

**Study of Diagnosis of Malaria Using Rapid Diagnostic Test (RDT) in Children**Arunabh Kumar<sup>1</sup>, Archana Singh<sup>2</sup>, Binoy Shankar<sup>3</sup><sup>1,2</sup>Senior Resident, Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar<sup>3</sup>Assistant Professor, Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar

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Conflict of interest: Nil

**Abstract:****Background:** In tropical nations, malaria is still a public health concern. In these nations, clinical evaluation, microscopy, the gold standard and more recently, rapid diagnostic tests (RDTs) are the mainstays of diagnosis. The purpose of this study is to evaluate the quick diagnostic test's diagnostic accuracy for detecting malaria in children who have a clinical suspicion of having the disease. They used microscopy as the gold standard.**Methods:** This six-month cross-sectional and observational study was carried out at the SKMCH in Muzaffarpur, Bihar, from November 2022 to April 2023. In this study, 70 patients of both sexes with a clinical suspicion of malaria and ages up to 12 years were enrolled. Age, sexual orientation, and symptoms were noted in great detail. A quick diagnostic test was run, and the results were compared to microscopic analysis. Microscopy was regarded as the ultimate test. The Rapid Diagnostic Test's sensitivity, specificity, PPV, NPV, and diagnostic accuracy were looked at. The data was examined using SPSS 24.0.**Results:** There were 27 (38.57%) female patients and 43 (61.43%) male patients. 39 patients (55.41%) were between the ages of 7 and 12 whereas 31 (44.29%) were between the ages of 0 and 6. By microscopic examination, 40 (57.14%) individuals tested positive for malaria, while 30 (42.86%) patients tested negative. By fast diagnostic test 29 (41.43%) people tested negative for malaria, while 41 (58.57%) people had malaria. Comparing the results of the two methods, it was found that 27 (38.57%) true negatives, 3 (4.29%) false positives, 2 (2.86%) false negatives, and 38 (54.29%) real positives. RDT has a 96.25% sensitivity, 90% specificity, 92.77% PPV, and 94.74% NPV. RDT's diagnostic precision was 93.57%.**Conclusion:** The rapid diagnostic test is an useful diagnostic technique that can be used in place of a microscopic examination to diagnose malaria in children.**Keywords:** Malaria, Microscopy, Rapid Diagnostic Test, Diagnostic Accuracy.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Plasmodium falciparum (Pf), Plasmodium vivax (Pv), Plasmodium knowlesi (Pk), Plasmodium malariae (Pm), and Plasmodium ovale (Po) are some of the parasites that cause malaria. P. falciparum and P. vivax are the most common but deadly forms of the disease[1,2]. Worldwide, there were 219 million cases of malaria in 2017 and about 435 thousand deaths that could have been prevented[3]. Children under the age of five are particularly susceptible to malaria since they account for 61% of all malaria-related deaths globally[3,4]. Children are more susceptible to infectious diseases than adults are, so it is important to distinguish between malaria and non-malaria fever quickly in order to reduce mortality and serious cases. The World Health Organization (WHO) mandates that all reported cases of malaria be tested parasitologically in order to confirm

diagnoses made with either microscopic or rapid diagnostic tests (RDTs) for malaria[5]. This tactic seeks to curtail the overuse of ART while preventing potential medication resistance[6]. The "gold standard" for diagnosing malaria is blood slide microscopy, but it is time-consuming, expensive, and requires a large amount of laboratory equipment that is difficult to maintain in most endemic locations[7,8]. RDTs in individual blood can identify specific Plasmodium antigens such histidine-rich protein-2 (HRP2), lactate dehydrogenase (LDH), and aldolase. Aldolase is found in all organisms (pan-specific), whereas HRP2 is P. Falciparum-specific. There are three different kinds of LDH: Pf-specific, Pv-specific, and pan-specific. In one type of RDT, antibodies against these antigens can be coupled to detect different Plasmodium species[9,10]. In order to

evaluate the efficacy of a quick diagnostic test for the diagnosis and microscopy of malaria in children, we conducted the current study.

### Material and Methods

This cross-sectional study was carried out for six months, from November 2022 to April 2023, at the department of pediatrics of Sri Krishna Medical College and Hospital in Muzaffarpur, Bihar. In total, 70 children of both sexes, aged up to 12, who had malaria clinically suspected were participated in this study.

After obtaining informed consent from the parents or other caregivers of the children, full patient information, including age, sex, and symptoms, was collected. Patients without consent, those with proven cases of malaria, those taking anti-malarial medications were excluded. All patients had a 3 ml blood sample drawn and forwarded to the lab for analysis. Blood smears were examined under a microscope to check for the presence of

plasmodium in both thick and thin smears. In accordance with the manufacturer's instructions, Paracheck-Pf RDT kits were used to detect malaria. Microscopy and RDT results were recorded, and the results of the two techniques were compared.

We looked at the RDT's sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy. The gold standard was microscopic analysis. SPSS 24.0 was used to analyze all the data. In tabulation form, frequency and percentages were recorded. To compare the results of the two procedures, a chi-square test was conducted. P-value <0.05 was considered as significant.

### Results

There were 27 (38.57%) female patients and 43 (61.43%) male patients.(Table 1) 39 patients (55.41%) were between the ages of 7 to 12 whereas 31 (44.29%) were between the ages of 0 to 6. (Table 2).

**Table 1: Sex wise distribution of study patients**

Sex Distribution	No. of patients	Percentage
Male	43	61.43%
Female	27	38.57%
Total	70	100.0%

**Table 2: Age wise distribution of study patients**

Age Distribution	No. of patients	Percentage
0 to 6 years	31	44.29%
7 to 12 years	39	55.41%
Total	70	100.0%

By microscopic inspection and quick diagnostic test, 40 (57.14%) patients demonstrated a positive malaria result while 30 (42.86%) patients demonstrated a negative malaria result. Comparing the results of the two methods, it was found that 27 (38.57%) true negatives, 3 (4.29%) false positives, 2 (2.86%) false negatives, and 38 (54.29%) real positives. RDT has a 96.25% sensitivity, 90% specificity, 92.77% PPV, and 94.74% NPV. 4.50-20.59 had a positive likelihood ratio of 9.63. RDT's diagnostic efficacy was 93.57%.

**Table 3: Correlation of finding of RDT and Microscopy**

	Microscopy		Total
	Positive	Negative	
RDT			
Positive	38	3	41
Negative	2	27	29
Total	40	30	70

**Table 4:**

Statistic	Value	95% CI
Sensitivity	96.25%	89.43% to 99.22%
Specificity	90.00%	79.49% to 96.24%
Positive Likelihood Ratio	9.63	4.50 to 20.59
Negative Likelihood Ratio	0.04	0.01 to 0.13
Disease prevalence (*)	57.14%	48.51% to 65.47%
Positive Predictive Value (*)	92.77%	85.71% to 96.49%
Negative Predictive Value(*)	94.74%	85.53% to 98.21%
Accuracy (*)	93.57%	88.15% to 97.02%

### Discussion

Malaria is the most prevalent childhood disease worldwide and is linked to increased complications and mortality, particularly in developing nations because of a lack of resources and a lack of understanding about the disease's high incidence [11–12]. Correct diagnosis may aid in lowering malaria-related complications and mortality. Malaria has been detected using a variety of diagnostic techniques, although microscopic inspection is still the gold standard [13]. The goal of the current study was to compare the rapid diagnostic test (RDT) to microscopy as the gold standard for diagnosing malaria. 70 children were enrolled in this program. In our study, male made up 60.71% of the patient population, while female made up 39.29%. Patients' ages ranged from 0 to 6 years for 62 (44.29%) and from 7 to 12 years for 78 (55.41%). These findings were consistent with a large number of earlier research where the majority of participants were men and children were typically 8 years old [14–15].

In the current study, a microscopic inspection revealed that 40 (57.14%) patients had malaria while 30 (42.86%) did not. A quick diagnostic test revealed that 41 (58.57%) patients had malaria while 29 (41.43%) did not. Malaria was present in our study 57.14% of the time. In a study by Afzal MF et al. [16], it was shown that 32.8% of 125 children with malaria suspicion tested positively by microscopic inspection. Acheampong, Desmond, et al. [17] reported in another study that 18.6% of patients had microscopic evidence of malaria. In Khyber pakhtunkhwa, Pakistan, 7.83% of patients with 17035 suspected cases of malaria tested positive, according to Khan A et al.

In our study, there were 38 (54.29%) true positive results, 3 (4.29%) false positive results, 2 (2.85%) false negative results, and 27 (38.57%) true negative results. RDT has a 96.25% sensitivity, 90% specificity, 92.77% PPV, and 94.74% NPV. 4.50-20.59 had a positive likelihood ratio of 9.63. RDT's diagnostic precision was 93.57%. According to a study by Nkenfou CN et al., the following metrics outperformed microscopy: sensitivity, specificity, positive and negative predictive values, respectively: 75, 48.8, 39, and 81.6%.

According to Afzal MF et al. [16], the PVV of RDT had diagnostic accuracies of 97.56%, 98.81%, 97.56%, and 97.56%, respectively. These conclusions matched those of our analysis exactly. Malaria RDT results were 88.9% and 75.3% more sensitive and positive (PPV) predictive than microscopy results, according to Mahende C et al research [20]. Iwuafor AA et al. RDT study demonstrated a sensitivity of 51.4% and a specificity of 73.2% in another investigation. False-negative rates were 48.6%, while false-positive rates were 26.8%. While the predictive negative

(NPV) was 67.6%, the predictive positive was 58.1%. The RDT also showed LR ratios of 1.92 for positive probability and 0.67 for negative probability. The RDT test had a precision of 64.1%.

### Conclusion

We find that the Rapid diagnostic test, which can be used in place of the microscopic test to diagnose malaria in children, is a highly helpful technique.

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