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Low Birth Weight and Intermittent Preventive Treatment of Malaria in Pregnant Women in Lomé (Togo) in 2021: A Cross-Sectional Study

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Abstract

Background: Since 2012, the World Health Organization has recommended intermittent preventive treatment with sulfadoxine-pyrimethamine (IPT-SP) to prevent malaria-related complications in pregnant women. Ten years following these recommendations, we conducted this study to estimate the coverage for three doses of IPT-SP (IPT3) as well as the prevalence of low birth weight (LBW), and its associated factors in Lomé (Togo) in 2021. **Methods**: A cross-sectional study was conducted between January and March 2021. An exhaustive recruitment of women and their newborns was carried out in the maternity wards of the Sylvanus Olympio University Hospital Center. Data from antenatal consultations and clinical data of the newborns were collected. Multivariate logistic regression was carried out to determine factors associated with LBW. **Results**: A total of 252 mother-child pairs were included in this study. Median age of the mothers was 27 years, IQR [24 - 31]. More than a third (35.3%) of the mothers were primigravida. IPT3 coverage was 66.7% and 14.7% of newborns had a LBW. The prevalence of LBW was 33.3% [23.3 - 43.4] in women who had received fewer than 3 doses of IPT-SP and 5.4% [2.0 - 8.8] in those who had received at least 3 doses of IPT-SP ($p < 0.001$). In multivariable analysis, administration of less than three doses was associated with LBW (aOR = 9.3; 95% CI [4.2 - 22.3]). **Conclusion**: Ten years following

recommendations of the WHO on IPT-SP, malaria prevention based on IPT-SP is not optimal among pregnant women in Lomé, and the proportion of LBW children remains high. Actions to strengthen the three-dose IPT-SP policy are needed to prevent malaria and its consequences among newborns in Togo.

Keywords

Malaria, Intermittent Preventive Treatment, Low Birth Weight, Togo

1. Introduction

Malaria is a febrile and haemolytic disease caused by a *Plasmodium* which is transmitted to humans by the bite of female *Anopheles*. *Plasmodium falciparum* is the most common species in sub-Saharan Africa (SSA) [1] [2]. SSA continues to register the highest prevalence of malaria [3]. In 2020, the SSA region accounted for 95% of all malaria cases (228 million cases) and 96% of all malaria deaths (602,000 deaths) globally. The majority (80%) of all malaria deaths in the region occurred in children under 5-year-old [4] [5] [6] [7]. Also, malaria infection during pregnancy represents a health risk to the mother and may result in her death [6].

Malaria during pregnancy is associated with anaemia and severe fetal-maternal complications such as spontaneous abortion and prematurity [7] [8]. Maternal malaria is responsible for more than 35% of low birth weight (LBW), one of the most important risk factors for infant mortality [9]. LBW is defined in a newborn as a birth weight below 2500 g [10] [11] [12].

To prevent maternal malaria and reduce the incidence of LBW, the WHO has recommended since 2010 that all women should receive at least three doses of intermittent preventive treatment with Sulfadoxine Pyrimethamine (IPT-SP) after the first trimester of pregnancy until delivery [13] [14]. IPT-SP with at least three doses of sulfadoxine-pyrimethamine is a preventive strategy which has proved effectiveness in reducing the rate of placental infestation by *Plasmodium falciparum* [15] [16], LBW [9] [17] [18], and severe anemia during pregnancy [9] [19].

In Togo, the majority of pregnant women and newborns do not have access to appropriate healthcare during pregnancy, childbirth and the first years of life. Between 2017 and 2022, the infant mortality rate remained high—an estimated 399 [253 - 576] infants out of every 100,000 mothers die as a result of complications during childbirth [20] [21].

According to the malaria indicator survey carried out by the National Malaria Control Program (NMCP) in 2017, only 42% of pregnant women received at least three doses of IPT during pregnancy [15]. The WHO recommendation on IPT-SP in pregnant women has been implemented in the country for more than a decade. Thus, it is necessary to update the data available at the national referral hospital, Centre Hospitalier Universitaire Sylvanus Olympio, which has the largest

maternity ward in the country. Therefore, the aim of this study was to estimate the proportion of women who have received three doses of IPT-SP, the proportion of underweight children, and to describe the factors associated with LBW in Lomé, Togo, in 2021.

2. Materials and Methods

2.1. Type and Period of Study

A cross-sectional study was conducted from January 20, 2021, to March 13, 2021.

2.2. Setting of the Study

The study was conducted in the gynecology and obstetrics department of the *Centre Hospitalier Universitaire Sylvanus Olympio* (CHU-SO) of Lomé, located in the Grand Lomé health region with more than two million people. It is a public hospital of national reference with three main missions: tertiary referral hospital, training, and research.

2.2.1. Inclusion Criteria

Mother-infant pairs were included in our study if:

1) Pregnancy term was greater than or equal to 37 weeks of amenorrhea (WA);

2) Childbirth occurring during the study period and for which the vital prognosis of the mother and the newborn was not compromised;

3) Antenatal care (ANC) records were available;

4) The mother gave her consent to participate in the study.

2.2.2. Exclusion Criteria

All women with following criteria were not included: ANC records not available; multiple pregnancies; birth before pregnancy term; medical history of LBW (hypertension, sickle-cell anemia, diabetes, heart disease, pre-eclampsia, HIV); and substance use (alcohol, tobacco, and drugs).

2.3. Sampling

All mothers who gave birth during the study period and met the inclusion criteria were recruited consecutively from the gynecology and obstetrics department of the CHU-SO, along with their newborns.

2.4. Data Collection and Tools

Data were collected during a face-to-face interview with eligible mothers. Additional data was extracted from their ANC booklet. Birth weight was measured using highly accurate Seca brand digital scales. For the mothers, the variables collected were sociodemographic characteristics (age, level of education, marital status, occupation, area of residence) and clinical characteristics (parity, number of live children, number of antenatal visits, and number of doses of IPT-SP taken). Children were grouped into two categories according to their weight: low

(<2500 g) and normal (≥2500 g) based WHO recommendations [10] [11] [12] [22] [23]. The guideline of three doses of IPT-SP was used to classify this variable into two categories: 1) incomplete IPT-SP coverage (0 - 2 doses); and 2) complete IPT-SP coverage (3 doses or more).

2.5. Data Processing and Analysis

Data of mother-infant pairs were recorded in Epi Data 3.1. Qualitative variables were described using frequencies and proportions and quantitative variables were presented with their median and interquartile range (IQR). Comparison of qualitative variables was performed with the Chi-2 test or Fisher's exact test. IPT-SP coverage was presented as a proportion with 95% confidence interval (95% CI). A binary logistic regression model was performed to describe factors associated with LBW. Statistical significance was set at α = 5%. The appropriateness of the model was examined by the Hosmer and Lemeshow test [24]. Statistical analyses were performed using R4.1.3 software.

2.6. Ethical Considerations

Surveyors explained the objectives of the study to participants and whether they have the choice to participate or not. The questionnaire was administered only after informed written consent was obtained. The study was approved by the ethical committee of the Faculty of Health Sciences of the University of Lomé. Administrative authorizations were also obtained from the Director of the CHU SO and the Head of the Department of Obstetrics and Gynaecology of the CHU SO before data collection.

3. Results

A total of 252 mother-child pairs were enrolled in our study.

3.1. Sociodemographic and Clinical Characteristics of the Mothers

The median age of the mothers was 27 years, IQR [23]-[29]. Approximately one out of six mothers (17.0%) had university education level and 14.3% were housewives. More than one-third (35.3%) of the mothers were primigravida. Complete IPT-SP coverage was 66.7%, 95% CI [58.2 - 75.2] (**Table 1**).

3.2. Characteristics of Newborns

The M/F sex ratio of newborns was 0.89. More than half (55.6%) of them were born at more than 39 WA. Perinatal asphyxia (6.7%) and neonatal sepsis (4.0%) were the main pathologies observed in newborns (**Table 2**).

3.3. Prevalence of Low Birth Weight

The overall prevalence of LBW was 14.7% (95% CI [10.3 - 19.1]). The prevalence was not statistically different by age group (p = 0.878). It was estimated at 33.3% [23.3 - 43.4] in women with incomplete IPT-SP coverage and 5.4% [2.0 - 8.8] in

those with complete IPT-SP coverage ($p < 0.001$). There was a statistically significant difference in the prevalence of LBW according to levels of education ($p = 0.049$). Regarding the term of pregnancy, the proportion of LBW was estimated at 20.5% in women who gave birth at less than 39 WA compared to 10.5% in those who gave birth at 39 WA and more ($p = 0.019$) (Table 3).

Table 1. Sociodemographic and clinical characteristics of mothers (N = 252).

	Total (N)	Proportion (%)
Age (year) median [IQR]	27 [24 - 31]	
Age (year)		
15 - 24	79	31.3
25 - 34	141	56.0
≥35	32	12.7
Level of education		
Primary	110	43.7
Secondary	99	39.3
University	43	17.0
Occupation		
Housewife	36	14.3
Retailer	67	26.6
Civil servant	17	6.7
Private sector job	120	47.6
Student	12	4.8
Marital status		
Single	205	81.3
Married	47	18.7
Residency		
Urban area	228	90.5
Rural area	24	9.5
Number of children		
1	89	35.3
2 - 3	84	33.3
≥4	79	31.4
Number of IPT-SP dose		
<3	84	33.3
≥3	168	66.7

IQR = Interquartile Range. IPT-SP: Intermittent Preventive Treatment with Sulfadoxine Pyrimethamine.

Table 2. Socio-demographic and clinical characteristics of newborns according to birth weight (N = 252).

	Total. N (%)	Birth weight (g) N (%)		p
		<2500	≥2500	
	N = 252	N = 37	N = 215	
Sex				0.586*
Male	119 (47.2)	19 (51.4)	100 (46.5)	
Female	133 (52.8)	18 (48.6)	115 (53.5)	
Pregnancy term (weeks of amenorrhea)				**0.019***
[37 - 39[	112 (44.4)	23 (62.2)	89 (41.4)	
≥39	140 (55.6)	14 (37.8)	126 (58.6)	
IUGR (yes). N (%)	1 (0.4)	1 (2.7)	0 (0.0)	0.147**
Perinatal asphyxia (yes). N (%)	17 (6.7)	4 (10.8)	13 (6.0)	0.288**
Neonatal sepsis (yes). N (%)	10 (4.0)	2 (5.4)	8 (3.7)	0.644**

IUGR: Intra Uterine Growth Restriction; *Chi-square test; **exact Fisher test.

Table 3. Prevalence of low birth weight (weight < 2500 g) by maternal characteristics.

	N	n	Prevalence (%)	95% IC	p
Global	252	37	14.7	[10.3 - 19.1]	
Age (year)					0.878*
<25	79	12	15.2	[7.3 - 23.1]	
25+	173	25	14.5	[9.2 - 19.7]	
Number of IPT-SP dose					**<0.001***
<3	84	28	33.3	[23.3 - 43.4]	
3+	168	9	5.4	[2.0 - 8.8]	
Marital status					0.157*
Single	205	27	13.2	[8.5 - 17.8]	
Married	47	10	21.3	[9.6 - 33.0]	
Number of children					0.672*
1	89	14	15.7	[8.2 - 23.3]	
2 - 3	84	10	11.9	[5.0 - 18.8]	
4+	79	13	16.5	[8.3 - 24.6]	
Level of education					**0.049***
Primary	110	22	20.0	[12.5 - 27.5]	
Secondary	99	8	8.1	[2.7 - 13.4]	
University	43	7	16.3	[5.2 - 27.3]	

Continued

Pregnancy term (weeks of amenorrhea)					**0.019***
[37 - 39[	112	23	20.5	[13.1 - 28]	
≥39	140	14	10.0	[5.0 - 15]	
Anaemia during pregnancy					0.530*
No	194	27	13.9	[9.0 - 18.8]	
Yes	58	10	17.2	[7.5 - 27]	

*Chi-square test; **Fisher's exact test. IPT-SP: Intermittent preventive treatment with Sulfadoxine Pyrimethamine.

3.4. Factors Associated with Low Birth Weight

In bivariate analysis, incomplete IPT-SP coverage (OR = 8.83; 95% CI (4.07 - 20.9), pregnancy term (weeks of amenorrhea) < 39 WA and having secondary/university level of education were factors associated with LBW.

In multivariable analysis, after adjusting for significant variable in the univariable analysis and maternal age, incomplete IPT-SP coverage during pregnancy (aOR = 9.28; 95% CI [4.22 - 22.3]; p < 0.001) and term of pregnancy < 39 WA (aOR = 2.62; 95% CI [1.22 - 5.85]; p = 0.016) were significantly associated with LBW (Table 4).

4. Discussion

We conducted a cross-sectional study among 252 postpartum women and their newborns at the maternity unit of the CHU SO of Lomé. The proportion of women who had received at least three doses of IPT-SP during pregnancy was 66.7%, and the proportion of LBW was 14.7%. Fewer than three doses of IPT-SP during pregnancy and a pregnancy term below 39 WA were associated with LBW.

Complete coverage of IPT-SP during pregnancy was 66.7% in our study. Similar results were reported in the health district of Yako (Burkina Faso in 2020) 77%, 95%, CI [74.2 - 79.9] [25]. These results are superior to those observed in studies in Benin in 2018 and in Côte d'Ivoire in 2011, which respectively reported complete coverage of IPT at 34.2%, 95% CI [24.8 - 43.3] and 49.8%, 95% CI [47.1 - 52.5] [26] [27]. Apart from changes in study periods, which could reflect changes in health policies, several other factors could be linked to the differences observed. These include differences in the implementation of national health policies, and the availability and accessibility of maternal health services, including the distribution of IPT-SP. Similarly, the organisation of targeted awareness campaigns on the importance of IPT-PS, the epidemiological context of malaria and finally economic barriers, such as the cost of travel to health centres or the availability of financial resources, may also play a role in adherence and compliance with the recommendation of at least three doses of intermittent preventive treatment for pregnant women before delivery.

Table 4. Factors associated with low birth weight in Lomé (Togo).

	Univariate Model			Multivariate Model		
	OR	95% CI	p	aOR	95% CI	p
Age (year)						
≥25	1.00	-		1.00	-	
<25	1.06	[0.49 - 2.20]	0.878	1.10	[0.47 - 2.49]	0.818
Number of ITP Dose						
≥3	1.00	-		1.00	-	
<3	8.83	[4.07 - 20.9]	**<0.001**	9.28	[4.22 - 22.3]	**<0.001**
Marital status						
single	1.00	-				
Married	1.78	[0.77 - 3.90]	0.161			
Number of children						
≥2	1.00	-				
<2	1.14	[0.54 - 2.31]	0.729			
Pregnancy term (weeks of amenorrhea)						
≥39	1.00	-		1.00	-	
[37 - 39[	2.33	[1.15 - 4.87]	**0.021**	2.62	[1.22 - 5.85]	**0.016**
Anaemia during pregnancy						
No	1.00	-				
Yes	1.29	[0.56 - 2.78]	0.531			
Level of education						
Primary	1.00	-				
Secondary/University	0.47	[0.23 - 0.95]	**0.039**			

IPT: Intermittent Preventive Treatment, OR: Odds Ratio. aOR: adjusted Odds Ratio, 95% CI: 95% Confidence interval.

At least one in ten children in our study had LBW. Similar results were reported in Cameroon in 2019 [28], Burkina Faso in 2020 [18], and Benin in 2017 [26], where the authors had reported a LBW prevalence of 12.3%, 11.0%, and 10.9%, respectively. A higher prevalence was observed in Niger where it was estimated at 38.4% in 2020 [6]. Finally, a regional study conducted in 35 countries in SSA reported a LBW prevalence of 9.8%, 95% CI: [9.6 - 9.9] [29]. The LBW prevalence observed in our study as in other SSA countries is higher than that reported in European countries. Indeed, a recent study reported a LBW prevalence of 7.6% (95% CI: 7.3 - 7.9) in Southern Europe and 4.98% (95% CI: 4.7 - 5.2) in Northern Europe [30]. The high prevalence of LBW in SSA could be ex-

plained by insufficient follow-up of pregnant women in Africa who do not attend ANC visits. However, the high reported prevalence could also be due to an overestimation because of the recruitment in hospitals.

Factors associated with LBW in this study after multivariable analysis were the number of doses of IPT-SP received during pregnancy and the term of pregnancy. Women who received fewer than three doses of IPT during pregnancy had a ninefold increased risk of having a LBW infant. A multicentre study by the Community-based Malaria Screening and Treatment for Pregnant Women Receiving Standard Intermittent Preventive Treatment with Sulfadoxine-Pyrimethamine Consortium (COSMIC Consortium) in Benin, Burkina Faso, and Gambia reported a 1.85-fold increased risk of LBW occurrence in mothers with incomplete IPT-SP coverage compared to those with complete coverage [31]. In 2018, in a series of LBW cases conducted in the district of Lacs in Togo, the risk of giving birth to a LBW infant was 3 times higher for mothers who did not take any dose of IPT-SP compared to those who took at least three doses [32]. Similar results were found in Benin in 2018 (aOR = 2.2; 95% CI: 1.2 - 3.7) and Burkina Faso in 2020 (aOR = 2.3; 95% CI: 1.3 - 3.9) [25] [26]. These findings confirm the fact that the IPT-doses have an impact on LBW. It also indicates the need to reinforce IPT-SP strategies in order to reduce the prevalence of LBW. A community-based approach to IPT-SP distribution could have a major impact.

Our study has some limitations. For example, we faced issues related to data quality problems. Medical and ANC records were poorly kept and incompletely filled out, making it impossible to obtain data on the number of ANC visits and other malaria prevention measures such as the use of mosquito nets. We also did not have data on the total number of deliveries during the study period. In addition, selection bias cannot be ruled out, as women with incomplete clinical records were excluded. However, this which assessed the effect of three-dose preventive IPT-SP chemoprophylaxis on LBW in Togo is a pilot study which provided a basis for a large-scale study involving several maternity hospitals.

5. Conclusion

Ten years after the WHO recommendations of three doses of IPT-SP during pregnancy, its application is not optimal at the CHU SO of Lomé in 2021. This pilot study points out the need to implement strategies to strengthen the application of the three-dose IPT policy for the prevention of malaria and its consequences for vulnerable targets such as pregnant women.

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Revision and editing: All authors have read and approved the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Availability of Data and Materials

All data generated or analyzed during this study are available under request to the corresponding author.

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Appendix

Data collection questionnaire

Date of survey /__/__/ /__/__/ /__/__/__/__/ (Day Month Year) Registration No. ……

Section 1: Characteristics of mothers

A) Sociodemographic data

1) Age /____/ years

2) Residence: Urban area /___/ Rural area /___/

3) Profession: Housewife /___/ Reseller /___/ Civil servant /____/ Employment in the private sector /___/ Other to specify _____

4) Level of education: Out of school /____/ Primary /___/ Secondary /___/ Higher /___/

5) Marital status: Married /____/ Single /___/ Cohabiting /___/ Widowed /____/ Divorced /____/

6) Type of household: Monogamous /___/ Polygamous /___/

7) Religion: Christian /___/ Muslim /___/ Animist /___/ Other: ……

8) Parity: Primiparous /____/ Paucipparous /___/ Multiparous /___/

9) Term of pregnancy: SA /___/ Days /____/

B) Clinical data

10) Medical background:

HT /___/ Sickle cell anemia /___/ Diabetes /___/ Heart disease /___/ pre-eclampsia /___/ Alcoholism /___/ Smoking /___/ Drug /___/

HIV positive Yes /___/ No /___/ if Yes taking Cotrimoxazole Yes /___/ No /___/

Malaria attack during pregnancy: Yes /___/ No /___/ if Yes at what term /___/

GE + to Plasmodium falciparum Yes /___/ No /___/

11) Gyneco-obstetric history

Number of prenatal consultations carried out /____/

Term of start of CPN: /___/ SA Days /____/

Time taken for the 1st dose of TPI: SA /___/ Days /____/

Genital infection: Yes /___/ No /___/

Prematurity (<37 weeks): Yes /___/ No /___/

C) Biological data

12) Anemia Yes /___/ No /___/ if yes, Tx Hb < 9 g/dl /___/ Tx Hb < 11 g/dl /___/

D) Therapeutic data

13) Taking IPT Yes /___/ No /___/ if yes

14) If Q13 is Yes: how many doses of IPT: One dose /___/; Two doses /___/; Three doses /___/ or ≥ 3 doses of IPT /__/

15) Use of long-lasting impregnated mosquito nets Yes /___/ No /___/

16) Folic Acid Yes /___/ No /___/

17) Iron supplementation Yes /___/ No /___/

18) Taking IPT in the first trimester Yes /____/ No /____/

Section 2: Characteristics of newborns

19) Gender: Male /___/ Female /___/

20) Birth weight: <2500 g /___/ 2500 - 3000 g /___/ 3000 - 3500 g /___/ >3500 g /___/

21) IUGR: Yes /___/ No /___/

22) Neonatal malformation syndrome: Yes /___/ No /___/

23) Congenital malaria: Yes /___/ No /___/

24) Prenatal asphyxia: Yes /___/ No /___/

25) Neonatal infection: Yes /___/ No /___/