

COMPARATIVE STUDIES ON DIAGNOSTIC PERFORMANCE OF RAPID DIAGNOSTIC KITS (RDTs) AND GIEMSA STAIN MICROSCOPY FOR MALARIA PARASITES DETECTION IN ABBAGANARAM PRIMARY HEALTH CARE CLINIC

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ABSTRACT

Malaria parasitemia still remains the major public health threat to the global population with approximately 219 million cases of malaria parasitemia occurred during 2017 with 435,000 deaths. Most malaria cases in 2017 were in Africa with approximately 200 million or 92%, followed by South-East Asia (5%) and the Eastern Mediterranean region (2%). Therefore, research into finding of diagnostic accuracy using RDTs and microscopy remains indispensable for effective and efficient treatment of malaria in the study area. A cross sectional study was conducted from June 2022 to June 2023 at Abbaganaram primary health care clinic, and 100 eligible patients were enrolled for study. The results of the comparison of malaria detection using microscopy and rapid diagnostic tests revealed that 10 (10%) out of the 100 samples examined using microscopy has positive detection status with 90(90%) negatives. No false positive nor false negative were recorded after the samples were examined using both the identification methods. Similar, the results of rapid diagnostic tests revealed that, 20(20%) out of 100 samples were positive, while 80 (80%) were tested negative. After the samples were tested using the microscopy 15(15%) were false positive, and 5 (5%) were tested false negative. The results on comparison of malaria detection using microscopy and RDTs examinations among different Sex revealed that, 40(40%) out of 100 samples diagnosed using microscopy were from male clients while 60(60%) were female. Similarly, the 30(30%) out of the 100 samples tested for the present of malaria parasites using rapid diagnostic tests were from male patients. While 70 (70%) out of 100 samples tested were from female patients. The comparison of malaria

parasite detection using microscopy diagnostic tests among different age group revealed that, 60 (60%) out of the 100 samples examined were from adult's blood samples. While 40(40%) out of 100 blood samples examined using microscopy were from children's patients. Similarly, 55 (55%) out of the blood samples examined using rapid diagnostic tests were from adult's patients, while 45(45%) out of 100 blood samples tested were from Children patients. The two diagnostic methods microscopy and RDTs should be use simultaneously for efficient and effective clinical diagnosis better performance in poor resources laboratories setting with little skillful personals.

Keywords: *Parasite Detection, Rapid Diagnostic Test, Microscopy, Comparative Studies, Primary Health Care, Diagnostic Performance.*

INTRODUCTION

As reported by WHO (2018) approximately 219 million cases of malaria parasitemia occurred during 2017 with 435,000 deaths. Most malaria cases in 2017 were in Africa (approximately 200 million or 92%), followed by South-East Asia (5%) and the Eastern Mediterranean region (2%). Therefore, research into finding diagnostic accuracy using RDTs and microscopy remains indispensable for effective and efficient treatment of malaria in the study area WHO, (2000). Malaria fever has the highest burden of morbidity and mortality with approximately 5% of the world's population infected and posed public health thread globally. Recent studies indicated that, estimated three million deaths due to malaria fever throughout the world with Sub- Sharan recording approximately 90% (Breman, et al., 2004). The bulk of malaria morbidity and mortality were concentrated in the developing countries particularly study area due poor infrastructural laboratory settings, lack of skillful personals and favorable factors such as temperature, rainfall, and relative humidity for sustainable mosquito lifecycle development Onyido et al., (2009). The high prevalence of malaria fever and prolific production of the vectors in the study area attributed to difficulties of its prevention and control, despite the national campaign against malaria in Nigeria Uzochukwu, and Onwujekwe, (2005). Despite the evidence that vector prevention and control as a cardinal measure for reducing malaria morbidity and mortality for efficient and effective diagnosis and treatment F.M.H (1991). The use of RDTs for diagnosis might occasionally give false-negative results if the parasite density is low, or if variations in the production of parasite antigen reduce the ability

of the RDT to detect the parasite among other limitations, thus combination of microscopy WHO (2010) and RDTs might yield accurate results WHO (2000).

MATERIALS AND METHODS

Study Area

A cross sectional study was conducted from June 2022 to June 2023 at Abbaganaram primary health care clinic. The area is located at Maiduguri with a latitude 11.85 and longitude of 13.16' East and attitude :320.0 meter.

Sample Size Determination

The sample size was determined by taking 50% expected prevalence since there is no recorded prevalence of malaria fever in the clinic. Confidence interval of 95% and 5% desired absolute precision was taken. The sample size of study was determined by using the formula given by Thrustfied (2005).

$$N = \frac{1.96^2 \times p_{exp}(1-p_{exp})}{d^2}$$

Where, N=requires sample size, 1.96 = the value of z at 95% confidence interval d= desired absolute precision (5%), p_{exp}=Expected prevalence (50%) accordingly, a total of 100 blood samples from eligible patients.

Sampling Method

A total of 100 eligible patients were selected after consent was sought for enrolment into the study. Blood samples were collected aseptically as described by WHO (2003) using standard procedures for blood sampling by pricking the thumb finger after swabbing with 70% alcohol sterility. Thick and thin blood films were prepared using dust and grease free clean glass slide as described by Cheesbrough (2006). The blood films were stained with Giemsa stain pH 7.2 for 10-20 min and examined under the light microscope using 100x oil immersion objective lens (WHO, 2015) and Fatima, et al., (2019). While some. Rapid Diagnostic Tests (Standard Diagnostics Inc., Gyeonggi-do, Republic of Korea) were used to detect the presence of *P. falciparum*. Tests were read when all blood had cleared the test reading window and a control indicator band appeared, approximately within 20 minutes of loading the blood sample as described by Humar et al. (1997) and Baird, et al., (1992). Subsequently, those patients' blood samples were further subjected to microscopic assay to determine false positive results obtained during RDTs assays.

Results

The results of the comparison of malaria detection using microscopy and rapid diagnostic tests revealed that 10 (10%) out of the 100 samples examined using microscopy has positive detection status with 90(90%) negatives. No false positive nor false negative were recorded after the samples were examined using both the identification methods. Similar, the results of rapid diagnostic tests revealed that, 20(20%) out of 100 samples were positive, while 80 (80%) were tested negative. After the samples were tested using the microscopy 15(15%) were false positive, and 5 (5%) were tested false negative respectively (Table 1).

Table 1. Comparison of malaria detection using Microscopy and RDTs examination (n=100)

Detection Status and Prevalence (%) using microscopy and RDTs Among different				
Detection Status	Microscopy	Prevalence (%)	RDTs	Prevalence (%)
No. of Positive	10	10	20	20
No. of Negative	90	90	80	80
No. of False Positive	00	00	15	15
No. of False Negative	00	00	5	5

Key: RDTs-Rapid diagnostic tests

The results on comparison of malaria detection using microscopy and RDTs examinations among different Sex revealed that, 40(40%) out of 100 samples diagnosed using microscopy were from male clients while 60(60%) were female. Similarly, the 30(30%) out of the 100 samples tested for the present of malaria parasites using rapid diagnostic tests were from male patients. While 70 (70%) out of 100 samples tested were from female patients as shown in (Table 2).

Table 2. Comparison of malaria detection using Microscopic and RDTs examination among different Sex (n=100).

Prevalence (%) using microscopy and RDTs Among different Sex

Sex	Microscopy	Prevalence (%)	RDTs	Prevalence (%)
Male	40	40	30	30
Female	60	60	70	70
Total	100	100	100	100

Key: RDTs-Rapid diagnostic tests

The comparison of malaria parasite detection using microscopy diagnostic tests among different age groups revealed that 60 (60%) out of the 100 samples examined were from adult's blood samples. While 40(40%) out of 100 blood samples examined using microscopy were from children's patients. Similarly, 55 (55%) out of the blood samples examined using rapid diagnostic tests were from adult patients, while 45(45%) out of 100 blood samples tested were from Children patients (Table 3).

Table 3. Comparison of malaria detection using Microscopic and RDTs examination among different Age Group (n=100).

Prevalence (%) using microscopy and RDTs Among different Age Group

Sex	Microscopy	Prevalence (%)	RDTs	Prevalence (%)
Adult	60	60	55	55
Children	40	40	45	45
Total	100	100	100	100

Key: RDTs-Rapid diagnostic tests

Discussion

In the present study, we examined the sensitivity and accuracy in diagnosis of malaria parasites using the microscopy and rapid diagnostic tests. WHO (1999) recommendation indicated that, rapid diagnostic tests have 95% sensitivity and efficiency as a diagnostic tool, however, there are false

positive and false negatives been experienced due to technical know-how by the users. As reported by WHO (2018) approximately 219 million cases occurred during 2017 with 435,000 deaths. Most malaria cases in 2017 were in Africa (approximately 200 million or 92%), followed by South-East Asia (5%) and the Eastern Mediterranean region (2%). Therefore, research into finding of diagnostic accuracy using RDTs remains indispensable for effective and efficient treatment of malaria in the study area. WHO in its recent bullets recommended that parasite specific tests should be conducted to confirm clinical symptoms examined from patients and determine the regional specificity of the parasites while embarking malaria detection tests. In line with the above development there is need to consolidate on accuracy and sensitivity of rapid diagnostic test and microscopy since *P. falciparum* is the most prevalent malaria parasite in Africa, accounting for 99.7% of estimated malaria cases in 2017, as well as in Southeast Asia (62.8%), and the Eastern Mediterranean (69%) and the Western Pacific regions (71.9%) Seo Hye Park et al., (2020) and Plucinski et al, (2021).

CONCLUSION

In conclusion, we evaluated the diagnostic accuracy of rapid diagnostic tests and microscopy for the detection of Malaria parasites using whole blood samples. Despite the recommendations by WHO on the sensitivity and accuracy of rapid diagnostics tests for the detection of malaria parasites, the microscopy is the gold standard in under developing countries. The two diagnostic methods microscopy and RDTs should be used simultaneously for efficient and effective clinical diagnosis better performance in poor resources laboratories setting with little skillful personals.

Conflict of Interest

There is no iota of conflict of interest among researchers.

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