


Overview Of Malaria Diagnosis Methods In Bitung City Community Health Center

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Article Info	ABSTRACT
<p>Keywords: Malaria diagnosis, microscopy examination, RDTs, Bitung City</p>	<p>Malaria remains one of the leading causes of morbidity and mortality in many countries. A definitive diagnosis of malaria can be made through microscopic examination or Rapid Diagnostic Tests (RDTs). Both microscopic examination and RDT have their own characteristics, advantages, and limitations. This study aims to describe the methods of malaria diagnosis at community health centers in Bitung City. A descriptive research design with a cross-sectional approach was used in this study. Data were obtained through interviews with nine health workers, including laboratory assistants and malaria program coordinators, from nine community health centers in Bitung City. The results showed that microscopic examination was available in only five community health centers. These centers confirmed RDT results and identified Plasmodium species through microscopic examination. In the primary health centers where only RDT was available, three referred patients to more equipped facilities, and one made a diagnosis using only RDT. The conclusion of this study is that RDT is available in all community health centers, whereas microscopic examination is available in only five community health centers due to limited diagnostic tools and human resources.</p>
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INTRODUCTION

Malaria remains one of the leading causes of global morbidity and mortality, especially in tropical and subtropical regions. This disease is more often happened in the area with limited access to health facility with adequate diagnostic and treatment capabilities. The most vulnerable groups is children and pregnant women, especially in areas with high transmission rates.¹

According to *World Malaria Report 2023*, as many as 249 million malaria cases with 608,000 deaths reported in 2022. An increasing trend in cases has been observed since 2015, with the largest surge occurring between 2019 and 2020, amounting to an additional 11 million cases. In Southeast Asia, India accounted for 65.7% of the cases, while Indonesia and India together contributed to 94% of malaria-related deaths in the region.²

Malaria remains a health public problem with distribution case that is not evenly distributed in Indonesia. In 2023, there were 418,546 cases recorded with 120 deaths.³ Papua Province reported the highest prevalence at 21.4%, whereas North Sulawesi had a lower prevalence of 0.46%.⁴ However, Bitung City in North Sulawesi exhibited an increase in the Annual Parasite Incidence (API) from 0.29 in 2021 to 0.98 in 2022, before declining to 0.73 in 2023.^{5,6,7}

Efforts to reduce malaria-related morbidity and mortality are carried out through malaria eradication programs, which include early diagnosis, prompt and appropriate treatment, surveillance, vector control, and improving community awareness about environmental health.⁸ Rapid and accurate malaria diagnosis is essential for effective disease treatment and malaria surveillance.⁹ According to the Decree of the Minister of Health of the Republic of Indonesia Number HK.01.07/MENKES/556/2019 on the National Guidelines for Malaria Management in Medical Services, definitive malaria diagnosis is performed through blood examination using Microscopic Examination or Rapid Diagnostic Test (RDT).⁸

Microscopic examination, as the gold standard for malaria diagnosis, offers advantages such as species identification and parasitemia quantification, with a sensitivity of up to 50 parasites/ μ l. However, this method has limitations, including the need for skilled personnel and adequate laboratory facilities. Research by Berzosa et al. (2020) highlights that microscopic examination in malaria-endemic areas is often limited due to insufficient training for healthcare workers and inadequate laboratory quality control, which can lead to diagnostic errors, particularly in species identification.⁹

Rapid Diagnostic Test (RDT) become practical alternative in Malaria detection. This method is easy to use, and results can be obtained within minutes, making it highly beneficial for quick screening in endemic areas.¹⁰ The limitations of RDT have been reported, with its sensitivity and specificity depending on the manufacturer, operator, supply chain, host, parasite, and varying under different epidemiological situations.¹¹

One of the policies in the malaria control program is to ensure that all patients with clinical malaria symptoms undergo laboratory diagnosis before receiving treatment. This approach aims to prevent treatment without laboratory confirmation, which carries the risk of malaria drug resistance.¹²

The Community Health Center as primary healthcare facilities play a strategic role in malaria diagnosis. However, the practice of using malaria diagnosis methods in health centers, especially in Bitung City, has not been extensively studied. Therefore, this study aims to provide an overview of the malaria diagnostic methods used in Bitung City's health centers. The information obtained is expected to contribute to improving diagnostic accuracy, supporting appropriate treatment, and strengthening malaria control programs in the region.

RESEARCH METHODS

This study use descriptive research design with cross sectional approach. The research sample includes all nine community health centers in Bitung City. Data were collected through interviews with questions covering malaria diagnostic methods used, the availability of

equipment and materials, training and competency of healthcare personnel, and challenges encountered in the implementation of malaria laboratory diagnostics.

RESEARCH RESULT

From the research conducted from August 2024 to early January 2025 at nine health centers in Bitung City, the following results were obtained:

Table 1. Available of Malaria Diagnosis Methods and Diagnostic Tools

No	Health Center	Diagnosis Methods	Availability Microscope	Availability of RDT	Main Obstacles
1.	Danowudu Health Center	RDT	Available , quantity : 2 (Moldy)	Available	Microscope moldy
2.	Tinombala Health Center	RDT	Available , quantity : 1 (Moldy)	Available	Microscope moldy
3.	Aertembaga Health Center	RDT	Available , quantity : 1 (Damaged)	Available	Microscope damaged
4.	Pintu Kota Health Center	RDT	Available , quantity : 1	Available	-
5.	Girian Weru Health Center	Microscopic Examination , RDT	Available , quantity : 3 (1 damaged)	Available	-
6.	Bitung Barat Health Center	Microscopic Examination , RDT	Available , quantity : 1	Available	-
7.	Paceda Health Center	Microscopic Examination , RDT	Available , quantity : 1	Available	-
8.	Papusungan Health Center	Microscopic Examination , RDT	Available , quantity : 1	Available	-
9.	Sagerat Health Center	Microscopic Examination , RDT	Available , quantity : 1	Available	-

Based on Table 1, it is known that four health center only available RDT diagnostic method, namely Danowudu , Tinombala , Aertembaga and Pintu Kota Health Center . Three among them, (Danowudu, Tinombala, Aertembaga), caused by microscope diagnostic tool that is not in good condition. Pintu Kota Health Center does not available Microscopic Examination although there is microscope tool. Girian Weru, Bitung Barat, Paceda,

Papusungan and Sagerat Health Center has available tool microscope and use Microscopic Examination in the diagnosis of malaria.

Table 2. Availability of Malaria Diagnostic Methods and Human Resources

No	Health Center	Diagnosis Methods	Availability Laboratory Technician	Training Microscopic Examination
1.	Danowudu Health Center	RDT	Not available	Yes, last 2010
2.	Tinombala Health Center	RDT	Not available	Yes, latest 2022
3.	Aertembaga Health Center	RDT	Not available	Yes, last 2018
4.	Pintu Kota Health Center	RDT	Not available	No
5.	Girian Weru Health Center	Microscopic Examination , RDT	Available	No
6.	Bitung Barat Health Center	Microscopic Examination , RDT	Not available	Yes, last 2011
7.	Paceda Health Center	Microscopic Examination , RDT	Available	Yes, last 2021
8.	Papusungan Health Center	Microscopic Examination , RDT	Not available	Yes, latest 2023
9.	Sagerat Health Center	Microscopic Examination , RDT	Available	No

Based on Table 2, there are one health center that does not available laboratory technician and not get training in microscopic examination that is Pintu Kota Health Center. Five health center—Danowudu, Tinombala, Aertembaga, Bitung Barat, and Sagerat—did not have laboratory technician but had received training in microscopic examination. The health center with dedicated laboratory technician were Girian Weru, Paceda, and Sagerat.

The research findings indicate that microscopic examination methods are not uniformly implemented across all community health centers in Bitung City due to limitations in diagnostic tools and human resources. Meanwhile, RDT is available in all health centers. Health centers with microscopic examination facilities initially diagnose malaria using RDT, then confirm the results and identify Plasmodium species through microscopy. In health center with only RDT available, such as Tinombala, Aertembaga, and Pintu Kota, patients with positive RDT results are referred to higher-level healthcare facilities. However, Danowudu Health Center relies solely on RDT for malaria diagnosis. This highlights limitations in diagnostic methods, given that microscopic examination remains the gold standard for malaria diagnosis.⁹

Based on data from the Bitung City Health Office's SISMAL cited by Tahulending, et al. (2024), malaria cases in Bitung City especially in the sub-district Pasir Panjang under the

jurisdiction of Patusungan Health Center, have shown a significant increase. Cases that were previously zero in 2019 and 2020, increased to 14 cases in 2021, 95 cases in 2022, and 32 cases in 2023.¹³ This indicates that malaria remains a significant public health issue in the region, emphasizing the need to evaluate diagnostic methods employed in Bitung City Health Centers.

Microscopic examination is essential for malaria diagnosis and cannot be replaced by RDT. It not only allows the identification of parasite species but also provides critical information for appropriate treatment.¹⁴ However, this method requires well-functioning equipment and trained personnel, which pose challenges for some health centers.

Malaria diagnosis with RDT is more practical in the field because it does not require specialized skills and provides fast results.¹⁰ In situations with a surge in malaria cases, as happened in the sub-district Pasir Panjang in 2022 and 2023, RDT enables prompt patient management. Although Thus, the sensitivity of RDT can decrease at low parasitemia, necessitating confirmation through microscopic examination.¹¹

The lack of functional microscopes has hindered the implementation of microscopic examinations in Danowudu, Tinombala, and Aertembaga Health Center. Addressing this requires regular maintenance, repair, and replacement of damaged equipment. Pintu Kota Health Center faces additional challenges, including the absence of laboratory technician and training for malaria diagnosis. Regular laboratory technician training is essential to ensure accurate and efficient microscopic examinations. Ngasala and Bushukatale (2019) highlight that improving microscopy quality can be achieved through on-the-job training programs, supportive supervision, and the provision of high-quality reagents, reliable electricity, and external quality assurance schemes.¹⁵

Interviews revealed that many positive malaria cases recorded in some health centers were reported by hospitals. This reflects the community's preference for hospitals over community health center, possibly due to easier access and the perception of better facilities and capacity to manage complex cases. Nonetheless, community health centers play a critical role in primary healthcare, particularly for remote communities where access to community health centers is more convenient.

The accessibility of community health center allows early malaria diagnosis using available methods, such as microscopic examination and RDT, despite existing limitations. As discussed, challenges in implementing diagnostic methods in some health centers stem from inadequate facilities and a lack of trained personnel. Therefore, efforts to enhance capacity, including improving diagnostic tools and providing healthcare worker training, are crucial to achieving better malaria diagnostic quality. These improvements can support broader malaria eradication programs and improve public health in Bitung City.

CONCLUSION

Microscopic examination at the Bitung City Health Center is not yet evenly distributed due to limitations in facilities and human resources. However, Rapid Diagnostic Test (RDT) is available across all health centers, enabling healthcare workers to conduct quick and practical malaria tests in various locations. Despite this, the reliance on RDT faces challenges in terms

of accuracy, especially in cases with low parasitic levels, making microscopic examination, which is more accurate, still necessary, although it is limited to certain facilities.

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