Clinical and Parasitological Profile of Children Aged 6 - 59 Months with Uncomplicated Malaria in Bolenge, Equateur Province, Democratic Republic of the Congo

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Abstract

Background: Malaria is an erythropathy caused by different species of parasites of the genus Plasmodium. It is the most common parasitic disease in the world. **Objective:** The objective was to assess the profile of children aged 6 - 59 months with uncomplicated malaria in Bolenge, Democratic Republic of the Congo (DRC). **Methods:** The present study is a descriptive cross-sectional study that was carried out in children less than 59 months old with uncomplicated malaria in Bolenge, Equateur province, DRC. All patients from 6 to 59 months of age, presenting fever and parasitemia greater than 2000 trophozoites and less than or equal to 250,000 trophozoites, were included. Patients were included after signing an informed consent by parents or guardians. Age, sex, weight and height, temperature and parasitaemia were the parameters of interest. **Results:** Ninety (90) children were included in the study, of which 47 (52.2%) were boys. The age ranges of 26 to 40 months and 41 to 54 months were respectively dominant with 27 (30%) children. The weight range of 9 - 13 kg was more represented with 46 (51.1%) children; 34 (37.8%) children were over 92 cm. Seventy-seven (85.6%) children had a body temperature between 37.5°C and 39°C. Forty (44.4%) children had a parasi-

taemia between 10,001 and 40,000 parasites. A correlation was found between parasitaemia and temperature. **Conclusion:** Children aged 6 - 59 months with uncomplicated malaria in Bolenge have a different profile than in other regions. There is a correlation found between body temperature and parasitaemia.

Subject Areas

Epidemiology, Pediatrics

Keywords

Child 6 - 59 Months, Uncomplicated Malaria, Profile, Bolenge

1. Introduction

Malaria is an erythropathy caused by different species of parasites of the genus Plasmodium. It is the most widespread parasitic disease in the world. It is caused by a protozoan of the genus Plasmodium transmitted to humans by the bite of an infected female Anopheles mosquito [1].

According to the latest World Health Organization (WHO) report on malaria in 2020, the number of malaria cases was estimated at 229 million in 2019 worldwide, of which 214 million (90%) were in Africa. The number of deaths was estimated at 409,000 in 2019 and 390,000 (90%) in Africa in 2019 [2].

To date, among the plasmodial species responsible for malaria in humans, *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae* and *Plasmodium knowlesi* are the most recognized and studied worldwide [1].

Plasmodium falciparum is the most widely distributed species worldwide. It develops resistance to antimalarial drugs and is responsible for life-threatening clinical forms. In addition to its harmful effects on human health, malaria causes enormous economic losses worldwide, particularly in Africa. This makes malaria a real scourge that hinders the socio-economic development of the continent [3].

Malaria represents an enormous financial burden for the populations and consequently the disease constitutes an obstacle to the development of the countries concerned, especially in Africa [4].

In DRC, the number of cases in 2019 was estimated at 21 million for simple malaria and 2 million for severe malaria. The number of deaths was estimated at 13,072 in 2019 and 75% of deaths were children under 5 years. Malaria is the leading cause of death in DRC. Children under five and pregnant women are the first victims because of their vulnerability [5].

According to the yearbook of health statistics published by the Directorate of Disease Control and Major Endemics of the Ministry of Public Health, malaria remains the major endemic and the leading cause of morbidity; it is also among the top three causes of mortality in the most vulnerable group, namely children

under five years of age and pregnant women [4].

The objective of this study was to evaluate the clinical and parasitological profile of children aged 6 - 59 months with uncomplicated malaria in Bolenge, Grand Equateur, Democratic Republic of the Congo.

2. Methods

2.1. Type of Study and Sampling

The present is a cross-sectional, descriptive study of children under 59 months of age with uncomplicated malaria in Bolenge, Equateur Province, Democratic Republic of the Congo. Non-probability sampling was chosen for convenience.

2.2. Nature, Setting and Period of Study

Patients aged 6 months to 59 months regardless of gender with diagnosed malaria. This study was conducted in the Bolenge site during the period from April 2021 to June 2022, a period of 14 months.

2.3. Inclusion Criteria

Any patient between 6 and 59 months of age, presenting fever and a parasitaemia greater than 2000 trophozoites and less than or equal to 250,000 trophozoites, with a *plasmodium falciparum* monoinfection was considered for the study. The patients were included after signature of an informed consent by the parents or guardians.

2.4. Parameters of Interest

The parameters of interest were: socio-demographic data of the patients (age, sex, weight and height), temperature and parasitemia.

2.5. Statistical Analysis

The data collected were entered on Windows Excel version 2016. The analysis of the results was on SPSS version 2020 for Windows. The statistical tests used are: the Student's t test for quantitative variables and the chi-square (x^2) test for qualitative variables.

The significant value (P) retained for the probability of $P < 0.05$. Results are expressed as mean standard deviation. Tables were reformatted in Excel.

2.6. Ethical Considerations

The study protocol was submitted to and approved in its entirety by the Ethics Committee of the Kinshasa School of Public Health ESP/CE/049/2016. Authorizations from local authorities as well as from parents were collected before the collection of patient data.

3. Results

Ninety (90) children aged 6 - 59 months diagnosed with uncomplicated malaria

in Bolenge were included in the present study. Of the total, 47 (52.2%) were boys and 43 (47.8%) were girls. The age groups 26 - 35 months and 36 - 45 months were respectively the most represented with 27 (30.0%) children each, followed by 11 - 25 months with 25 (27.8%) children, 45 - 56 months with 6 (6.67%) children and less than 10 months with 5 (5.56%) children. The most represented weight range was 9 - 13 kg with 46 (51.11%) children, followed by over 13 kg with 30 (33.33%) children and under 8 kg with 14 (15.56%) children. The most represented height range was over 92 cm with 34 (37.78%) children, followed by 82 - 92 cm with 29 (32.22%) children, 71 - 81 cm with 17 (18.89%) children and under 71 cm with 10 (11.11%) children. These data are presented in Table 1.

Table 1. Distribution of children by socio-demographic data.

Variables	Workforce	Percentage
Age		
Less than 10 months	5	5.56
11 to 25 months	25	27.78
26 to 35 months	27	30.00
36 to 45 months	27	30.00
46 to 55 months	6	6.67
>56 months	0	0.00
Total	90	100.00
Sex		
Boys	47	52.22
Girls	43	47.78
Total	90	100.00
Weight		
Less than 8 Kg	14	15.56
9 to 13 Kg	46	51.11
More than 13 Kg	30	33.33
Total	90	100.00
Size		
Less than 70 cm	10	11.11
71 to 81 cm	17	18.89
82 to 92 cm	29	32.22
Over 92 cm	34	37.78
Total	90	100.00

The most represented temperature range was 37.5°C - 39°C with 77 (85.56%) children, followed by 36°C - 37.5°C and over 39°C with 6 (6.67%) children each and under 36°C with 1 (1.11%) child. The most represented parasitaemia range was 10,001 to 40,000 (unit) with 40 (44.44%) children, followed by less than 10,000 (unit) with 30 (33.33%) children, 40,001 to 80,000 (unit) with 12 (13.33%) children, and over 100,000 (unit) with 7 (7.78%) children. These results are presented in Table 2.

Tables 3-5 show significant correlations between temperature and parasitemia.

Table 2. Distribution of children by body temperature and parasitaemia.

Variables	Workforce	Percentage
Temperature		
<36°	1	1.11
36° to 37.5°	6	6.67
37.5° to 39°	77	85.56
>39°	6	6.67
Total	90	100.00
Parasitemies		
<10,000 M/l	30	33.33
10,001 to 40,000 M/l	40	44.44
40,001 to 80,000 M/l	12	13.33
80,001 to 100,000 M/l	1	1.11
>100,000 M/l	7	7.78
Total	90	100.00

Table 3. From the correlation test.

Cross-tabulation							
Patient Temperature		Parasitemy					Total
		<10,000 M/l	10,001 to 40,000 M/l	40,001 to 80,000 M/l	80,001 to 100,000 M/l	>100,000 M/l	
<36°	Workforce	1	0	0	0	0	1
	% in Patient Temperature	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
36° to 37.5°	Workforce	2	1	1	0	2	6
	% in Patient Temperature	33.3%	16.7%	16.7%	0.0%	33.3%	100.0%
37.5° to 39°	Workforce	26	37	9	0	5	77
	% in Patient Temperature	33.8%	48.1%	11.7%	0.0%	6.5%	100.0%
>39°	Workforce	1	2	2	1	0	6
	% in Patient Temperature	16.7%	33.3%	33.3%	16.7%	0.0%	100.0%
Total	Workforce	30	40	12	1	7	90
	% in Patient Temperature	33.3%	44.4%	13.3%	1.1%	7.8%	100.0%

Table 4. Parasitemia and temperature correlation test.

		Patient Temperature	Parasitemy
Patient Temperature	Pearson correlation	1	0.003
	Sig (bilateral)		0.980
	N	90	90
Parasitemy	Pearson correlation	0.003	1
	Sig (bilateral)	0.980	
	N	90	90

Table 5. Chi-square tests.

Chi-square tests			
Value		ddl	Asymptotic Significance (bilateral)
Pearson's Chi-square	25.601[a]	12	0.012
Likelihood ratio	15.318	12	0.224
Linear association by linear	0.001	1	0.980
N of valid observations	90		

4. Discussion

The objective of this study was to evaluate the profile of children aged from 6 to 59 months with uncomplicated malaria in Bolenge, Grand Equateur, Democratic Republic of the Congo. Ninety (90) children aged 6 - 59 months diagnosed with uncomplicated malaria in Bolenge were included.

4.1. Socio-Demographic

The average age was of 43.5 ± 10.5 months. The range of 26 to 45 months was dominant with 60% of patients. These results are found higher than those found in Mali at Yirimadio where the age range of 24 - 59 months was more represented with 55.9% Sidibé, B and all in Mali where the age group of 24 to 59 months was more represented with 58.8%, and the average age was of 35 months [6] [7]. This could be justified by the sample size of this study which was smaller compared to the other study with a sample size 3 times larger and that this age group constituted the risk groups for malaria.

Forty-seven (47) children (52.2%) were boys and 43 (47.8%) were girls. These results were similar to those presented in Mali and Lubumbashi where boys were more represented than girls [6] [8] [9].

The interval of weight of 9 to 13 kg was represented by 46 children (51.1%). This result is different from that presented in the Northern region of Cameroon where the average weight was higher [10], and that in Mali where the average

weight was lower than that found in Bolenge [9]. These differences could be explained by the difference in population and environment of the children.

Thirty-four (34) children (37.8%) had a height of 92 cm or more a variable that was not taken into account by several previous studies.

4.2. Clinical and Para-Clinical

During our study, we found 77 children, or 85.6%, with a body temperature between 37.5˚C and 39˚C. Six children, or 6.7%, had a body temperature above 39˚C. These results corroborate with those observed by G. MOYEN in Brazzaville, slightly different from the results of Mr. Tiémoko SOUMARE in Mali in Yirimadio, Augustin M. Mutombo *et al.* in Lubumbashi and J. KOKO and all at Gabon who had found 100% fever, Mr. Aliou Lousseyni SANOGO in Mali, and Mr. M. M. M. KARRAH in Mali who had found 100% fever. Fever was the main reason for consultation of the children in our sample, *i.e.* 97.1% [6] [8] [11] [12] [13] [14]. This is justified by the fact that we divided the children according to the degree of temperature.

In relation to the parasitemia, our study shows that 30 patients or 33.3% had a parasitemia lower than 10,000 Troph/microliter, 40 patients or 44.4% have a parasitemia between 10,001 to 40,000 Troph/microliter, 12 patients or 13.3% have a parasitemia between 40,001 to 80,000 Troph/microliter 1 patient or 1.1% had a parasitemia between 80,001 to 100,000 Troph/microliter, and 7 patients or 7.8% had a parasitemia higher than 100,000 Troph/microliter. This result is different from that of Mr. Aliou Lousseyni SANOGO in Mali who found the parasite density was between 1600 to 80,000 trophozoites or 66.62% of cases, that of R. Dembélé, who found 62.3% density between 0 to 159 trophozoites and that of Sompwe Eric Mukomena in Lubumbashi who found that 88.4% of children had a parasitemia between 200 and 2000, 12% of schoolchildren had a parasitemia higher than 2000 and different from Mitangala, P. N in Kivu, Democratic Republic of the Congo, which observed a lower risk of malaria parasitemia greater than or equal to 5000 troph/microliter [14] [15] [16]. The difference is explained by the fact that we conducted in an endemic area.

5. Conclusion

Children aged 6 - 59 months with uncomplicated malaria in Bolenge have a different profile than in other areas. There is a correlation between body temperature and parasitaemia.

Conflicts of Interest

No conflict of interest declared.

References

[1]   Mouchet, J. (2004) Biodiversité du paludisme dans le monde. John Libbey Eurotext, Paris, 1-391.

[2] Ministère du Plan et Suivi de la Mise en œuvre de la Révolution de la Modernité, MPSMRM/Congo, Ministère de la Santé Publique, MSP/Congo, and ICF International. (2014) République Démocratique du Congo Enquête Démographique et de Santé (EDS-RDC) 2013-2014.

[3] Bamadio, A. (2012) Efficacité *in vivo* de l'Artéméther-Luméfantrine sur les souches de *plasmodium falciparum* et son impact sur les marqueurs moléculaires de résistances parasitaires aux antipaludiques, au Mali. Bibliothèque Numérique Sanitaire du Mali, 1-115. https://www.bibliosante.ml/handle/123456789/1329

[4] World Health Organization (2022) World Malaria Report 2022. World Health Organization.

[5] Severe Malaria Observatory, République Démocratique du Congo (2022) Partage de connaissances à propos du paludisme grave. https://www.severemalaria.org/fr/pays/r%C3%A9publique-d%C3%A9mocratique-du-congo

[6] Soumaré, T. (2021) Etude de la prise en charge du paludisme chez les enfants de 0 à 59 mois au centre de santé communautaire de Yirimadio. Thèse de doctorat, USTTB, Bamako, 1-100.

[7] Sidibé, B. (2011) Impact du Traitement Préventif Intermittent sur le Paludisme chez les enfants dormants sous Moustiquaires Imprégnées d'Insecticide à Djoliba, Cercle de Kati, Mali. 1-56. https://bibliosante.ml/bitstream/handle/123456789/1174/11M270.pdf?sequence=1&isAllowed=y

[8] Mutombo, A.M., Kamona, Y.M., Tshibanda, C.N., Mukuku, O., Ngwej, D.T., Wembonyama, S.O., Luboya, O.N. and Lutumba, P. (2018) Paludisme grave chez les enfants âgés de moins de 5 ans à l'hôpital Panda à Likasi. *République Démocratique du Congo*, **2**, 4-10.

[9] Diarra, O. (2021) Paludisme et Malnutrition chez les enfants de 06 à 59 mois après campagne de chimioprévention du paludisme saisonnier. Thèse de doctorat, USTTB, Bamako, 1-77.

[10] Sakwe, N., Bigoga, J., Ngondi, J., Njeambosay, B., Esemu, L., Kouambeng, C., *et al.* (2019) Relationship between Malaria, Anaemia, Nutritional and Socio-Economic Status amongst Under-Ten Children, in the North Region of Cameroon: A Cross-Sectional Assessment. *PLOS ONE*, **14**, e0218442. https://doi.org/10.1371/journal.pone.0218442

[11] Koko, J., Dufillot, D., Zima-Ebeyard, A., Duong, T., Gahouma, D. and Kombila, M. (1999) Aspects cliniques et approche épidémiologique du paludisme de l'enfant à Libreville, Gabon. *Médecine d'Afrique Noire*, **46**, 10-14.

[12] Coulibaly, B.N. (2012) Le paludisme de l'enfant de moins de 5 ans dans le service de pédiatrie du centre de sante de référence de la commune I du district de Bamako du 1er juillet au 31 décembre 2010. 1-88. https://www.bibliosante.ml/bitstream/handle/123456789/1434/12M290.pdf?sequence=1&isAllowed=y

[13] Moyen, G., Nzingoula, S., Mowandza-Ndinga, J.C., Nkoua, J.L., Mpemba, A.B. and Fourcarde, V. (1993) Paludisme de l'enfant dans un service de pédiatriea Brazzaville—A propos de 1073 observations. *Médecine d'Afrique Noire*, **40**, 177-181.

[14] Sanogo, A.L. (2021) Morbidité et Mortalité du paludisme grave chez les enfants de 6 à 59 mois dans le service de pédiatrie du centre de santé de référence de Sikasso. Thèse de doctorat, USTTB, Bamako. https://bibliosante.ml/bitstream/handle/123456789/4843/21M234.pdf?sequence=1&

isAllowed=y

[15] Mitangala, P.N., D'Alessandro, U., Donnen, P., Hennart, P., Porignon, D., Balaluka, G.B., Nyarukweba, D.Z., Mbiribindi, N.C. and Wilmet, M.D. (2013) Infection palustre et état nutritionnel: Résultats d'une cohorte d'enfants âgés de 6 à 59 mois au Kivu en République démocratique du Congo. *Revue d'Épidémiologie et de Santé Publique*, **61**, 111-120. https://doi.org/10.1371/journal.pone.0218442

[16] Mukomena, S.E., Philipe, C.M., Désiré, M.K., Pascal, L.T., Ali, M.M. and Oscar, L.N. (2016) Parasitémie asymptomatique chez les enfants de moins de 5 ans, enfants en âge scolaire et prise en charge des épisodes fébriles dans les ménages de Lubumbashi, République Démocratique du Congo. *The Pan African Medical Journal*, **24**, 1-7. https://www.panafrican-med-journal.com/content/article/24/94/pdf/94.pdf https://doi.org/10.11604/pamj.2016.24.94.9350