KWARA STATE UNIVERSITY, MALETE

...the Green University for Community Development and Entrepreneurship

The Twentieth (20th)
Inaugural Lecture

Title:

The Malaria Odyssey: From Test-tube to Natural Products and Geospatial Modelling

By

Professor Oluwasogo Adewole Olalubi

BSc (Ilorin), MSc, PhD (Ibadan); ACIEH (Glasgow);
Cert. Immunol (Luxembourg); FSEPHON (Abuja)
Professor of Public Health,
Department of Public Health,
Faculty of Allied Health Sciences,
Kwara State University, Malete, Nigeria

DATE: 15th April 2026

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BSc (Ilorin), MSc, PhD (Ibadan)

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Esteemed Invited Guests, Friends and Relatives,
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Great KWASU Students,
Gentlemen of the Print and Electronic Media,
Distinguished Ladies and Gentlemen.

Preamble

I thank the Almighty God, the creator of the universe and the giver of life, for preserving all of us to witness today. I would also like to thank you, Sir, Mr. Vice-Chancellor, for allowing me to deliver this inaugural lecture, which will showcase my innovative research and academic contributions to knowledge in the fields of Medical Parasitology and Genomics Epidemiology.

This happens to be the first (1st) at both the Department of Public Health and in the Faculty of Allied Health Sciences and Twentieth (20th) in the series of inaugural lectures at Kwara State University, Malete.

Today, I feel highly honoured and privileged as I stand before this very august assembly of highly resourceful intellectuals and eminent personalities to deliver this lecture, titled "The Malaria Odyssey: From Test-tube to Natural Products and Geospatial Modelling." It is my sincere hope that this discourse will greatly add value to the field of malariology, not only in Nigeria but also worldwide.

Mr. Vice-Chancellor, Sir, before I delve into the content of this lecture, please permit me to give a brief account of my career profile. Being born to a middle-class parent and nurtured in Ilesa, Osun State, in the late 1960s was an experience that was deeply felt with enthusiasm. My mother enrolled me at Saint John Primary School, Iloro, Ilesa, in 1973, and I completed primary school at the age of 11. I lost my dad early at age 10 when I was in primary five, but my mother was there for me like the rock of Gibraltar. She caught the vision at a tender age, and she committed her totality to its fulfilment. The Bible says in the Book of Habakkuk 2:1-3, "I will stand upon my watch, and set me upon the tower, and will watch to see what he will say unto me, and what I shall answer when I am reproved. Vs 2: And the Lord answered me, and said, write the vision, and make it plain upon tables, that he may run that readeth it. Vs 3: For the vision is yet for an appointed time, but at the end it shall speak, and not lie: though it tarries, wait for it; because it will surely come, it will not tarry". My mother wanted me to have my secondary education at Ilesa Grammar School, the best Secondary School in Ilesa, but my name was omitted post-interview. Instead, I was admitted to The Apostolic Modern and Commercial School, Oke-Ooye, Ilesa, in 1979 and later joined Ijesa Muslim

Grammar School in Form 2 in 1982, and graduated from the school in 1986. To the Glory of God, I passed my West African School Certificate Examination (WASC) at my first sitting with the second-best result in the school. I proceeded immediately to Ilesa Grammar School for my Higher School Certificate and did GCE Advanced level in 1988. My mother and the entire family wanted me to study Medicine, but I could not just beat the cut-off point for Medicine after three (3) consecutive attempts at OAU, UI and Unilorin, respectively. I eventually entered the University of Ilorin to study Zoology in 1989, and I graduated with a BSc (Honours) Degree, Second Class Upper Division in 1993. After the NYSC programme at Government College Rimi, Kano State, from 1994 to 1995, I was admitted immediately into the University of Ibadan for an M.Sc. degree programme in Zoology (Cellular Parasitology), a WHO/TDR / UNDP / UNICEF / WORLD BANK-supported Special Training Programme in Tropical Medicine and graduated in 1997. I followed up with a PhD degree in the Faculty of Veterinary Medicine with specialization in Medical Parasitology & Genomics Epidemiology, University of Ibadan, Nigeria, in 2007.

My teaching career started at the Houdegbe North American University, Cotonou, Republique de Benin, in 2006 as a Lecturer 1. I moved back to Nigeria to join Crawford University, a private University, owned by the Apostolic Faith Church, Igbesa, Ogun State, as a Lecturer 1 immediately after the completion of my PhD in 2007. While at Crawford University, I got a post-doctoral research opportunity at the NIH Pain Centre, Department of Oral & Maxillofacial Surgery, Behavioural Pharmacology Unit, University of California, San Francisco (UCSF), CA, USA in the year 2008. My post-doctoral fellowship training focused on investigating pain and inflammation mechanisms in Animal (Albino Rat) models of induced Diabetes, Hypertension and Cancer.

I returned to Nigeria to advance my teaching career with Crawford University in 2010 and worked passionately as a full-time staff till 2014 before joining the services of Kwara State University, Department of Public Health, as a full-time Senior Lecturer and Pioneer Head of Department in February 2014. Through hard work and the grace of God, I contributed to the growth of the Department from an initial cohort of five (5) pioneer students to several thousand today. Over the years, I progressed through the academic ranks and attained the position of full Professor in October 2021, becoming the first Professor of Public Health in the Faculty of Allied Health Sciences, Kwara State University.

INTRODUCTION

1. The Overview of Malaria Research

Mr. Vice-Chancellor Sir, malaria research is a multidisciplinary field encompassing Parasitology, Entomology and Vector Control, Epidemiology, Immunology and Vaccinology, Pharmacology/Drug Discovery, Molecular Biology and Genetics, Biotechnology, Bioinformatics, Biostatistics, Social and Behavioural Sciences, Environmental and Public Health.

In this Inaugural Lecture, I will review my contributions by discussing: the Epidemiology of Malaria in Nigeria; the Life Cycle of the Malaria Parasite; Diagnosis; laboratory-based control strategies, including vaccine development, chemotherapy and drug resistance trends; combination therapies and artemisinin tolerance; and the role of natural products. Effort will be devoted to analyze geospatial modelling for surveillance, environmental risk mapping for malaria prediction and validation in rural communities of Malete, Elemere, Apodu, and Gbugudu, Moro LGA, Kwara State,

alongside its application in policy-making. Finally, I will highlight innovative and contemporary malaria control and elimination approaches in Nigeria.

2. The Epidemiology of Malaria in Nigeria

Mr. Vice-Chancellor, Sir, understanding malaria epidemiology is vital for targeted control and elimination in Nigeria. Malaria, from the Italian *mal'aria* meaning "bad air," is a vector-borne disease caused by *Plasmodium* species (Escalante et al., 2019). Of over 200 species, only five infect humans—*P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale*, and *P. knowlesi* (Antony & Parija, 2016); *P. falciparum* causes the most severe disease (WHO, 2014), while *P. knowlesi* is of simian origin (Singh & Daneshvar, 2013).

Globally, malaria caused 263 million cases and 597,000 deaths as of 2023; 95% of such deaths occurred in the African region, with children under five accounting for 76% of deaths (WHO, 2024). The top five countries carrying the heaviest estimated burden of malaria cases as of 2023 were Nigeria (26%), the Democratic Republic of the Congo (13%), Uganda (5%), Ethiopia (4%) and Mozambique (4%).

Nigeria has the highest burden of malaria globally, with an estimated 68 million cases and 194,000 deaths accounting for nearly 27% of the global malaria burden (WHO, 2023).

Also, the prevalence of malaria varies significantly across the states due to factors such as climate, healthcare access, and socioeconomic conditions. Borno state, affected by prolonged conflict, had the highest prevalence rate of 40%. In contrast, Southern Nigeria, with states like Lagos, Rivers, and Delta, reports relatively lower malaria prevalence. This is attributed to improve healthcare systems, higher socioeconomic status, and

more effective public health interventions. Lagos has one of the lowest prevalence rates in the country, averaging 10% from 2018 to 2023 (Ezemba *et al.,* 2024).

The recent detection and spread of a new variant of the *Anopheles stephensi* vector across Asia, to Ethiopia and Nigeria, is of strong public health concern.

In Nigeria, *A. stephensi* was first detected in 2020 in Gombe State by Gombe State University, the Nigeria Institute of Medical Research, and the National Malaria Elimination Program (NMEP). Its link to rising cases prompted NMEP, with U.S. PMI VectorLink support, to begin surveillance and train entomologists from seven high-risk states in 2022 (Pommier de Santi *et al.*, 2021).

3. The Life Cycle of Malaria Parasite

Mr. Vice-Chancellor, Sir, understanding the *Plasmodium* life cycle is crucial for malaria control, as each stage offers intervention opportunities. Spanning humans and *Anopheles* mosquitoes, it involves both sexual and asexual reproduction, complicating vaccine and drug development (Guttery *et al.,* 2012).

Infection starts when an infected mosquito injects sporozoites into the bloodstream, which travel to the liver for multiplication during the hepatic stage (Ryan, 2019). Mature parasites emerge as merozoites (Baron, 1996); in *P. vivax* and *P. ovale*, some persist as hypnozoites, causing relapses (Jong & Stevens, 2021).

In the erythrocytic stage, merozoites invade red blood cells (RBCs), multiply, and burst them to infect new cells (Zuccala & Baum, 2011). Host cell preference varies—*P. vivax* and *P. ovale* target young RBCs, *P. malariae* older ones, and *P. falciparum*/*P. knowlesi* at any age (Ryan *et al*., 2019).

Some parasites form gametocytes, which mosquitoes ingest. In the mosquito midgut, gametes fuse into zygotes, develop into ookinetes, and embed in the gut wall as oocysts (Ngwa, 2016; Bennink, 2016). These release sporozoites that migrate to salivary glands, ready for transmission (Smith *et al.*, 2016).

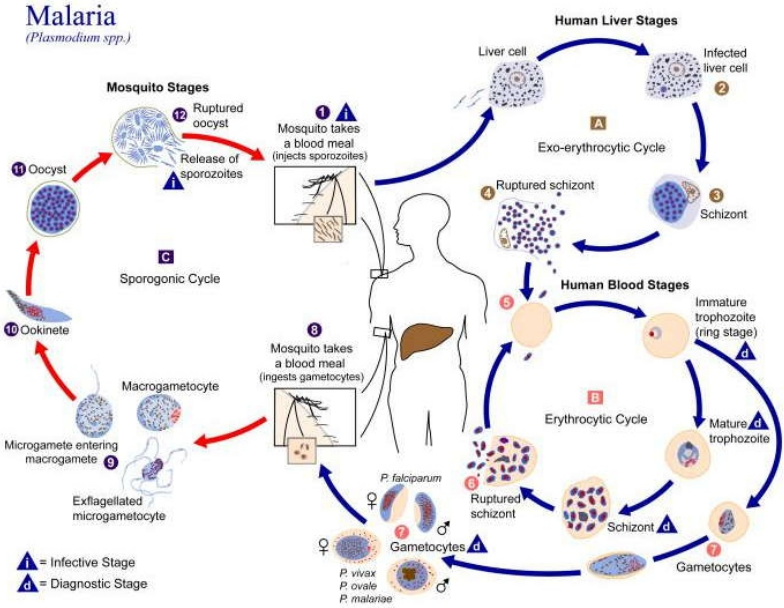


Figure 1: The *Plasmodium* Life Cycle

4. The Test-Tube Experimental Approaches to Malaria Control

The Diagnosis of Malaria

Mr. Vice-Chancellor, Sir, accurate diagnosis is vital for malaria control, particularly in sub-Saharan Africa, where overlapping symptoms with other tropical diseases lead to frequent

misdiagnosis (Ilesanmi & Olalubi, 2017). Clinical diagnosis alone is unreliable.

Traditional methods include microscopy—detecting parasites in stained blood films—and rapid diagnostic tests (RDTs) targeting antigens such as HRP-2, LDH, or aldolase (Kasetsirikul, 2016). Both have sensitivity and specificity limitations, prompting interest in molecular and biosensing tools (Krampa, 2017). PCR offers high sensitivity but is costly and infrastructure-dependent (Kasetsirikul, 2016). Despite advances, Giemsa-stained microscopy remains the gold standard, while RDTs are widely used in Nigeria (Ilesanmi & Olalubi, 2017).

We evaluated three RDT brands—SD Bioline, Acon, and Paracheck—against microscopy at Ibadan between June and December 2012. Of the 525 suspected cases, microscopy detected 300 positives (57.1%). SD Bioline identified 260 (49.5%), Acon 200 (38.1%), and Paracheck 150 (28.6%). Performance was: SD Bioline—Sensitivity 86.3%, Specificity 99.6%, Efficiency 92%; Acon—66.7, 100, 80.9%; Paracheck—50, 97.7, 70.4%.

The highest parasite density occurred in pre-teens (mean 6,631/μL; $p < 0.01$). *P. falciparum* predominated (93.3%), with mixed infections of *P. vivax* (5.0%) and *P. malariae* (1.7%). Parasite density inversely correlated with hematocrit ($r = -0.744$; $p < 0.01$), indicating severe anaemia at higher parasitemia. Infection rates were similar for males (56.3%) and females (58.2%).

These findings align with previous research (Ilesanmi & Olalubi, 2017). The slight increase in malaria positivity among females (+1.9%) may be attributed to sex-specific hormonal influences, which can affect immune responses (Ilesanmi & Olalubi, 2017). Females, particularly during pregnancy, are known to have lower immunity and higher malaria-related mortality compared to males (Ilesanmi & Olalubi, 2017).

As shown in Figure 2 below, the highest malaria parasite densities were recorded in children aged 6–12 years, followed by under-five children, with the differences being statistically significant ($p < 0.01$). In contrast, individuals over 50 years exhibited the lowest parasite densities. This reduced parasitemia in older adults is likely due to acquired immunity developed through repeated exposure to malaria over time.

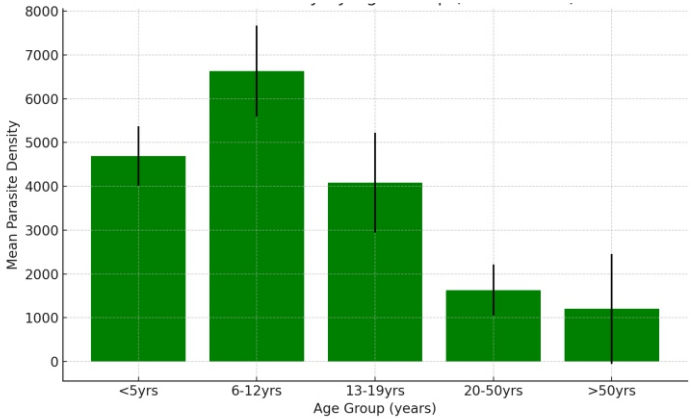


Figure 2: Parasite density of the sample population by age group

Mr. Vice-Chancellor, Sir, *Plasmodium falciparum* was the most prevalent species (93.3%; Figure 3). Also, co-infections involving *P. falciparum / P. vivax* and *P. falciparum / P. malariae* were identified in 5.0% and 1.7% of the samples, respectively. These mixed infections showed the highest mean parasite densities among all detected species. Specifically, *P. falciparum* alone had a mean density of 2,245 parasites/µL, while *P. falciparum / P. vivax* and *P. falciparum / P. malariae* co-infections recorded 15,917 and 13,520 parasites/µL, respectively.

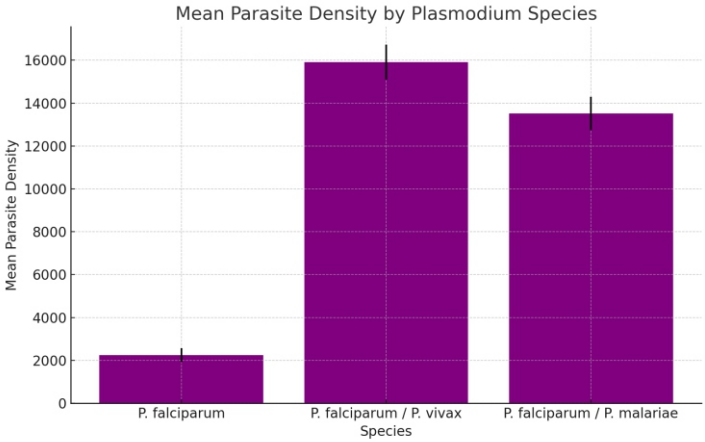


Figure 3: Malaria positivity by Plasmodium species

The frequency of fever among malaria-positive patients is presented in Figure 4. Among malaria-positive patients, 242 (89%) presented with fever, while 58 (22.9%) did not exhibit febrile symptoms. Conversely, 195 (77.1%) of malaria-negative individuals were afebrile, though 30 (11.0%) tested negative but had fever. These cases may likely reflect non-malarial febrile illnesses such as pneumonia, respiratory infections, urinary tract infections, viral infections or typhoid. A statistically significant relationship was found between fever and malaria positivity ($p < 0.05$).

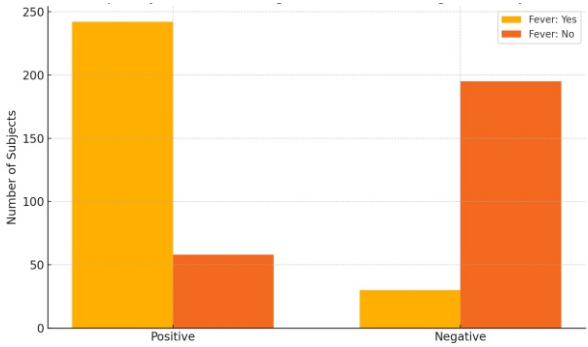


Figure 4: Frequency of subjects with fever among positive malaria patients. X^2=233.6, P<0.05

Figure 5 presents the relationship between haematocrit values and malaria parasite density. A Pearson's two-tailed correlation was conducted and found to be significant at $p < 0.01$.

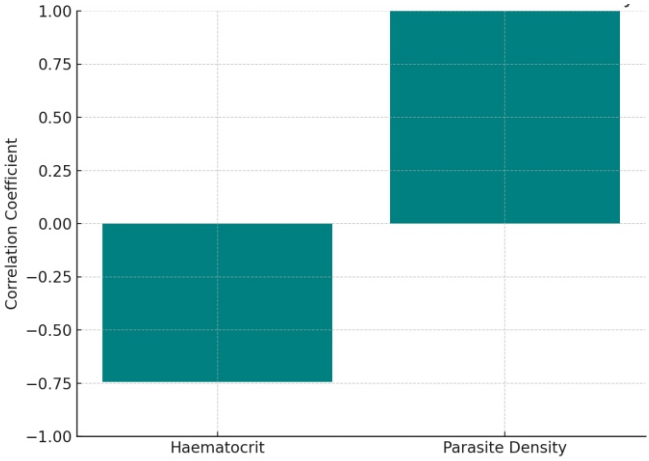


Figure 5: Comparison of haematocrit values in malaria and non-malaria subjects. ** P<0.01

A strong negative correlation was found between haematocrit values and malaria parasite density (r = –0.744), showing that lower red blood cell levels correspond to higher parasite loads. Among diagnostic methods, Giemsa-stained thick smears detected the most cases—300 positives (57.1%) and 225 negatives (42.9%) out of 525 samples (Figure 6). The SD Bioline RDT identified 260 positives (49.5%) and 265 negatives (50.5%), while Paracheck recorded the lowest positives—150 (28.6%)—and 375 negatives (71.4%). These findings reaffirm Giemsa microscopy as the most sensitive and accurate diagnostic tool, outperforming the RDTs.

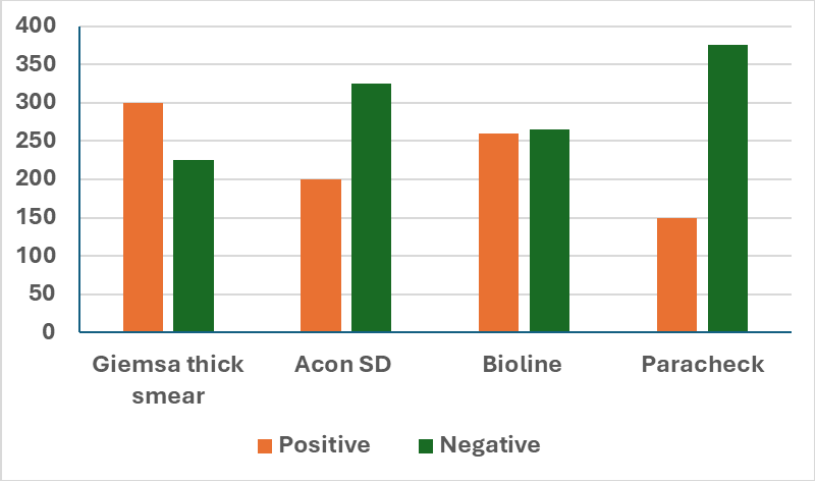


Figure 6: Relative malaria positivity by RDT kit used.

The study further demonstrated that the SD Bioline RDT kit had the highest overall performance among the three rapid diagnostic tests. It showed a sensitivity of 86.3%, specificity of 99.6%, and diagnostic efficiency of 92.0%. The Acon RDT kit ranked second, with a sensitivity of 66.7%, an efficiency of 80.9%, and

the highest specificity at 100%. In contrast, the Paracheck RDT kit had the lowest performance, with values of 50.0% sensitivity, 97.7% specificity, and 70.4% efficiency.

This study reaffirms microscopy as the gold standard for malaria diagnosis, offering greater accuracy than rapid diagnostic tests (RDTs). Among the RDTs, SD Bioline proved most effective, with high sensitivity (86.3%) and specificity (99.6%) (Ilesanmi & Olalubi, 2017), and superior ability to detect low-level parasitaemia.

Inferences:

1. Mandate RDT use, especially SD Bioline, in community pharmacies to ensure accurate diagnosis before dispensing antimalarial drugs, thereby reducing presumptive treatment and improving outcomes.
2. Establish a national regulatory framework for RDT quality control to prevent diagnostic errors from unverified kits, as assuming uniform performance among RDTs could undermine malaria control.

5. Immunogenic Responses in Malaria Vaccine Development

Mr. Vice-Chancellor, Sir, my malaria research journey began in 1996 as a Master's student in Prof. Mark Nwagwu's laboratory, Department of Zoology, University of Ibadan, under the WHO/TDR/UNDP/UNICEF/WORLD BANK Special Training Programme in Tropical Medicine. The lab focused on *Plasmodium falciparum* biology, host immune responses, and vaccine targets such as recombinant circumsporozoite protein (CSP) and merozoite surface protein-1 (MSP-1).

My MSc thesis, *Evaluation of Host Humoral Antibody Production Against P. falciparum Recombinant Circumsporozoite Antigen in Nigerian Children*, later published

(Olalubi *et al.,* 2012), assessed IgG and subclass responses to CSP (R32tet32 protein) in 67 smear-positive Nigerian children (<10 years old). Antibody detection used ELISA, with negative controls from malaria-naïve North American Serum (NAS) and healthy Igbo-ora residents (PNCS).

Key findings:

- Predominant cytophilic antibodies: IgG3 > IgG1 > IgG2 > IgG4.
- IgG1 and IgG3 are significantly higher in infected children vs. controls ($p < 0.01$).
- IgG4 is lowest in young children; IgG3 is highest in older ones.
- Antibody levels increased with age and were higher in males.
- Total IgG generally exceeded subclass levels except IgG3.
- NAS controls showed lower titres, with slightly higher IgG2 than other subclasses.

These results highlight IgG1 and IgG3 as potential correlates of protection, supporting their relevance in malaria vaccine development.

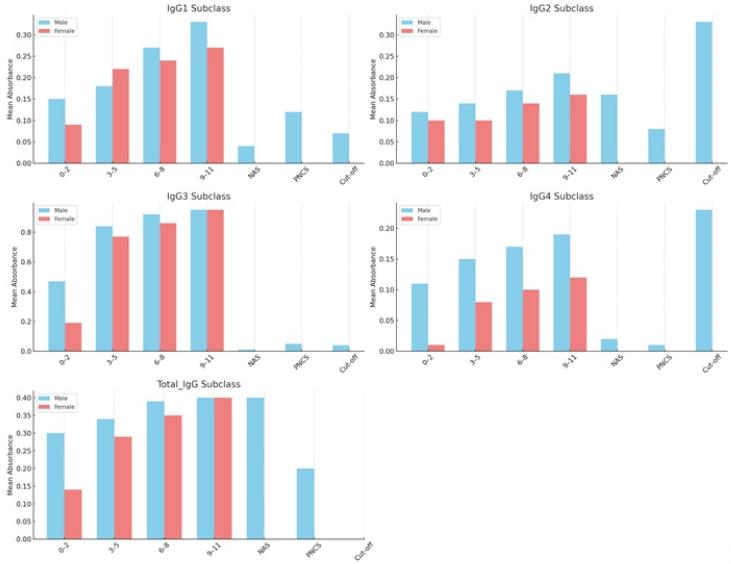


Figure 7: Bar Chart of Mean Absorbance Values of IgG Subclasses by Age and Sex

The data reveal that the mean total serum IgG subclass levels were higher than the corresponding CSP-specific IgG subclass levels across all age groups (Figures 7 and 8). Among the subclasses, IgG2 had the highest mean absorbance values in malaria-infected children, followed by IgG1, IgG4, and IgG3. Thus, the order of total serum IgG subclass concentration was: IgG2 > IgG1 > IgG4 > IgG3 (Figure 7).

A clear age-dependent increase in IgG levels was observed, indicating a direct relationship between IgG subclass expression and age. This suggests that with increasing age, children develop stronger humoral immune responses to *P. falciparum*. Additionally, within each age group, male subjects consistently

showed higher IgG subclass levels than their female counterparts, further highlighting potential sex-based differences in immune reactivity.

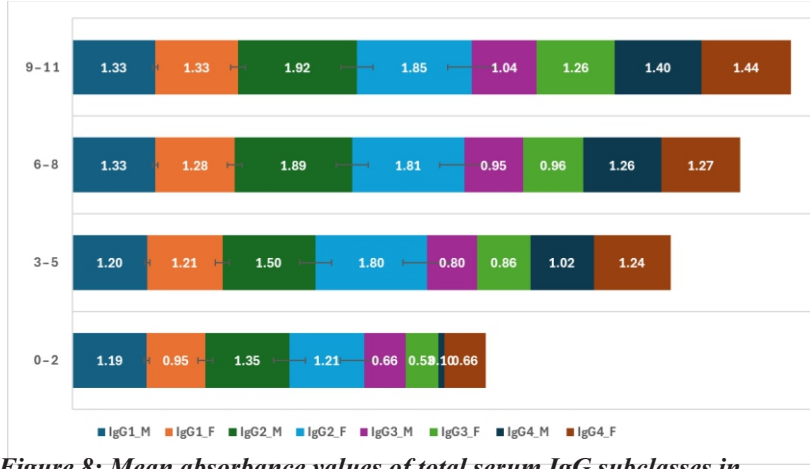


Figure 8: Mean absorbance values of total serum IgG subclasses in malaria-positive children (ë = 405 nm)

Mr. Vice-Chancellor, Sir, the mean total serum IgG subclasses followed the order IgG2 > IgG1 > IgG4 > IgG3 (Fig. 8), with levels increasing with age and consistently higher in males. IgG3 and IgG1, both cytophilic antibodies, were the most frequently expressed in malaria-infected children, suggesting sequential B-cell activation—from IgG4 to IgG2—via repeated antigen exposure (Olalubi *et al.,* 2012). IgG3 eventually surpassed IgG1, reflecting acquired immunity and a decrease in malaria episodes, underscoring its potential as a vaccine target.

The Concept of Malaria Chemotherapy and Drug Resistance

Treatment of malaria dates to 168 BC China with *Artemisia annua* (Premji, 2009), later quinine from Cinchona bark, and

artemisinin in the 1970s (Talapko *et al.,* 2019). Laveran's 1880s parasite discovery advanced vector control; Dichloro-Diphenyl-Trichloroethane (DDT) and chloroquine usage post–World War II reduced malaria (Snow, 2015) until resistance, toxicity and environmental concerns ended DDT use in 1978 (Nosten *et al.,* 2022). Pyrethroid-based LLINs replaced it but face reduced efficacy from resistance and behavioural shifts (Nosten et al., 2022).

During my PhD at the University of Ibadan under Prof. B.O. Fagbemi of the Faculty of Veterinary Medicine and the IAMRAT Malaria Research Group, College of Medicine, UI led by Prof. A.M.J. Oduola, I gained unquantifiable expertise in microscopy, rapid diagnostic testing, in vitro drug assays, parasite cultivation, molecular genotyping (Pfmdr1, Pfcrt), and HPLC drug monitoring. Antimalarial drug resistance, a key barrier to control (WHO, 2020), demands robust surveillance and improved therapies (Fikadu & Ashenafi, 2023). Resistance is confirmed when parasitemia persists despite adequate observed therapy and verified therapeutic drug levels.

Basic Approaches for characterizing resistant *P. falciparum*:

1. **In vitro assays** – parasite susceptibility testing via growth inhibition (MIC, 1C 50 & 90).
2. **In vivo assays** – monitoring treatment outcomes in clinical/animal studies.
3. **Molecular techniques** – detecting resistance mutations via PCR/RFLP.
4. **Pharmacokinetics** – measuring drug/metabolite levels in blood (HPLC).

My PhD study (WHO/TDR Project Grant ID: 980080) applied *in vitro* schizont inhibition assays (Olalubi *et al.,* 2013) to 104 isolates from Ibadan, testing amodiaquine (AQ) alone and

combined with resistance-reversing agents: verapamil (VER), chlorpheniramine (CP), and promethazine (PRO).

Key findings:

- AQ MIC: 6.2–500.0 ng/mL; mean = 120.51 ± 15.10 ng/mL.
- 73% sensitive, 27% resistant to AQ.
- MIC reductions with combinations: AQ + VER = 83.08 ± 9.39; AQ + CP = 106.93 ± 13.28; AQ + PRO = 111.09 ± 14.82 ng/mL

  These results indicate that certain agents can partially reverse AQ resistance, offering promising leads for combination therapy strategies.

Mr. Vice-Chancellor, Sir, this study showed that combining amodiaquine (AQ) with resistance-reversing agents enhanced *in vitro* parasite sensitivity in some patient isolates.

With AQ+verapamil, 25% (26/104) of isolates had significantly reduced MIC ($p < 0.05$), while 75% (78/104) were unchanged. AQ+chlorpheniramine reduced MIC in 15% (16/104) of isolates, and AQ+promethazine in 22% (23/104).

Overall *in vitro* sensitivity was highest with chlorpheniramine (85%), followed by promethazine (78%) and verapamil (75%). Resistance rates were 15%, 22%, and 25%, respectively. Chlorpheniramine showed the strongest reversal effect and is a safe, affordable, widely used drug, making it a promising partner for quinoline-based therapies (Sowunmi *et al.,* 2007).

Since *in vitro* data may overestimate resistance, they should be complemented with *in vivo* and molecular surveillance to guide effective malaria treatment and policy in Nigeria.

Trend of Antimalarial Drug Resistance in Nigeria

Over the past two decades, antimalarial drug resistance in Nigeria has emerged as a growing public health concern, threatening malaria control efforts and sustaining the disease as a leading cause of illness and death nationwide. The progressive pattern of its emergence is illustrated in Figure 9.

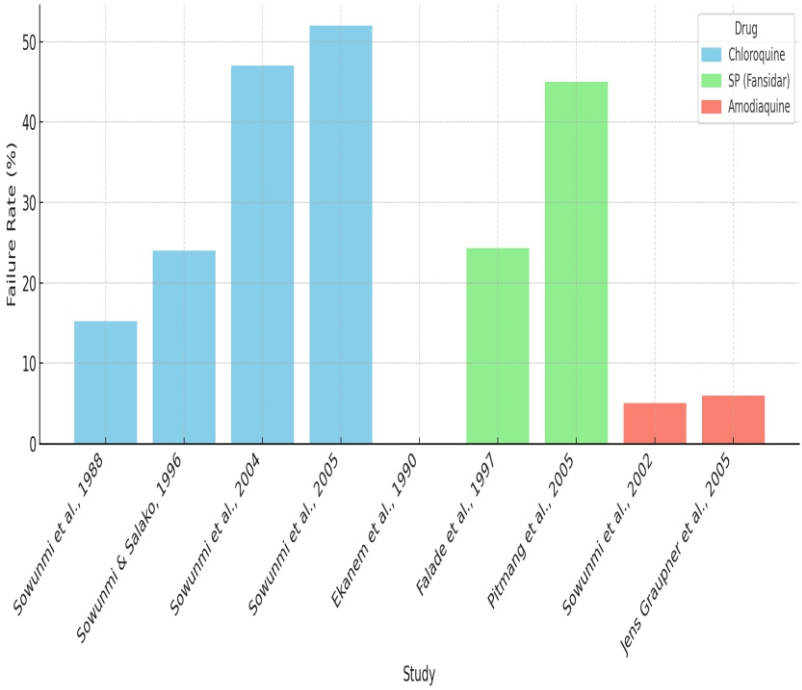


Fig.9: The Trend Pattern of Antimalarial Drug Resistance in Nigeria

Based on this finding, Artemisinin-based combination (ACT) with Artemether-lumefantrine (Coartem®) and Artesunate-amodiaquine (Larimal®) were adopted and approved by FMOH and WHO and introduced into the Nigerian market in 2005.

6. Malaria Treatment Failure and Drug Resistance Interface

Mr. Vice-Chancellor, Sir, treatment failure is not always synonymous with true antimalarial drug resistance. While resistance can cause failure, factors such as incorrect dosing, non-compliance, poor drug quality, interactions, malabsorption, and misdiagnosis also contribute and may promote resistance by exposing parasites to sub-therapeutic levels.

In Nigeria, resistance is worsened by self-medication with substandard over-the-counter mixtures (e.g., Akape), over-treatment via unnecessary prescriptions, and limited molecular surveillance. Mitigation strategies include drug combinations with different mechanisms and ensuring full adherence (Madubogwu *et al.,* 2019). Artemether-Lumefantrine (AL), first-line for *P. falciparum* since 2005, has shown 90.7% ACPR in Enugu, though declining efficacy is a concern.

Study on AL Tolerance and Molecular Markers in Ilorin
The KWASU Malaria Research Group assessed AL efficacy and Kelch 13-mediated artemisinin resistance in Ilorin (Abdulraheem, Olalubi & Awe, 2025). Blood samples from 150 patients at KWASU Teaching Hospital and UITH were tested by microscopy and 18S rRNA PCR. Genomic DNA was extracted, sequenced (Inqaba Biotech), and submitted to GenBank (PP291573–PP291583). Of 150 patients, 51 (34%) were positive on Day 0; post-treatment follow-up of 35 patients found 4 (11.4%) still positive.

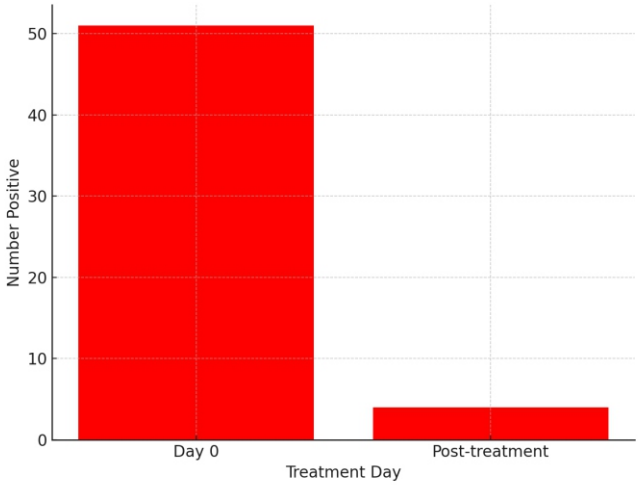


Figure 10: Prevalence of malaria parasite before and after treatment with AL

Day 0 represents the pre-treatment day, while post-treatment represents the samples taken on the days of treatment failure following administration of the anti-malaria drug; days 3, 7, 14, 21, and 28, respectively.

This result was confirmed by PCR and then used together with the initial 51 samples from day 0, giving a total of 55 samples and was used for downstream molecular analysis.
It was revealed that 27 samples (53%) from day 0 samples carried the *Kelch 13* gene, and were reduced to four (4) at follow-up days.

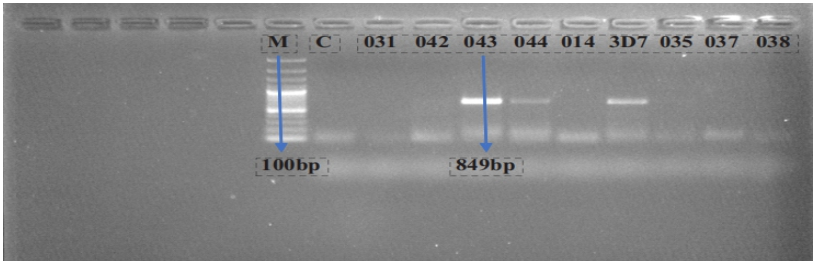


Figure 11: Agarose gel amplification of fragments (first-round PCR). M = 100 bp Molecular ladder / ref. standard, C, 031, 042, 043, 044, 014, 3D7, 035, 037, 038. C= Negative control (no DNA)

From nested PCR, 850 bp fragments corresponding to nucleotide sequence 1279-2127 representing codons 427-709 of the Pf3D7_1343700 *K13* propeller domain were amplified successfully in 50 samples . The nested PCR products were purified, and 10 were sequenced.

Mr. Vice-Chancellor, Sir, multiple sequence alignment of 10 successfully sequenced samples, compared with the *P. falciparum* 3D7 reference strain, revealed no mutations in the Pfk13 propeller domain (positions 427–709). This suggests delayed parasite clearance observed in some patients is unlikely to be linked to known ACT-resistance mutations. SNPs previously associated with artemisinin resistance—Y493H, R539T, I543T, and C580Y—were absent, consistent with findings from western and coastal Kenya (Wamae *et al.,* 2019). Although resistance-associated SNPs vary geographically and are influenced by parasite genetics, transmission intensity, population movement, treatment-seeking behaviour, and treatment adherence (Abdulraheem, Olalubi & Awe, 2025), these results indicate continued AL sensitivity in Ilorin.

While encouraging, this limited-scope study highlights the need for expanded molecular surveillance. Findings support AL's

continued use as first-line therapy for uncomplicated *P. falciparum* malaria in Ilorin.

Inferences:

1. Maintain AL (Coartem) as first-line therapy in Ilorin and similar endemic areas.
2. Strengthen ACT efficacy surveillance and implement routine therapeutic efficacy studies (TES) for additional resistance genes (e.g., *Pfmdr1*, *Pfcrt*).
3. The urgent need to enforce the policy on the ban of over-the-counter chloroquine sales and ensure rational ACT use.
4. Expand healthcare worker training and retraining across all tiers on malaria diagnosis, rational drug use, and resistance prevention.
5. Enhance pharmacovigilance, enforce antimalarial drug quality assurance, and eliminate substandard/counterfeit drugs from supply chains.

7. Efforts on Natural Products and Malaria Control and Elimination

Mr. Vice-Chancellor, Sir, natural products, particularly medicinal plants, remain vital for malaria control in Nigeria's rural and under-served areas, where modern healthcare is limited. Globally, over 85% of traditional medicines originate from plants, which also serve as raw materials for pharmaceutical and traditional health sectors (Olalubi *et al.,* 2021). In Nigeria, these plants have been used for centuries to treat febrile illnesses, especially malaria, due to their affordability, accessibility, and cultural acceptance. However, urbanization, farming expansion, and over-harvesting threaten their availability and could lead to extinction (Olalubi *et al.,* 2021).

Guided by this concern, our malaria research group conducted a biodiversity, ethnobotanical, and geospatial survey of indigenous antimalarial plants in rural Malete, Kwara State. Using GPS (Garmin eTrex 75), we mapped species across five communities—Malete-Okete, Gbugudu, Malete-KWASU campus, 2 km south of Yeregi, and settlements near Apodu and Alapo. The rural environment supports diverse medicinal plants harvested for alternative healthcare.

Data were gathered through semi-structured questionnaires (qualitative and quantitative) on plant use for malaria and other related illnesses, including preparation methods and effectiveness for acute, uncomplicated, and severe malaria. We identified 21 ethnomedicinal plant species used across the study sites (Olalubi *et al.,* 2021).

Mr. Vice-Chancellor, Sir, of the twenty-one (21) medicinal plants surveyed, the top five most effective medicinal plants for the treatment of both Acute Uncomplicated and Severe malaria were in the magnitude order of *Mitragyna inermis* (African linden), Ewe Okobo > Antidesma *Antidesma velutinum* L. Aro Dudu > *Ficus thoningii blume* (Strangler fig, common wild fig, bark-cloth fig) Ewe-Odan eki > *Cedrela odorata* + *Capsisum annuum* L. (Bell Pepper) Ewe-Gbogi + Ewe- Rodo Rodo > *Spondias mombin* (Hog plum) Ewe Iyeye-Ode respectively (Table 1). These findings highlight key ethnobotanical resources with promising antimalarial potential that may warrant further scientific validation.

Table 1: Most Effective Medicinal Plant for Treatment of both Acute Uncomplicated and Severe Malaria

S/ No	Local / Yoruba Name	English / Species Name	Usage and Dosage
1	Ewe Okobo	*Mitragyna inermis* (African linden)	The leaves are macerated with water, add salt, filter and drink. Drink one (1) cup once daily for 3 days
2	Aro Dudu	Antidesma *Antidesma velutinum* L.	Macerate and boil the leaves in water to steam, allow to cool, bathe and drink. Drink one (1) cup twice daily for three (3) days.
3	Ewe-Odan eki	*Ficus thoningii Blume* (Strangler fig, common wild fig, bark-cloth fig)	Boil the leaf, macerate with unripe banana fruit and potassium permanganate, dissolve in palm oil, pour into the bottle, place under the sun and shake vigorously. Then rub a cream once on the body of the child. Two (2) teaspoons of the concoction are consumed twice daily. The patient sweats after five (5) minutes of administration, as an indicator of the efficacy of the herb. It is also effective for the treatment of diarrhoea, dysentery and vomiting. The *Ficus* species plant could also be used singly to treat malaria without combining it with other plants.
4	Ewe-Gbogi + Ewe-Rodo Rodo	*Cedrela odorata* + *Capsisum annuum* L. (Bell Pepper)	Macerate and boil both leaves together in water, bathe and drink. Drink one (1) cup twice daily for three (3) days.
5	Ewe Iyeye-Ode	*Spondias mombin* (Hog plum)	Macerate and boil the leaf in water to steam, allow cooling, bathe and drink. Drink one (1) cup twice daily for three (3) days.

Source: Olalubi, (2021)

Mr. Vice-Chancellor, Sir, this survey identified several potentially threatened plant species in the Malete–KWASU campus area, including *Aristolochia ringes*, *Mucuna pruriens*, *Azadirachta indica*, *Kigelia africana*, *Citrus limon*, *Ludwigia suffruticosa*, *Parkia biglobosa*, and *Picralima nitida*, primarily located in degraded woodland and settlement clusters. The threat is largely due to extensive forest destruction from massive student hostel construction to meet the growing population, with the presence of surface water bodies significantly influencing medicinal plant distribution (Olalubi *et al.,* 2021). Given the heavy reliance on these plants for healthcare in surrounding communities, sustainable harvesting practices and socio-ecological safeguards are essential to prevent their depletion or extinction. Urban expansion driven by KWASU's growing influence should be carefully monitored, with urban planning incorporating cultivation of these plants into the Kwara State government's greening initiatives (Olalubi *et al.,* 2021).

Given the ethnobotanical survey that has identified *Mitragyna inermis* (Ewe Okobo) as the most effective plant for acute and severe malaria treatment in Malete and nearby settlements. We proceeded to phytochemical analysis of its methanol leaf extract via GC–MS revealed 40 compounds, with cis-13,16-docasadienoic acid (12.33%) as the dominant constituent (Olalubi *et al.,* 2024). Molecular docking against Plasmepsin II, a key malarial enzyme, showed 2,5-dibenzyloxynitrobenzene with the strongest binding affinity, while other compounds also demonstrated promising interactions. ADME and toxicity profiling indicated favorable drug-like properties, high gastrointestinal absorption, and blood–brain barrier permeability, although some compounds showed potential CYP enzyme inhibition, hepatotoxicity, and immunotoxicity. Collectively, these findings underscore the therapeutic potential of *M. inermis* in antimalarial drug development (Olalubi *et al.,* 2024).

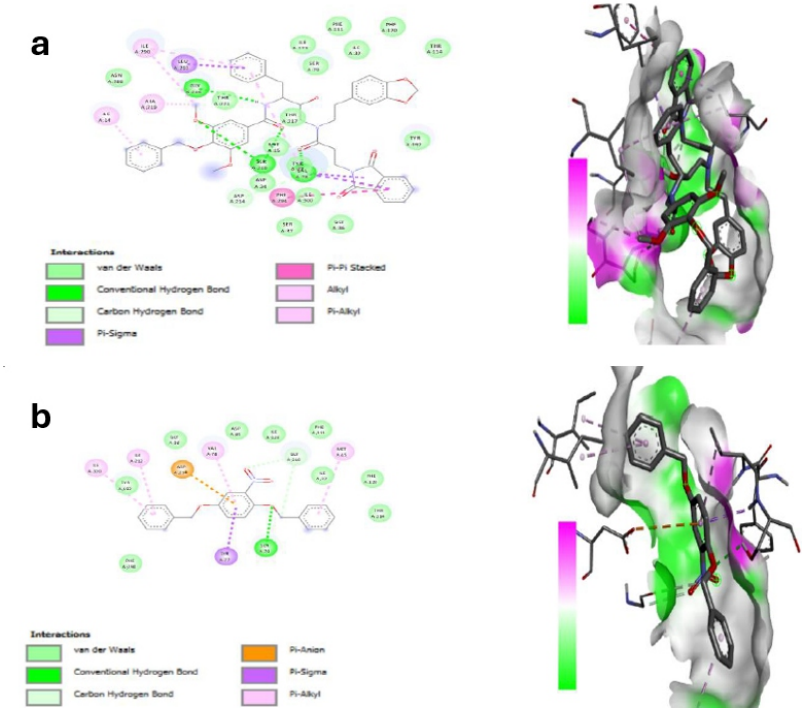


Figure 12: Molecular interaction of amino acid residue of plasmepsin with (a) EH58, 2D left 3D right and (b) 2,5 dibenzyloxynitrobenzene, 2D left 3D right.

Conclusively, molecular docking analysis demonstrated that phytochemicals from *M. inermis* can effectively interact with the Plasmepsin II enzyme, indicating strong antimalarial potential (Figure 12). The identified compounds showed favourable drug-like properties with minimal toxicity concerns, supporting their candidacy for further development as antimalarial agents.

8. Application of Geospatial Modeling to Malaria Control and Elimination

Mr. Vice-Chancellor, Sir, "Everything is somewhere and can be located" captures a core principle of geography, echoed in Tobler's First Law: "Everything is related to everything else, but near things are more related than distant things." Building on this, geospatial technology has become indispensable in malaria control, enabling improved surveillance, targeted interventions, and informed policy-making in endemic countries like Nigeria (Olalubi *et al.,* 2020). Geospatial modelling integrates GIS, remote sensing, and spatial statistical methods to map, analyse, and predict disease patterns using environmental, demographic, and health data, with applications in risk mapping, hotspot detection, predictive surveillance, resource allocation, and program evaluation.

In a case study of Moro LGA, Kwara State, my team combined microscopy, RDTs, and GPS to collect blood samples, geographic coordinates, and climate data. Remote sensing was used to map water bodies, vegetation, topography, and drainage features influencing mosquito breeding, enabling settlement-specific malaria risk modelling (Figure 13). This approach demonstrates how geospatial modelling provides an evidence-based framework for precision public health and more effective malaria elimination strategies in Nigeria and beyond.

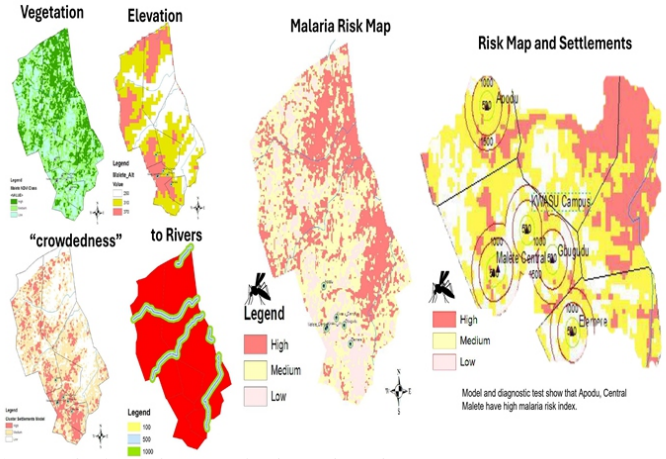


Figure 13: Malaria risk map of selected settlements
Geospatial Malaria Risk and Settlement-Level Analysis

Mr. Vice-Chancellor, Sir, our geospatial risk modelling showed that malaria risk in the study area follows the descending order: Apodu > Central Malete > Elemere > KWASU Campus > Gbugudu. Apodu recorded the highest risk index, with significant exposure within a 500 m radius, largely due to a large pond/lake serving as a breeding site and dense surrounding vegetation. Risk generally increased with distance from settlement centres, reflecting the influence of environmental conditions. In contrast, Gbugudu showed moderate risk at a 100 m buffer (60%), declining further out, likely due to the absence of thick vegetation and the presence of open farmlands on its eastern side. Central Malete's relatively high risk is linked to environmental factors and dense vegetation despite its built-up nature, while areas within 1 km of the KWASU Campus recorded lower risk, likely due to sparser vegetation.

Validation through diagnostic testing (Figure 14) confirmed these spatial patterns: Apodu had the highest malaria prevalence

at 46% (RDT) and 58.7% (microscopy), followed by Elemere with 41% and 30.3%, while Gbugudu recorded the lowest prevalence across both methods.

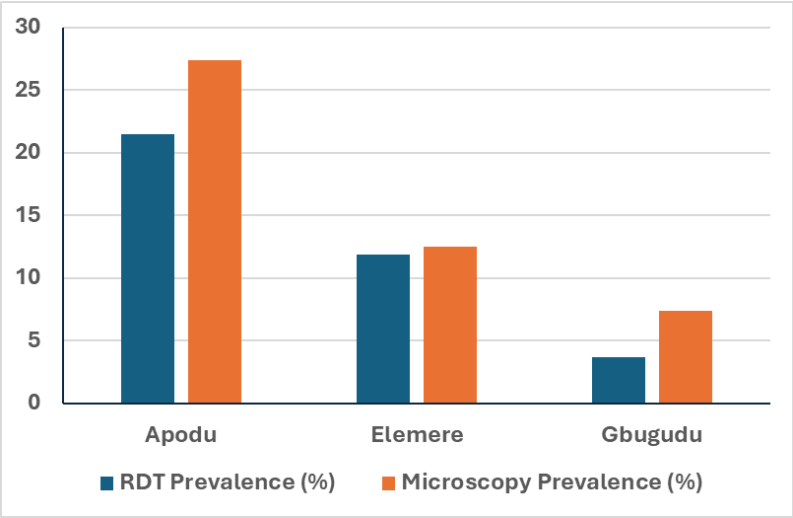


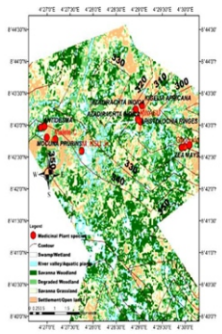
Figure 14: The geospatial risk model closely correlated with field diagnostics.

These results confirm that malaria parasitaemia in major settlements correlates closely with environmental risk indicators detected through remote sensing.

Geospatial Mapping of Medicinal Plant Habitats

Using geospatial tools, we mapped medicinal plant species across the community to identify habitats vulnerable to human activities such as farming and construction, and to understand the environmental conditions essential for their growth. The mapping revealed both the locations of these valuable species and the fragility of their ecosystems (Figure 15), underscoring

the urgent need for habitat protection to safeguard traditional health resources and biodiversity.



S/No	Settlements	Land cover categories	Associated medicinal plants
1	Apodu	Swamp/wetland	Citrus lemon
2	Alapo	River valley	*Mitragyna inermis, Solanum torvum Sw, Ficus thoningii Blume, Tithonia diversifolia Chromolaena odorata*
3	Yeregi, Gbugudu	Savanna woodland	*Antidesma velutinum, Capsicum annum, Cedrela odorata, Byrsocarpus coccineus Schumach*
4	Malete, Okete	Degraded woodland	*Kigelia Africana, Spondia mombin L, Azadirachta Indica*
5	Central Malete	Savanna Grassland	*Vernonia amgdalina Azadirachta Indica*
6	Malete, KWASU	Settlement cluster / Openland	*Azadirachta Indica*

Figure 15: Medicinal Plant Species, their habitats and Associated Settlements

The figure illustrates the spatial distribution of key medicinal plant species, highlighting the need to protect their fragile habitats. For example, *Citrus limon*, found in the wetlands and river valleys of Apodu, thrives in an ecosystem functioning as a "natural sponge," essential for biodiversity and human health. Safeguarding these environments ensures the sustainability of both traditional medicine and ecological balance—ultimately, their survival is tied to ours.

Inferences:

(i) **Adopt Geospatial Modelling in the Field** – Integrate geospatial analysis of environmental and ecological variables into routine malaria epidemiology and surveillance.

(ii) **Policy Integration** – Embed geospatial modelling into national malaria control strategies and decision-making frameworks.

(iii) **Support the "One Health" Approach** – Apply geospatial techniques within WHO's One Health strategy to tackle malaria and other vector-borne diseases across human, animal, plant and environmental health sectors.

(iv) **Strengthen Data Systems** – Enhance the quality, accuracy, and frequency of health and environmental data collection to support reliable geospatial analysis.

(v) **Capacity Building** – Provide targeted training in GIS and spatial modelling for local health workers, analysts, and planners at community and state levels.

(vi) **Foster Collaboration** – Encourage partnerships between government agencies, academic institutions, and international organizations to expand geospatial innovations in malaria control.

9. Contemporary Approaches to Malaria Control and Elimination

Mr. Vice-Chancellor, Sir, beyond antimalarial drugs and vaccines, innovative technologies and integrated strategies are advancing malaria control and elimination. These include next-generation insecticide-treated nets (ITNs), indoor residual spraying (IRS) with novel insecticides, larval source management (LSM), gene drive technology, spatial repellents, eave tubes, sterile insect technique (SIT), biological control, climate-based early warning systems, and Integrated Vector Management (IVM) (Olalubi & Chinwe, 2016).

Vector Control and Larval Source Management (LSM) Vector control remains central to malaria prevention. While LLINs and IRS target adult mosquitoes, LSM interrupts mosquito development at the larval stage—most effective where breeding sites are "few, fixed, and findable" (WHO; Olalubi & Chinwe, 2016). LSM interventions include:

1. **Habitat modification** – permanent changes (e.g., drainage, land reclamation)
2. **Habitat manipulation** – periodic changes (e.g., shading, water regulation)
3. **Larviciding** – biological/chemical larvicides in breeding sites
4. **Biological control** – larva-eating organisms (e.g., *Gambusia affinis*)

Field Trials in Nigeria NMEP and researchers (Olalubi & Chinwe, 2016) demonstrated larvicide effectiveness across:

- **Lagos State** (Ojo, Badagry, Ikorodu): Skeeter ABATE 5% PG provided effective *Anopheles* control for 30 days, with residual and pre-hatch action.
- **Ogun & Nasarawa States**: *Bacillus thuringiensis israelensis* (Bactivec) and *Bacillus sphaericus* (Griselesf) reduced larvae within 24 hours and maintained control for 30 days (80.3–100% effectiveness).

10. Challenges of Malaria Control and Elimination in Nigeria

Mr. Vice-Chancellor, Sir, despite progress, Nigeria's malaria elimination faces persistent and emerging challenges:

i. Weak Health System Infrastructure – Inadequate rural facilities, frequent stock-outs of drugs, RDTs, and ITNs, plus high health worker attrition due to emigration.

ii. Insecticide and Drug Resistance – Mosquito resistance to pyrethroids weakens ITNs and IRS; *P. falciparum* resistance to artemisinin derivatives is rising in hyper-endemic areas.

iii. Poor Surveillance and Data Management – Weak reporting from private providers, lack of real-time systems, and under-reporting reduce response capacity.

iv. **Poor Funding and Sustainability** – Heavy reliance on donors; the 2025 USAID funding freeze disrupted malaria and related health programs, with insufficient domestic financing.

v. **Political and Governance Issues** – Weak political will, poor intergovernmental coordination, and corruption hinder program implementation.

vi. **Sociocultural Barriers** – Low awareness, ITN misuse, and reliance on traditional remedies delay prevention and treatment (Oluwasogo *et al.,* 2016).

vii. **Climate/Environmental Factors** – Tropical climate, poor drainage, and vegetation-sustained mosquito breeding.

viii. **Conflict and Displacement** – Insecurity in the North-East disrupts services of IDPs.

ix. **Poor Program Integration** – Malaria programs often operate in isolation, though projects like Kwara State's IMPACT initiative show integrated success.

11. Pragmatic Solutions and Recommendations for Malaria Control in Nigeria

Mr. Vice-Chancellor, Sir, malaria in Nigeria is not just a disease—it is a developmental crisis. With nearly one in four global malaria deaths occurring here (WHO, 2023), the burden spans health, education, productivity, gender equity, and economic growth. Urgent, collective, and strategic action is essential.

Strategic Recommendations:

1. **The NMEP under the Federal Ministry of Health-** should prioritize and schedule Kwara State for larvicide field trials, customizing LSM for local conditions. The integration of LLINs, IRS and LSM offers a greater control effort than either alone. No further research is

needed—LSM is ready for implementation and should be adopted as a central pillar to fast-track Nigeria toward malaria elimination.

2. **Invest in Research & Innovation** – Advance indigenous diagnostics, vector control, drugs, and vaccines; expand Plasmodium/Anopheles genomic surveillance; link researchers and policymakers.
3. **Adopt Data-Driven Tools** – Use mobile reporting, DHIS2 dashboards, and geospatial mapping to guide interventions. *No effective data, No disease control.*
4. **Strengthen PHC & Supply Chains** – Guarantee ACT/RDT access, integrate IPTp in ANC, and mandate testing before dispensing.
5. **Empower Communities** – Partner with leaders, replace mass net campaigns with targeted distributions, and equip CHWs for outreach.
6. **Boost Domestic Funding** – Secure transparent local financing and private-sector investment.
7. **Tailor Urban/Rural Strategies** – Urban: drainage cleanup, IRS; Rural: vegetation control, rotational insecticides, CHW-led outreach.
8. **Promote PPPs** – Engage private clinics, encourage local ACT/RDT/insecticide production.
9. **Protect Vulnerable Groups** – Mobile clinics for IDPs, disability-inclusive services.
10. **Reform Policies & Institutions** – Strengthen SMEPs, track budgets, integrate malaria with BHCPF and PHCUOR.
11. **Establish a Nigerian Institute of Malaria Studies** – Proposed KWASU-based Centre for multidisciplinary

research, training, and operational science toward a malaria-free Nigeria.

12: My Contribution to Knowledge

Mr. Vice-Chancellor, Sir, by the grace of God and with the invaluable support of the Kwara State University community, I have been privileged to contribute meaningfully to malaria research, public health, and scientific knowledge at large. My research has spanned diagnostics, vaccine immunogenicity studies, vector control, ethnobotany, drug resistance, and geospatial applications.

Below are my core contributions:

A. Peer-Reviewed Research Publications

1. **Malaria Vaccine Development** *Evaluation of Host Humoral Antibody Production Against Plasmodium falciparum Recombinant Circumsporozoite Antigen in Nigerian Children* – This foundational study contributed to vaccine candidate research in Nigeria. Published in: *Journal of Vector-Borne Diseases*, 49, 151–156. http://www.mrcindia.org/journal/issues/493151.pdf
2. **Antimalarial Drug Combination Efficacy** *In-vivo Evaluation of Antiplasmodial Effect of Amodiaquine and Amodiaquine-Promethazine Combination in P. berghei-Infected Mice* – Validated drug combination over monotherapy. *International Journal of Health Research*, 4(2): 83–89. http://www.ijhr.org/vol4_no2/ijhr_2011_4_2_3_Olalubi.pdf
3. **Drug Resistance Reversal In Vitro** *Testing Susceptibility of P. falciparum to Amodiaquine with Verapamil, Chlorpheniramine, and Promethazine* –

Demonstrated resistance reversal in vitro. *International Journal of Biology & Biological Sciences*, 2(7): 105–109. http://academeresearchjournals.org/journal/ijbbs

4. **Larval Source Management (LSM)** *Promoting LSM as a Cost-Effective Vector Control Strategy in Nigeria* – Recognized by the National Malaria Elimination Programme (NMEP). *Journal of Prevention and Control*, 2(2): 1–6. Email: infectioncontrol@imedpub.org
5. **RDT Evaluation Study** *Comparative Assessment of Malaria Rapid Diagnostic Tests in Ibadan* – Validated SD Bioline as a reliable community diagnostic tool. *Malaria World Journal*, 8(17): 1–7. https://malariaworld.org/
6. **Geospatial Risk Mapping of Malaria** *Geospatial Modelled Analysis and Laboratory-Based Technology for Malaria Risk* – Demonstrated strong correlation between risk modelling and lab-based diagnostic results. *International Journal of Tropical Disease & Health*, 41(8): 59–71. http://sciencedomain.org/journal
7. **Medicinal Plant Ethnobotany and Conservation** *Ethnobotanical Survey and Habitat Mapping in Rural Kwara Communities* – Emphasized medicinal plant preservation. *Research in Health Science*, 6(2): 39–58. http://www.scholink.org/ojs/index.php/rhs/article
8. **GC-MS and In Silico Drug Discovery** *Phytochemical and Molecular Docking Studies of M. inermis (Ewe-Okobo)* – Revealed promising antimalarial drug candidates with favorable ADME profiles. *J. Compl. Altern. Med. Res.*, 25(9): 18–32, 2024. [DOI: JOCAMR.120266]

9. **Kelch13 Resistance Surveillance** *Absence of Kelch13 Mutations in P. falciparum Isolates in Ilorin, Nigeria* – A pioneer molecular surveillance study sustaining ACT efficacy. *Nigerian Journal of Parasitology*, 46(2), 2025. https://doi.org/10.4314/njpar.v46iXXXX

B. Textbooks and Knowledge Dissemination

1. **Ethnobotanical Survey of Indigenous Medicinal Plants** Funded by TETFund, this community-focused textbook documented malaria treatment practices in Kwara. ISBN: TETFUND KWASUIBR/CSP/250918/VOL5/TETF/0065
2. **Risk-Based Malaria Mapping in Rural Kwara** Documented spatial malaria distribution and modelling approaches. ISBN: 978-978-54873-7-4 Grant Ref: KWASUNGR/CSP/062215/VOL3/TETF/0030
3. **Advances in Malariology: An African Perspective** An academic reference text for students, researchers, and policymakers. Published by LAP Lambert Academic Publishing, Germany, 2016 [ISBN-13: 978-3-659-91521-5] Available: www.lap-publishing.com

Hence, my contributions span the full malaria research continuum, from vaccine trials, drug resistance, and vector management to geospatial intelligence, ethnobotany, and molecular surveillance, all aimed at evidence-based control and eventual elimination of malaria in Nigeria and beyond.

Conclusion

Mr. Vice-Chancellor, Sir, Ladies and Gentlemen, the clock is ticking. Malaria control and elimination in Nigeria is not just a public health challenge—it is a test of equity, innovation, political will, and global solidarity.

Until every Nigerian child—regardless of location, social status, or background—can sleep under a treated net, receive timely, best diagnosis, and access effective treatment, elimination will remain a distant dream.

The question is no longer whether we have the tools, but whether we have the courage and commitment to use them for all and without fail.

Who is winning the malaria war—mosquitoes or man? Only a united, evidence-driven, and sustained effort will answer this question. With consistent application of proven interventions, strong leadership, and inclusive policies, malaria can shift from a life-threatening burden to a public health success story.

It is my sincere hope that our collective efforts bring us lasting victory.

Elimination of malaria is not a dream; it is a collective mission that demands commitment, innovation, equity, and resilience. The tools exist. What remains is bold, sustained action. Together, we can change the answer to the question:

"The malaria war: Who is winning—the mosquito or man?"

With unified effort, man can win.

Acknowledgements

I will forever be grateful to the Almighty God, the Father of light, in whom there is no variableness nor shadow of turning. Truly, it has been by His grace that I have been preserved and sustained. As the Psalmist declared in Psalm 103:1 5: "Bless the Lord, O my soul, and all that is within me, bless His holy name... and forget not all His benefits." Indeed, God has been good to me and to my family.

My deepest gratitude goes to the Kwara State University Management and the Principal Officers—Prof Shaykh-Luqman Jimoh (Vice-Chancellor), Prof Moshood Mahmood Jimba (Deputy Vice-Chancellor, Administration), Prof Olubukola Christianah Dada (Deputy Vice-Chancellor, Academics), Dr Kikelomo Wasilah Sallee (Registrar), Mallam Mohammed Abubakar Sanni (Bursar), and Prof Abdulsalam Abiodun Salman (University Librarian), for your unwavering commitment to academic excellence and innovation at KWASU. Your inspiring leadership has created an enabling environment for us to thrive.

I sincerely appreciate our Pioneer Vice-Chancellor, Prof AbdulRasheed Na'Allah, for recruiting me in 2014 as a Senior Lecturer in the Department of Public Health. I fondly remember our one-on-one interview and your pointed question: "What will you do to grow a new programme?" Thank you for believing in me and giving me that opportunity.

I remain eternally grateful to my former Vice-Chancellor, Late Prof Muhammed Mustapha Akanbi SAN, who facilitated my promotion to Professor of Public Health in October 2021. Though he is no longer with us, may Almighty Allah grant him Al-Jannat al-Firdaus.

To my late parents—Mr Samuel Adefirantan Olalubi of the Olalubi Alarajeomoko dynasty, and Mrs Alice Aarinola Olalubi of the Chief Nathaniel Awoyinfa Ologbarebete dynasty—I owe you everything. Despite all odds, you both gave your children the best foundation. My mother, a visionary and martyr who was denied education due to the ancient beliefs (despite her paternal, wealthy background), committed herself to ensuring that all her children were educated. She was a symbol of strength, resilience, and love. Even as a single mother, she carried the responsibilities of both parents with unmatched grace and determination.

Permit me, Mr. Vice-Chancellor, to eulogize my late mother in my dialect (Ijesa): *Anrin ninu ola, Olopo ewa (Epitome of Beauty), Omo Ologbarebete (Large Compound) la lede Ijesa, Yeye mi, lelu ahoro lewebi oroke, oko obi alejo, mo si gaga elu kan, omo oloni asure bu mun, omo oloni awegbokungbe, omo oloni abuwemoye, omo oloni ajoji o wese, ajoji o ba wese nibe, o deni ebora. Omo olomi tita wiriwiri ara ota, Owo elule o jenfiran, omo elule o jenfiran, Aso elule o jenfiran, jenfiran loloke uloro, Omo onigbado araba tala (Huge grains), Owi ki igun (kind of bird) maje, ki akalamagbo maje, ki aimona gbe sinu agbado (maize plantation). Yeye mi!!! abo mi oko bi iyo (salt). E fi ese mi le ona otito, E sin mi de bi teru oni bami, E se mo ma dupe ore tese gbogbo* (Culled from Ebenezer Obey), Sun re oooo! Capturing her essence as a woman of virtue and fortitude. Her memory remains my compass.

My sincere appreciation also goes to my maternal uncles and their wives: Late Chief Daniel Ademidun (The Lumobi of Iwara, Ijesa) and Mrs Victoria Morenike Ademidun, Late Engr. Emmanuel Olufemi Awoyinfa and Mrs Winifred Abimbola Awoyinfa, Engr Ajibade Aladeojebi and Late Mrs Monisola Aladeojebi. Thank you for your love and mentorship.

To my siblings and their families—Late Elder Peter Adebanji Onileorioke and Deaconess Margaret Olusola Onileorioke (Retired Principal, our Big Mummy, Ibadan); Elder Muyiwa Olalubi and Deaconess Folake Olalubi (Lagos); Elder Emmanuel Makanjuola and Chief (Mrs) Oluwatoyin Makanjuola (née Olalubi, The Iya-laje of Ijesaland); Mr Adeniyi Oluwaseun Olalubi and Mrs Kehinde Olalubi—I thank you all for your constant support and encouragement.

I also acknowledge the entire Awoyinfa Ologbarebete family, especially my big sister and her husband from Lagos, Alhaji and Mrs Odunola Bello, Prof Joseph Ola Awoyinfa (University of

Lagos) and his lovely wife Mrs Grace Abimbola Awoyinfa and Uncle Sunday Awoyinfa. Thank you for preserving our family ties.

Professionally, I am indebted to colleagues across the three faculties where I have served in KWASU—Pure and Applied Sciences, Basic Medical Sciences, and Allied Health Sciences. I thank Prof Emmanuel Ajani (former Dean of Pure and Applied Sciences and current DAP), Prof Clement Olatunbosun Bewaji and Prof Adenike Temidayo Oladiji (Former Deans of Faculty of Basic Medical Sciences, now VC, FUTA).

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Mr. Vice-Chancellor, Sir, distinguished audience, as I conclude this Inaugural Lecture, I hope that the insights shared today ignite further academic inquiry, public engagement, and national commitment toward eliminating malaria in Nigeria. Thank you all for your rapt attention and support. May God grant you safe journeys back to your respective destinations.

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