

Research Article

Epidemio-clinical Study of Simple Malaria in Adults in the General Medicine Department of the Reference Health Center of Bamako Municipality III in 2023

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Abstract

Introduction: Malaria remains a major public health problem in Mali. This study aimed to analyze the epidemiological and clinical aspects of uncomplicated malaria cases in adults treated at the general medicine department of the Reference Health Center in Commune III of Bamako in 2023. **Methods:** This was a cross-sectional study conducted from July 1 to December 31, 2023. All patients aged 18 years or older with either clinically suspected or confirmed uncomplicated malaria-diagnosed through thick blood film, thin blood smear, or rapid diagnostic test (RDT)-were included. Data were gathered through a questionnaire and subsequently entered and analyzed with SPSS version 25. The national malaria control protocol served as a reference for evaluating prescriptions. **Results:** A total of 317 uncomplicated malaria cases were recorded among 7,584 admissions, accounting for 4.9%. The mean age was 34 ± 15 years, with a female predominance (63%). The main clinical signs were headache (86.12%), chills (49.53%), and fever (52.7%). Thick blood smears were performed in 94% of cases and were positive in 86.44%. Antimalarial treatment was primarily based on artemether/lumefantrine (60.88%). The treatment protocol was appropriate in 65% of prescriptions. **Conclusion:** Uncomplicated malaria remains prevalent among adults in Commune III. Strengthening preventive measures and adhering to the protocol remain essential to reduce morbidity and prevent severe forms of malaria.

Keywords

Epidemiological-clinical, Uncomplicated Malaria, Bamako, Mali

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1. Introduction

Malaria is a parasitic disease caused by a blood parasite of the genus *Plasmodium* (*P.*). Five species are known to cause this disease: *P. vivax*, *P. ovale*, *P. malariae*, *P. falciparum*, and *P. knowlesi*. However, the most dangerous and widespread species remains *P. falciparum*. Malaria is mainly transmitted by the bite of a female *Anopheles* mosquito [1].

Malaria continues to be a public health problem, with 247 million cases and 619,000 deaths globally reported in 2021 [2]. The World Health Organization (WHO) African Region bears a large and disproportionate share of the global malaria burden. In 2021, 95% of malaria cases and 96% of malaria deaths were recorded in this region. Children under 5 years of age accounted for 80% of all malaria deaths in the region [2].

In Mali, according to the sixth Demographic and Health Survey (DHS-VI, 2018), the national prevalence of malaria is 19% [3]. Malaria constitutes a significant public health problem and is the leading reason for seeking medical care in health facilities (34%). According to the Local Health Information System, in 2021, health facilities recorded 3,204,130 confirmed cases of malaria, including 2,156,200 uncomplicated cases and 1,047,930 severe cases, with 1,480 deaths [4].

According to the Mali National Malaria Control Program (PNLP), uncomplicated malaria is essentially characterized by a fever (axillary temperature $\geq 37.5^{\circ}\text{C}$) or a history of fever with often headaches, muscle pain, joint weakness, digestive disorders, chills, and body aches, confirmed by a biological examination (positive RDT or GE/FM) [5].

A suspected case of malaria must be confirmed by parasitological diagnosis, microscopy (thick blood film), or a rapid diagnostic test (RDT) before initiating antimalarial treatment. Treatment based on clinical signs should only be administered if RDTs are not immediately available within two hours of the patient's presentation for treatment [6].

Insecticide-treated bed nets and indoor residual spraying (IRS) are the two main tools for controlling mosquito populations that transmit malaria. Malaria during pregnancy and childhood includes the implementation of intermittent preventive treatment for pregnant women and children [7, 8] and seasonal malaria chemoprevention for children aged 3 to 59 months during the period of high seasonal transmission [4]. The WHO recommends the use of insecticide-treated bed nets (ITNs) and indoor residual sprays (IRS) to prevent mosquito bites. In 2018, 72% of households in sub-Saharan Africa had at least one ITN, and approximately 57% of the population had access to an ITN, while 40% of the population lived in households with enough ITNs for all occupants [9].

Like other countries worldwide, Mali has introduced artemisinin-based combination therapies for the treatment of uncomplicated malaria following chloroquine resistance [5]. This treatment protocol combines artemether and lumefantrine at doses of 20 mg and 120 mg, respectively, administered orally based on the patient's weight [5].

Malaria remains a major public health problem in Mali due

to the high prevalence, the high mortality rate, and the high treatment cost, which hinder the socio-economic development of the population. In this context, the Commune III Reference Health Center (CSREF) in Bamako reports a significant number of malaria cases, particularly uncomplicated cases, which are primarily managed on an outpatient basis. However, few studies have focused on the epidemiological and clinical description of these cases in adults at this center. Therefore, this study was deemed important to better understand the characteristics of uncomplicated malaria in this population and to improve its management. The objective was to study the epidemiological and clinical aspects of uncomplicated malaria cases in adults treated at the general medicine department of the Commune III Reference Health Center in Bamako in 2023.

2. Methodology

2.1. Study Setting

The study took place in the general medicine department of the Commune III Reference Health Center in Bamako. The Commune III Reference Health Center is a secondary care facility located in the heart of the city of Bamako.

2.2. Type and Period of Study

This was a descriptive cross-sectional study with prospective data collection. The study took place over a 6-month period from July 1, 2023 to December 31, 2023.

2.3. Study Population

Study population consisted of all patients from the general medicine department who came for consultation during the study period. Were included, (1) All patients in whom the diagnosis of uncomplicated malaria has been clinically established or confirmed with thick blood smear, thin blood smear or rapid diagnostic test (RDT); (2) Any patient who agreed to participate in the study; (3) All patients aged 18 years or older.

2.4. Sampling

The study included, through an exhaustive census, all suspected and confirmed cases of uncomplicated malaria in patients aged 18 years and older, treated at the general medicine department of the Commune III Reference Health Center in Bamako during the data collection period (2023). Patients who met the inclusion criteria and agreed to participate were recruited consecutively until the end of the study period. The sample size was calculated according to Daniel Schwartz's formula: $n = \frac{Z_{\alpha}^2 (p \times q)}{i^2}$. Were,

p = prevalence of uncomplicated malaria, i.e. 26.8% according to a previous study [10].

$q = 1-p$, hence $1-0.268 = 0.732$; $q=0.732$.

$Z\alpha$ = normal distribution test, reduced deviation. With a risk of error chosen at 5%, $Z\alpha = 1.96$.

i = the desired precision ($i = 0.05$);

n = sample size.

$$n = \frac{1,96^2 (0,27 \times 0,73)}{0,05^2} = 303 \text{ patients.}$$

The minimum sample size is estimated at 303 patients.

2.5. Data Collection

Data collection was carried out using pre-established survey forms. Data were collected from patients in face-to-face interviews and supplemented with information from the patient consultation register. Variables were sociodemographic data (age, sex, education level, marital status, etc.); clinical data (reasons for consultation, general and functional signs). Paraclinical data (rapid diagnostic test, thick blood smear, etc.) and therapeutic data.

2.6. Data Analysis

The data were entered and analyzed using SPSS version 25.

The averages Standard deviations were calculated for quantitative variables, and percentages for qualitative variables. The results were presented in tables and graphs using Excel 2016 software.

2.7. Ethical and Professional Considerations

Authorization from the Chief Physician and the Head of the General Medicine Unit at the Commune III Referral Health Center was obtained before the start of the study. Verbal, voluntary, free, and informed consent was obtained from the patients before administering the questionnaires. Patient privacy was protected by anonymizing the survey forms and assigning a registration number. No data will allow for the identification of any patient.

3. Results

We recorded 317 cases of uncomplicated malaria among 7584 admissions during the study period, representing 4.9%.

Sociodemographic data

The female represented 63.1%. The 20-30 age group represented 39.4%. The mean age was 34 ± 15 years. Secondary education represented 44.79%. 63.09% of study participants were married, and 32.49% were single (Table 1).

Table 1. Distribution according to sociodemographic characteristics ($n=317$).

Sociodemographic characteristics	n	%
Sex		
Male	117	36.9
Female	200	63.1
Age range (in years)		
≤ 19	46	14.5
20-30	125	39.4
31-40	67	21.1
41-50	35	11.1
≥ 51	44	13.9
Level of study		
Not enrolled in school	31	9.8
Primary	24	7.5
Secondary	142	44.8
Superior	120	37.9
Marital status		
Bachelor	103	32.5
Bride	200	63.1
Divorcee	6	1.9

Sociodemographic characteristics	n	%
Widowed	8	2.5

*Clinical data***Table 2.** Distribution of patients according to reason for consultation (n=317).

Reason for consultation	n	%
Functional signs		
Headaches	273	86.1
Thrill	157	49.5
Muscle pain	148	46.7
Fatigue	124	39.1
Vertigo	92	29.0
Weakening	91	28.7
Diarrhea	17	5.4
Anorexia	16	5.0
Muscle soreness	11	3.5
Vomiting	10	3.2
Abdominal pain	10	3.2
Nausea	8	2.5
Lower back pain	5	1.6
Cough	4	1.3

Reason for consultation	n	%
Dysphagia	3	0.9
physical signs		
Fever (38.2°C)	167	52.7
Pale conjunctiva	5	1.6

The reasons for consultation were headaches in 86.1%, fever in 52.7%, chills in 49.5%, and muscle pain in 46.69%.

Table 3. Distribution according to the biological test and its result (n=317).

Biological test	n	%
Test type		
GE	298	94.0
TDR	19	6.0
Result of the biological test		
Positive	274	86.4
Negative	43	13.6

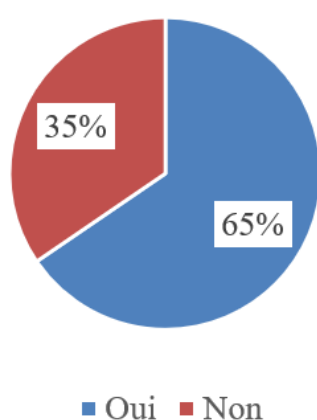
The tests were positive in 86.4%.

Table 4. Distribution according to treatment type.

Type of treatment	n	%
Antimalarial		
Artemether/lumefantrine 80/480mg	193	60.9
Artemether/lumefantrine 80/480mg, Artesunate 60mg	100	31.5
Dihydroartemisinin 40mg + piperaquine 320mg	7	2.2
Sulfamethoxypyrazine 500mg + artesunate + 20mg +pyrimethamine 25mg	7	2.2
Arterolane 150mg +piperaquine 750mg	1	0.3
Artemether/lumefantrine 80/480mg, Artemether 80mg injectable	1	0.3
Artemether/lumefantrine 80/480mg, Sulfamethoxypyrazine 500mg + artesunate 200mg +pyrimethamine	1	0.3
Adjuvant		0.0
Paracétamol	184	58.0

Type of treatment	n	%
Antibiotique	168	53.0
Oméprazole	23	7.3
Antihistamine	13	4.1
Ringer's lactate	13	4.1
Vitamin B	12	3.8
Vitamin C	1	0.3

Antimalarial treatment was based on artemether/lumefantrine 80/480 mg in 60.9% of cases. Paracetamol was prescribed as an adjunct treatment in 58%.



Antimalarial treatment was adapted to the PNLP protocol in 65%.

Figure 1. Distribution according to the antimalarial treatment adapted to the PNLP protocol.

4. Discussion

Frequency

During the study period, we recorded 317 cases of uncomplicated malaria among 7,584 admissions, for a prevalence of 4.9%. This relatively low prevalence could be explained by several factors: The Commune III Referral Health Center is a secondary care center, where referred cases are often more complex or involve other non-malarial conditions. Uncomplicated malaria cases are generally managed at Community Health Centers (CSComs) or by Community Health Workers (CHW) before being referred to the Referral Health Center. Adults often develop partial immunity after multiple exposures, and infections are frequently asymptomatic or mild, so they are less often reported at referral facilities. This result is similar to that of Argaw et al. [11] in 2019 in Ethiopia, who found an uncomplicated malaria rate of 3.69%. In Mali at Dangassa, Toure M et al. [12] found a malaria prevalence ranging from 9.5 to 62.8% at the beginning of the rainy season and from 15.1 to 66.7% at the end of the rainy season between 2015 and 2020. These differences could be explained by the

fact that they included all ages and the study was carried out in rural areas of Mali, where malaria prevalence is very high.

Sociodemographic characteristics

In our study, females predominated, representing 63% of cases. This contrasts with the findings of Niambele Z [13] and Pen a F et al. [14], who reported male predominance of 50.8% and 69%, respectively. This difference could be explained by sampling fluctuations. The subjects in our study had the highest percentage of secondary education (44.79%) and higher education (37.85%). These levels could be explained by the study location, Commune III, in the Bamako district, which has the highest school enrollment rate in Mali, according to the National Institute of Statistics of Mali (INSTAT) [15].

Clinical signs

Clinical signs are helpful in diagnosing malaria. They are diverse, but the first symptoms of malaria include fever, chills, headache, muscle pain, nausea, and vomiting. Sometimes, these symptoms are nonspecific and can also be confused with other illnesses (for example, influenza and other viral infections). Similarly, clinical signs are often not explicit (e.g., high temperature, sweating, and fatigue). Only the detection of Plasmodium or "malaria microbes" by direct or immunochromatographic methods allows for diagnostic confirmation, a prerequisite for initiating curative treatment [16].

In our study, the most frequently reported clinical manifestations were headaches (86.12%), followed by fever (52.7%) and chills (47.95%). These results differ from those reported by Zakoun Z [17] in Morocco, where fever (99.86%) and chills (68.9%) were the most common clinical signs. This difference could be explained by the distinct epidemiological context: Morocco is not a malaria-endemic area, so cases are most often imported and therefore present with more typical, pronounced symptoms, unlike in endemic areas such as Mali, where partial immunity acquired in adults can attenuate the classic signs of the disease.

Biological examination performed

In our study, thick blood smear was the most frequently performed laboratory test, with a completion rate of 94%. The result was positive in 86.44% of cases. The higher rate of thick blood smears compared with rapid diagnostic tests (RDTs)

could be explained by the availability of laboratory equipment, clinicians' preference for a more precise confirmatory diagnosis, and established practices within a referral center with sufficient technical resources. According to the study by Keïta M et al. [18], thick blood smears were performed in 55.6% of cases, compared with 44.4% for rapid diagnostic tests.

Support

1) Antimalarial treatment

The treatment of malaria relies primarily on antimalarial drugs. These natural or synthetic antimalarials are characterized by their site of action across the various stages of Plasmodium.

In our study, antimalarial treatment with Artemether/Lumefantrine 80/480 mg was administered in 60.88% of cases. This result is similar to that of Zakoun Z [17], Razouk I [19], and Badi H [20], who reported that Artemether + Lumefantrine was administered in 59.09%, 59%, and 69% of cases, respectively. This similarity in results could be explained by the fact that malaria cases were managed according to the national malaria control treatment protocol developed in accordance with WHO guidelines and standards [21] at various levels.

2) Treatment according to the National Malaria Control Program

According to the National Malaria Control Programme, the combinations Artesunate + Amodiaquine (AS + AQ) and Artemether + Lumefantrine (AT + LU) are retained for the treatment of uncomplicated malaria, based on research conducted by the MRTC/DEAP on monotherapies. [22].

In our study, antimalarial treatment according to the National Malaria Control Protocol was adapted in 65% of cases (Figure 1). The relatively low rate of antimalarial treatment adaptation observed in our study could be explained by a lack of awareness of the national protocol, stockouts of ACTs, patients' economic constraints, and organizational difficulties encountered by healthcare personnel. These results highlight the need to strengthen continuing education, supervision, and the availability of essential medicines to improve treatment adherence.

3) Adjuvant treatments

Paracetamol was the most frequently used adjunctive treatment (58.04%), followed by antibiotics (53%). The frequent use of paracetamol to complement other treatments in our study could be explained by the febrile and painful nature of malaria, as paracetamol, being a level I analgesic and antipyretic, is the ideal drug. This result is similar to that of Zakoun Z [17], in which all patients received a paracetamol-based antipyretic. This high use of paracetamol confirms the importance of symptomatic management in the treatment of uncomplicated malaria, aiming to improve patient comfort and reduce morbidity related to fever and pain. It also reflects adherence to good clinical practice, which systematically combines an antipyretic with maintenance antimalarial therapy, in accordance with national and international recommendations.

5. Conclusion

The results of our study indicate that uncomplicated malaria in adults remains a common condition at the Bamako Commune III Reference Health Center, although its prevalence (4.9%) is relatively low compared to national data. The most common clinical manifestations were headaches, fever, and chills, consistent with the classic symptoms of malaria, although the severity of these signs may be attenuated in individuals living in endemic areas due to partial acquired immunity. For diagnosis, thick blood film was the primary examination performed, reflecting the preference for microscopic confirmation within the reference centers.

The therapeutic approach and the rate of adaptation to the national protocol still need improvement.

Overall, this study highlights the need to strengthen health worker training and promote therapeutic compliance to improve the quality of care for uncomplicated malaria in adults.

Abbreviations

°C	Degre Celsius
CHW	Community Health Workers
CNRST	National Center for Scientific and Technological Research
CSComs	Community Health Centers
CSREF	Reference Health Center
DGSHP	Directorate General of Health and Public Hygiene
DHS	Demographic and Health Survey
FM	Thin Smear
GE	Thick Drop
i	Precision
INSTAT	National Institute of Statistics of Mali
IRS	Indoor Residual Spraying
ITNs	Insecticide-treated Bed Nets
MD	Medical Doctor
mg	Milligram
MPH	Master in Public Health
n	Sample Size
P	Plasmodium
p	Prevalence
PhD	Philosophiæ Doctor
PNLP	National Malaria Control Program
q	1-p
RDT	Rapid Diagnostic Test
SPSS	Statistical Package for Social Sciences
UCRC	University Clinical Research Center
WHO	World Health Organization
Zα	Normal Distribution Test

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Oumar Sangho: Conceptualization, Methodology, Supervision, Validation, Writing – original draft

Salia Keita: Formal Analysis, Methodology, Writing –

original draft

Fanta Sangho: Formal Analysis, Methodology, Writing – review & editing

Haïsseba Dansala: Conceptualization, Formal Analysis, Investigation, Methodology, Software, Writing – review & editing

Cheick Abou Coulibaly: Methodology, Writing – review & editing

Ibrahim Fall: Conceptualization, Investigation, Methodology, Supervision, Validation, Writing – review & editing

Abou Sogodogo: Methodology, Validation, Writing – review & editing

Borodjan Diarra: Methodology, Writing – review & editing

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Lancina Doumbia: Methodology, Validation, Writing – review & editing

Conflicts of Interest

The authors declare that they have no conflicts of interest in this work.

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