
Mosquito-net use	Continuity correction	0.000	1	**1.000**	Not statistically significant
Mosquito-net use	Likelihood ratio	0.577	1	**0.448**	Not statistically significant
Mosquito-net use	Fisher's exact test (two-sided)	—	—	**1.000**	Not statistically significant
Mosquito-net use	Fisher's exact test (one-sided)	—	—	**0.750**	Not statistically significant
Mosquito-net use	Linear-by-linear association	0.310	1	**0.578**	Not statistically significant
Education level	Pearson Chi-square	3.164	2	**0.206**	Not statistically significant
Education level	Likelihood ratio	3.789	2	**0.150**	Not statistically significant
Education level	Linear-by-linear association	2.415	1	**0.120**	Not statistically significant

Note: The supplied source reports no statistically significant association between malaria prevalence and mosquito-net use or education level. Fisher's exact test was reported for mosquito-net use. The education-level values shown are those reported in the supplied Table 3.

4. Discussion

The study found a malaria prevalence of 1.3% among 150 pregnant women attending Midnimo and Jazeera Hospitals in Abudwak. This is a low observed prevalence within the study sample. The finding should not be interpreted as evidence that malaria is absent from Abudwak because the study was hospital-based, used convenience sampling, included a relatively small sample, and assessed malaria using microscopy. The estimate therefore describes the participating women during the study period rather than the prevalence in all pregnant women in Abudwak.

The low prevalence observed in Abudwak contrasts with higher estimates reported in several contemporary African studies. For example, a Ghanaian hospital-based study reported 17.1% malaria prevalence among 140 pregnant women, while a Nigerian study reported 8.7% among 300 women at antenatal booking. Such differences are expected because malaria transmission is heterogeneous across sub-Saharan Africa and is influenced by ecological conditions, seasonality, preventive intervention coverage, health-service access and diagnostic methods. The comparison therefore strengthens the interpretation that the Abudwak estimate is context-specific rather than evidence of a uniformly low malaria burden in Soma-

lia [7] [8].

The study population was predominantly urban, married and composed of housewives. Most participants reported a previous history of malaria, despite the low proportion who were positive at the time of examination. This contrast may indicate previous exposure to malaria or previous clinical diagnoses, but the study did not independently verify the historical malaria diagnoses.

The thesis originally described the mosquito-net relationship as significant; however, the reported Fisher's exact test was two-sided p = 1.000. Therefore, no statistically significant association was demonstrated in this sample. The small number of positive cases substantially limits the ability to detect associations.

The study also found no statistically significant association between education level and malaria status (p = 0.206). This result should similarly be interpreted cautiously because only two malaria-positive participants were observed. Larger studies are needed to investigate whether education, residence, socioeconomic status, pregnancy stage, malaria prevention practices and other environmental factors are associated with malaria infection in Abudwak.

The study is relevant to the Somali context because local facility-level evidence from central Somalia is limited. A SCIRP Health article has also reported malaria-related research among pregnant women in Somalia, demonstrating continued relevance of pregnancy and malaria prevention research within the country. Current WHO reporting confirms that malaria remains a major global health problem and that women and girls are among populations requiring effective access to malaria prevention and care [1].

4.1. Strengths

The study combined questionnaire data with laboratory microscopic examination rather than relying only on self-reported malaria status. It also included participants from two hospitals and documented several socio-demographic and prevention-related characteristics.

4.2. Limitations

The final sample was smaller than the calculated sample size (150 rather than 384), and convenience sampling limits generalizability. The cross-sectional design prevents causal inference. Only two malaria-positive participants were identified, resulting in low statistical power for association testing. The study relied on microscopy, which may have lower sensitivity for low-density infections than some alternative diagnostic approaches. In addition, the thesis contains an inconsistent statement reporting a 40.1% prevalence in the discussion, whereas the actual results table and conclusion report 2/150 (1.3%). The manuscript uses the result supported by the primary results table and conclusion.

5. Conclusion

Among 150 pregnant women attending Midnimo and Jazeera Hospitals in Ab-

udwak, 2 (1.3%) were positive for malaria by microscopic examination. Most participants reported mosquito-net use, but the study did not demonstrate statistically significant associations between malaria status and mosquito-net use or education level. The low number of positive cases limits interpretation of risk factors. Continued antenatal malaria prevention, surveillance and further adequately powered community- and facility-based studies are warranted.

6. Recommendations

1) Strengthen malaria surveillance and diagnostic capacity in Abudwak, including routine monitoring of pregnant women.

2) Continue health education and promotion of effective insecticide-treated mosquito-net use.

3) Strengthen antenatal care and prompt testing and treatment of suspected and confirmed malaria.

4) Support environmental measures that reduce mosquito breeding sites where feasible.

5) Conduct larger studies using probability-based sampling and, where appropriate, more sensitive diagnostic methods to estimate malaria prevalence and investigate determinants among pregnant women in Galmudug.

Ethics Approval and Consent to Participate

Ethics approval was granted by Somali National University under approval/reference no. JUS/GB/0178-2025. Oral informed consent was obtained from participants before enrollment, with the consent information read and interpreted in Somali for participants who were illiterate. Confidentiality was maintained by omitting names and other personal identifiers. The exact name of the reviewing ethics committee should be added if it is stated on the institutional approval letter.

Availability of Data and Materials

The de-identified dataset is not publicly available because of ethical and participant-confidentiality considerations. The dataset may be available from the corresponding author on reasonable request, subject to institutional and ethical approval.

Author Contributions

Hassan Ahmed Dirie, Saido Adan Bulhan and Osman Hassan Ali contributed to study conception and design, data collection, data analysis and interpretation, and preparation and revision of the manuscript. All authors approved the final version and agreed to be accountable for the work.

Conflicts of Interest

The authors declare that they have no competing interests.

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