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Efficacy of Sulfadoxine Pyrimethamine as an Intermittent Preventive Treatment in Real-World Conditions on Parameters at Childbirth in Mali

Oumou Coulibaly[1], Mariam Tall[2], Abdou KB KAYENTAO[3], Mahamadou Dembele[1], Mahamadou Guindo[4], Sory I Diawara[1] and Kassoum Kayentao[1]

[1]International Center of Excellence in Research (ICER-Mali)/FMOS/FAPH, University of Science and Technology and Technology of Bamako, Mali

[2]National Malaria Control Program of Mali

[3]Gynecology and Obstetrics Services of the Kita Reference Health Centre

[4]Regional Direction of Health of Koulikoro

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***Corresponding Author:**

Oumou Coulibaly,
International Centre of Excellence in Research (ICER-Mali)/FMOS/FAPH, University of Science and Technology and Technology of Bamako, Mali

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1. Abstract

Malaria during pregnancy is a major public health problem and is often associated with complications during pregnancy and childbirth. The aim of this study is to evaluate the effectiveness of intermittent preventive treatment with sulfadoxine pyrimethamine on delivery parameters. Data were collected on pregnant women and their child. Multivariate logistic regression was used to determine the effect of SP intake on delivery parameters. The average age was 25 years, with a predominance of women aged 20 and over (74.4%). Multiple pregnancies and large multiple pregnancies represented 26.1%, with a median of 4 pregnancies. Only 32.5% of women received 3 or more doses of SP. A significant association was found between anemia (OR= 0.635 [0.492-0.821]), birth weight (OR=2.539 [1.474-4.375]), residence (OR=2.495 [1.841-3.382]), study site (OR=0.635 [0.510-0.852]) and taking 3 or more doses of SP. However, this study shows that the administration of at least 3 doses of SP is effective for preventing malaria infection during pregnancy but also for preventing the risk of placental infection, ranging from LBW in newborns to maternal anemia. Further studies are needed to further elucidate the issues related to the burden of malaria during pregnancy with the aim of improving maternal and child health indicators.

2. Background

Malaria during pregnancy is a major public health problem in Africa, particularly in Mali. It is often associated with complications during pregnancy and childbirth. Its impact on pregnant women includes maternal anemia, miscarriage, stillbirth, premature delivery, placental malaria and low birth weight (LBW) [1]. The World Health Organization recommends a range of interventions for its prevention during pregnancy, including the use of long-lasting insecticide-treated nets (LLINs) and at least 3 doses of sulfadoxine-pyrimethamine (SP) as an intermittent preventive treatment

(IPTp) [1]. According to the WHO report, out of 33 African countries that reported IPTp coverage data, 22% of eligible pregnant women received three doses of SP in 2017, compared to 35% in 2022 [2]. In Mali, the Malaria Indicator Survey (EIPM) in 2021 showed an upward trend in the national average coverage of three or more doses of IPTp from 28% in 2018 to 35% in 2021. Despite these efforts, this rate is still low in the country [3].

The efficacy of at least 3 doses of IPTp-SP in reducing the risk of placental infection, maternal anemia, and LBW has been demonstrated in previous studies [4-8]. IPTp-SP is the mainstay of malaria prevention among pregnant women in sub-Saharan Africa. A better understanding of the relationship between real-world IPTp efficacy and resistance is needed. Currently, resistance to in vivo SP treatment in pregnant women cannot be measured because of the use of ACTs in the treatment of malaria in pregnant women. New approaches are needed to monitor the effectiveness (in real-world conditions) of IPT in SP. A uniform, international effort toward this could produce comparable data that help generate evidence-based information to the overall policy of the IPT. A meeting of the WHO/GMP technical expert group in July 2007 identified the use of molecular markers of SP resistance, therapeutic efficacy in vivo of SP during pregnancy in women receiving IPT in SP, and an effect of IPT on parameters at delivery as a priority for evaluation as a tool to monitor the effectiveness (in the real-world setting) of IPT-SP [9]. Regular monitoring of this molecule is necessary since we do not yet have a therapeutic alternative for the prevention of malaria in pregnant women. In this context, this study was conducted to evaluate the effectiveness of IPT at the SP on the parameters at delivery under real conditions.

3. Materials and Methods

3.1. Study Site, Design, Participants and Sampling and Sample Size

The study was conducted in the health facilities of Kita and San in Mali, from 2017 to 2019. Malaria is endemic there with intense transmission during the rainy season from June to October. A cross-sectional study was conducted to determine the effectiveness (in real-world conditions) of IPT at the SP for the prevention of placental malaria, maternal anemia and low birth weight in women who gave birth at health facilities. The calculation of sample size at delivery was based on the detection of twice the difference in placental infection in women who received two doses of SP compared to those who took less than two doses (e.g., 5% vs 10%), with 80% potency and 95% confidence). A sample of 1103 women was needed. The study included women aged 18 or emancipated minors who provided free and informed consent to give birth at one of the health facilities in the study.

3.2. Data Collection Techniques and Tools

Women presenting to the selected health facilities for delivery were invited to participate in the study. Women who met the eligibility criteria were enrolled, and information was requested on the number of doses of SP administered via IPT during pregnancy; this information was obtained through an interview confirmed by Antenatal consultation (ANC) card. Before delivery, blood samples were taken to assess maternal thickness, hemoglobin levels, and polymerase chain reaction (PCR) results (using filter papers). At delivery, the thick placental drop, placental tissue, and cord drop were collected, as well as the birth weight of the newborns. Thick drops were made for all blood samples. PCR was used to detect positive drops in the mother and placenta. Women with positive thick gout at delivery and all newborns with a positive cord were treated according to the recommendations of the National Malaria Control Program. Women with a hemoglobin level <11 g/dl were treated in accordance with the national health policy in force. The temperature of all the women at delivery was recorded.

Newborns were weighed within 24 hours of delivery using a baby scale of the same brand at all study sites. Thus, low weight was defined as a birth weight less than 2500 g. The Ballard score of the newborn was used (within 6 hours of delivery at most) to assess the age of pregnancy. His assessment was used to define preterm birth (< 37SA).

Blood samples were collected from all the participants from the fingertip, placenta and umbilical cord. On these samples, we carried out analyses on the following: Thick drops were applied to all women. After delivery, placental blood was collected. An incision was made on the maternal side of the placenta, and whole blood was collected. The drops of blood were stained with Giemsa according to the standard protocol. Each blood sample had a unique identification number with the date and day of delivery. Laboratory technicians read the slides to determine the density and the parasitic species. The hemoglobin concentration was measured by taking a drop of blood from the fingertip and quantified in g/dl using HemoCue® (System 301). Anemia was defined as a hemoglobin level<11 g/dl. Each result is reported in the woman's file.

3.3. Data Collection and Analysis

In the field, data were reported on a case report card, entered Access and analyzed using SPSS version 25.0 software. The data were analyzed by group (by study site). For delivery parameters, data were collected at enrollment for demographic variables, pregnancy status, malaria symptoms, net use, number of doses of SP received (from the ANC card if available), and temperature measurements. Birth weight was also measured.

Means and proportions with 95% confidence intervals were estimated for the different parameters of interest (placental and peripheral infection, low birth weight, prematurity, maternal anemia, mean parasite density transformed into log, mean birth weight and hemoglobin). Comparisons were made using appropriate statisti-

cal tests between variables and numbers of doses received. These tests include the chi-square test, which was applied for the analysis of the relationships between the qualitative variables, and Student's t test, which was used for the comparison of the means of the quantitative variables. A univariate logistic regression analysis model was used to assess the influence of SP on delivery parameters. Then, a multivariate logistic regression analysis model was used for significant determinants in the univariate model to assess the influence of SP on these different determinants. The different indicators were estimated with a degree of significance of $p<0.05$. Only the weight and gestational age of living singletons were analyzed.

3.3. Ethical Considerations

The protocol for this study was approved by the Ethics Committee of the Faculty of Medicine and Dentistry (FMOS) and the Faculty of Pharmacy (FPHA) (No. 2017/81/CE/FMPOS). Informed consent was obtained from all participants prior to their inclusion in the study. In addition, the heads of the various health facilities agreed to participate in the study. A unique identification number consisting of the district code, facility code, and number, in the order of inclusion in the study, was used for all participants and specimens.

4. Results

4.1. A Total of 1259 Women was Enrolled, 604 in Kita (48%) and 655 in San (52%).

The average age of the women was 25 years overall, with a predominance of women aged 20 and over (74.4%), and 68.8% lived in urban areas. Majority of participants were married (95.6%), 50.6% were out of school, and only 7.3% had a higher level of education. Housewives represented 77.4% of the participants, and female employees represented only 2.6% (Table 1). The mean axillary temperatures of the women were 36.3°C and 36.5°C in Kita and San, respectively. Approximately 3.5% of women had a fever at childbirth. Overall, multigravida and large multigravida were the majority, i.e., 26.1%, followed by first-time pregnancies, which represented 26.0%, with a median pregnancy of 3 and 4 pregnancies per woman, respectively, in Kita and San. The mean gestational age was 38 weeks, according to ultrasound, and approximately 23.7% of women gave birth before 37 weeks. The mean hemoglobin level was 10.3 g/dl in Kita and 10.7 g/dl in San. Approximately 38.6% of the women had normal hemoglobin levels, compared to 51.9% of women who had moderate anemia and 7.3% who had severe anemia. The proportions of positive thick drops were 4.8% for peripheral parasitemia, 4.6% for placental parasitemia and 0.5% for cord parasitemia (Table 2). Of the participants, 94.7% owned a net, including 93.9% of LLINS and approximately 90.8% of women reported using it the night before enlistment. In this sample, 25.4% of women had not received any doses of SP, and only 32.5% had received 3 or more doses (Table 3). In total, we recorded 3.3% of twin births. However, 1209 live births were collected, i.e., 96.1%. After evaluation with the Ballard score, the mean gestational age was estimated to be 38.4 weeks. According to Ballard's score, approximately 2.8% of births occurred before 37 weeks. Most of the participants were male, at 53.3%. The average weight was 2970 g, and approximately 8.2% of the newborns weighed less than 2500 g (Table 4). Regarding the study site, the proportion of women who received 3 or more doses at Kita (36.8%) was greater than that at San (28.7%). This difference was statistically significant (OR=0.693), 95% CI (0.545-0.881), p=0.003. By female age group, the proportion of women who received 3 or more doses was comparable in the <20-year age group (31.9%) compared to the >=20-year age group (32.7%), (OR=1.035), 95% CI (0.786-1.363), p=0.804. In terms of women's place of residence, the proportion of women who received 3 or more doses of SP in urban areas (38.4%) was greater than that in rural areas (19.1%). Women in urban areas were more likely (OR=2.639) to receive more doses of SP than were those in rural areas (95% CI (1.968-3.538), p<0.001). Depending on the dose of SP received, the proportion of women who received 3 or more doses of SP and who had anemia was much lower (28.6%) than that of women who received fewer than 3 doses (38.3%). Therefore, receiving 3 or more doses of SP was more effective against anemia (OR=0.645, 95% CI (0.503-0.825), p<0.000). The proportion of low-birth-weight infants was significantly lower (15.7%) in the group of women who received 3 or more doses of SP than in those who received less than 3 doses (38.3%). This explains why 3 or more doses of SP are a protective factor for women not to give birth to a low-birth-weight newborn (OR=2.779, 95% CI (1.632-4.733), p<0.000). The proportion of women with a positive drop was much greater (79.3%) in the group of women who received less than 3 doses than in the group of women who received 3 or more doses of SP (20.7%). These results prove that receiving less than 3 doses of SP is a risk factor for women to have gout, OR=2.779, 95% CI (1.632-4.733), p<0.000. The proportion of women with a positive placental drop was significantly greater (80.4%) in the group of women who received less than 3 doses than in the group of women who received 3 or more doses of SP (20.7%). This finding explains why receiving fewer than 3 doses of SP is a risk factor for placental infection in women (OR=0.494, 95% CI (0.253-0.966), p=0.036). Thick cord drop was negative in all newborns born to women who received 3 or more doses of SP. The difference between the two groups was not significant (OR=0.674, 95% CI (0.648-0.700), p=1.86) (Table 5). According to multivariate analysis, after adjustment, the main factors associated with taking 3 or more doses of SP were anemia, birth weight, residence and district (Table 6).

Table 1: Sociodemographic characteristics of the women.

Characteristics	Kita (n=604)	San (n=655)	Total (n=1259)
Age in years			
Mean (Standard Deviation)	24 (6)	26 (7)	25 (7)
Age groups n (%)			
<20 years	183 (30.3)	139 (21.3)	322 (25.6)
20 years and older	421 (69.7)	515 (78.7)	936 (74.4)
Residence n (%)			
Urban	421 (69.7)	443 (67.9)	864 (68.8)
Rural	183 (30.3)	209 (32.1)	392 (31.2)
Marital status n (%)			
Bride	577 (95.7)	626 (95.6)	1203 (95.6)
Unmarried	26 (4.3)	29 (4.4)	55 (4.4)
Educational attainment n (%)			
Not in school	283 (46.9)	354 (54.4)	637 (50.6)
Primary 1	82 (13.6)	97 (14.9)	179 (14.3)
Primary 2	104 (17.2)	106 (16.3)	210 (16,7)
Secondary	82 (13.6)	55 (8.4)	137 (10.9)
Upper	52 (8.6)	39 (6.0)	91 (7.3)
Occupation n (%)			
Housewives	458 (75.8)	516 (78.9)	974 (77.4)
Employed	19 (3.1)	14 (2.1)	33 (2.6)
Shopping	36 (6.0)	86 (13.1)	122 (9.7)
Students	91 (15.1)	38 (5.8)	129 (9.7)

Table 2: Clinical and biological characteristics of the women.

Characteristics	Kita (n=604)	San (n=655)	Total (n=1259)
Axillary temperature in °C			
Mean (Standard Deviation)	36.3°C (0.6)	36.5°C (0.5)	36.4°C (0.6)
Fever n (%)			
Yes	19 (3.1)	25 (3.8)	44 (3.5)
No	585 (96.9)	629 (96.2)	1214 (96.5)
Gesturity			
Median (Min–Max)	3 (1-14)	4 (1-13)	4 (1-14)
Gestality classes n (%)			
Primigravida	157 (26.1)	168 (25.8)	325 (26.0)
Paucigravida	145 (24.1)	129 (19.8)	274 (21.9)
Multigravida	153 (25.5)	173 (26.6)	326 (26.1)
Grand multigravida	146 (24.3)	180 (28.7)	326 (26.1)
Gestational age at AS echo			
Mean (Standard Deviation)	38.1 (2.8)	36,4 (4.6)	38 (3.6)
<37 SA n (%)	58 (19.9)	46 (31.1)	104 (23.7)
>=37 SA n (%)	233 (80.1)	102 (68.9)	335 (76.3)
Hemoglobin level in g/dl			
Mean (Standard Deviation)	10.3 (1.8)	10,7 (1,5)	10,5 (1,6)
Anemia type n (%)			
No anemia	202 (35.6)	263 (41.2)	465 (38.6)

Moderate	306 (53.9)	347 (54.4)	653 (51.9)
Severe	60 (10.6)	282 (4.4)	88 (7.3)
Peripheral drop n (%)			
Positive	20 (3.3)	40 (6.1)	60 (4.8)
Negative	584 (96.7)	615 (93.9)	1199 (95.2)
Placental drop n (%)			
Positive	14 (2.3)	44 (6.7)	58 (4.6)
Negative	590 (97.7)	611 (93.3)	1201 (95.4)
Cord drop n (%)			
Positive	0 (0.0)	6 (0.9)	6 (0.5)
Negative	604 (100)	649 (99.1)	1253 (99.5)

Table 3: Malaria prevention measures used by mothers during pregnancy.

Characteristics	Kita (n=604)	San (n=655)	Total (n=1259)
Nets			
Possession n (%)			
Yes	558 (92.4)	632 (96.8)	1190 (94.7)
No	46 (7.6)	21 (3.2)	67 (5.3)
Utilization n (%)			
Yes	520 (88.3)	599 (93.2)	1119 (90.8)
No	69 (11.7)	44 (6.8)	113 (9.2)
LLINs n (%)			
Yes	553 (93.9)	602 (93.9)	1155 (93.9)
No	32 (5.4)	10 (1.6)	42 (3.4)
NSP	4 (0.7)	29 (4.5)	33 (2.7)
SP n dose (%)			
Zero (0)	121 (21.3)	189 (28.9)	310 (25.4)
1	105 (18.5)	123 (18.8)	228 (18.7)
2	133 (23.4)	154 (23.5)	287 (23.5)
3	137 (24.1)	128 (19.6)	265 (21.7)
4	61(1.7)	49 (7.5)	110 (9.0)
5	11 (1.9)	11 (1.7)	22 (1.8)
Dose class n (%)			
Less than 3 doses	359 (63.2)	466 (71.3)	825 (67.5)
3 or more doses	209 (36.8)	188 (28.7)	397 (32.5)

Table 4: Characteristics of newborns at childbirth.

Characteristics	Kita (n=604)	San (n=655)	Total (n=1259)
Number of newborns at delivery n (%)			
One newborn	587 (97.2)	631 (96.3)	1217(96.7)
Two newborns	17 (2.8)	24 (3.7)	41(3.3)
Newborn assessment n (%)			
Alive	583 (96.5)	626 (95.7)	1209 (96.1)

Deceased	21 (3.5)	28 (4.3)	49 (3.9)
Gestational age at Ballard			
Mean (Standard Deviation)	38.7 (1.0)	38,3 (1.3)	38.4 (1.2)
<37SA	14 (2.6)	18 (3.0)	32 (2.8)
>=37SA	516 (97.4)	582 (97.0)	1098 (97.2)
Sex n (%)			
Female	286 (47.5)	298 (46.0)	584 (46.7)
Male	316 (52.5)	350 (54.0)	666 (53.3)
Weight			
Mean (Standard Deviation)	2966.2 (500)	2973.7 (483)	2970 (491)
Weight classes n (%)			
<2500	51 (8.7)	48 (7.7)	99 (8.2)
>=2500	586 (91.3)	579 (92.3)	1114 (91.8)

Table 5: Relationships between variables and doses of SP received by women during pregnancy.

Variables	Less than 3 doses of SP 825 (67.4%)	3 or more doses of SP 397 (32.6%)	OR	IC	P value
Sites					
Kita	359 (63.2%)	209 (36.8%)	1	0.545-0.881	**0.003**
San	466 (71.3%)	188 (28.7%)	0.693		
Maternal age group					
<20 years	213 (68.1%)	100 (31.9%)	1	0.786-1.363	0.804
>=20 years	611 (67.3%)	297 (32.7%)	1.035		
Residence					
Rural	300 (80.9%)	71(19.1%)	1	1.968-3.538	**0**
Urban	522 (61.6%)	326 (38.4%)	2.639		
Anemia					
Yes	488 (71.4%)	195 (28.6%)	0.645	0.503-0.825	**0**
No	300 (61.7%)	186 (38.3%)	1		
Birth Weight					
<2500 g	91 (84.3%)	17 (15.7%)	1	1.632-4.733	**0**
>=2500 g	730 (65.8%)	379 (34.2%)	2.779		
Maternal Thick Drop					
Positive	46 (79.3%)	12 (20.7%)	0.528	0.276-1.008	0.049
Negative	779 (66.9%)	385 (33.1%)	1		
Thick drop of the placenta					
Positive	45 (80.4%)	11 (20.7%)	0.494	0.253-0.966	**0.036**
Negative	780 (66.9%)	386 (33.1%)	1		
Thick cord drop					
Positive	6 (100%)	0 (0%)	0.674	0648-0.700	1.86
Negative	819 (67.5%)	397 (32.5%)	1		

Table 6: Impact of IPT/SP on anemia-adjusted delivery parameters.

Variables	Less than 3 doses of SP 788 (67.4%)	3 doses or more of SP 381 (32.6%)	Adjusted OR	IC	P value
Anemia					
Yes	488 (71.4%)	195 (28.6%)	0.635	0.492-0.821	**0.001**
No	300 (61.7%)	186 (38.3%)	1		
GE materna l					
Yes	300 (61.7%)	186 (38.3%)	0.861	0.296-2.510	0.785
No	488 (71.4%)	195 (28.6%)	1		
GE of the placenta					
Yes	300 (61.7%)	186 (38.3%)	0.75	0.258-2.183	0.598
No	488 (71.4%)	195 (28.6%)	1		
Birth Weight					
Yes	300 (61.7%)	186 (38.3%)	2.539	1.474-4.375	**0.001**
No	488 (71.4%)	195 (28.6%)	1		
Residence					
Rural	300 (80.9%)	71(19.1%)	1		
Urban	522 (61.6%)	326 (38.4%)	2.495	1.841-3.382	**0**
District					
Kita	359 (63.2%)	209 (36.8%)	1		
San	466 (71.3%)	188 (28.7%)	0.635	0.510-0.852	**0.001**

5. Discussion

At the same time, we conducted a cross-sectional study in Kita and San to determine the effectiveness (in real-world conditions) of IPT in SP for the prevention of maternal and placental malaria, maternal anemia and low birth weight in women who gave birth at different health facilities. The same methodology was adopted by Famanta et al. in Mali in 2011. However, the studies conducted by Bamba et al. in Burkina Faso in 2013 and by Agyeman et al. in Ghana in 2020 were prospective cohorts. In this study, the average age of the women was 25 (7) years, with a predominance of women aged 20 years and older. The same observation was made in Burkina Faso by Bamba et al. in 2013. At both sites, 68.8% of women resided in urban areas, and the majority were married; the same observation was made in Ghana in 2020 and in Bamako in 2011 [10,11]. The majority of women were out of school; Agyeman in 2020 in Ghana and Bamba et al. in Burkina Faso reported the same phenomenon [12,13]. This could be explained by the low enrollment rate of girls in Africa, which remains a real problem [14].

Housewives were the most represented, followed by shopkeepers and students. This result is in line with that found in Burkina Faso. This is not surprising because most women in our sample were not in school. The average temperature ranged from 36.3°C to 36.5°C in Kita and San, respectively. Approximately 3.5% of women had a fever at childbirth. This proportion is much lower than that found by Famanta et al. in Bamako [15]. This difference in proportion could be explained by the fact that in Famanta's study, women received only two doses of SP (one dose in the second trimester and one in the third trimester according to policy). Overall, multigravida and large multigravida were the majority, i.e., 26.1%, with a median pregnancy of 3 or 4 pregnancies per woman; the same observation was made by Agyeman et al. [12]. These figures are different from those observed by Bamba et al. in 2013 in Burkina Faso and Famanta et al. in 2011 Bamako, all of which have regained

a predominance of primigravidae [12,15]. This could be linked to chance and not to the way women are recruited. The mean gestational age was 38 weeks according to ultrasound, and approximately 23.7% of the participants gave birth before 37 weeks. The mean hemoglobin level was 10.3 g/dl in Kita and 10.7 g/dl in San. Approximately 38.6% of the women had normal hemoglobin levels, 51.9% had moderate anemia, and 7.3% had severe anemia. Only 4.8% of women had positive peripheral parasitemia in our 0.5% positive cord drop sample. This result was corroborated by Famanta et al.; however, there was a difference between the prevalence of placental drops (4.6% vs 1.6% in our study and that of Famanta, respectively) [15]. These differences could be because the sample size in our study was larger than that in Famanta (1259 and 379 pregnant women, respectively) and because in the Ugandan study, the policy was 2 doses or more. Approximately 38.3% of women who received 3 or more doses of SP had positive thick gout. This result is 16.9% higher than that of Agyeman [12] in Ghana. This difference could be due to the design of the study, which included the cohort type and the stratification of women into 3 groups vs 2 groups. Approximately 8.2% of the newborns born to the women included in this study were less than 2500 g in weight. This result is similar to that reported by Arinaitwe in 2013 in Uganda but lower than that of Famanta et al. (12,1%) [15,16]. This could be due to the means of prevention used by women during their pregnancy (IPT in SP and LLINs). However, most cases of low birth weight were observed in women who received less than 3 doses of SP, which is not surprising since the effectiveness of this molecule has been proven to improve the birth weight of newborns. Most participants performed LLINs (93.9%), and approximately 90.8% of women reported using it the night before enrollment. This result is in line with that of the EDSM VI in 2018 [17] but higher than that of Agyeman in 2020 [12]. In this sample, 25.4% of the women had not received any dose of SP. Approximately 32.5% of the women had received at least 3 doses of SP. This proportion is higher than that published in the ESDM VI in Mali (28.1%) [18]. This value is also higher than that reported by Arinaitwe et al. in Uganda in 2013 [16]. However, it is lower than the proportion found in Ghana by Agyeman in 2020 [12]. This difference could be linked to the multiple efforts made by the political and health authorities and the recommendations of the World Health Organization [19].

We found a statistically significant difference between women who received 3 or more doses of SP in the two districts. This could be attributed to chance since the populations of these two areas have similar characteristics.

In terms of women's place of residence, the proportion of women in urban areas who received 3 or more doses of SP was greater than that in rural areas. This difference between the two settings could be explained by the fact that women's educational attainment is greater in urban areas than in rural areas. This increase in the proportion of women who received 3 or more doses of SP in this study could be due, on the one hand, to the efforts made by politicians to raise awareness among maternity workers and women about the extent of adequate administration and regular intake of this drug and, on the other hand, to the supply of SP to health facilities. The incidence of maternal anemia at delivery was significantly lower in the group of women who received 3 or more doses of SP. This finding is not surprising because the effectiveness of this molecule in improving hemoglobin levels has been proven by the authors [20]. In this study, the prevalence of LBW was greater in newborns born to women who received less than 3 doses of SP. The same observation was made by Arinaitwe in Uganda [16]. This finding indicates that receiving multiple doses of SP protects newborns from the harm of malaria. The prevalence of placental malaria was significantly lower in this sample, in contrast to that found in Uganda in 2013 [16], which was 17.5% by microscopy. This low prevalence may be due to the current SP administration policy that every woman should receive at least 3 doses of SP during pregnancy in a healthcare worker-supervised setting. However, the majority of women who were positive for placental drop were those who had received less than 3 doses of SP. Meta-analyses have supported this theory [21]. Receiving 3 or more doses has been shown to be associated with a decrease in episodes of malaria infection during pregnancy [14]. Several studies have shown that receiving 3 or more doses of SP is a protective factor against malaria infection and maternal anemia, especially against placental infection [14]. However, previous studies have also shown that women who have not received any doses of SP are specifically prone to developing malaria and suffering adverse outcomes, including maternal anemia, preterm delivery, LBW, and maternal and infant death [15]. Monitoring the efficacy of IPT with SP is challenging because it is generally not considered ethical to conduct randomized clinical trials with a placebo arm in areas of high transmission. Surrogate data from in vivo studies for the treatment of symptomatic malaria have been used. However, SP monotherapy is no longer recommended for the treatment of malaria in Africa. The WHO now recommends evaluating the effectiveness of in vivo SP in patients with asymptomatic parasitemia as a method of monitoring the effectiveness of IPT with SP [19].

6. Conclusion

This study suggests that IPTp in SP at least 3 doses could reduce not only episodes of malaria during pregnancy but also the risk of placental infection from LBW at birth in newborns compared to women who received less than 3 doses of SP during pregnancy. However, there is a need to strengthen surveillance by establishing a surveillance system to detect malaria cases in pregnant women after the administration of sulfadoxine-pyrimethamine.

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