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ASSESSMENT OF DELIVERY OUTCOMES AND FACTORS ASSOCIATED WITH LOW BIRTH WEIGHT FOLLOWING THE INTRODUCTION OF SP-IPTP AS PART OF FOCUSED ANTENATAL CARE IN THE HOHOE MUNICIPALITY, GHANA

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ABSTRACT

Background: Intermittent Preventive Treatment with Sulphadoxine-Pyrimethamine (SP-IPTp) is a key component of malaria control in pregnancy. This study assessed delivery outcomes and factors associated with low birth weight (LBW) following the introduction SP-IPTp. **Methods:** A cross-sectional study carried out from March 2015 to February 2017 involving paucigravid women who delivered at the Hohoe Municipal Hospital. A semi-structured questionnaire was used to collect data on socio-demographic characteristics, obstetrics and medical history. Information on medical conditions and delivery outcomes were extracted from the antenatal care (ANC) book. Chi-square test and logistic regression were used to determine the association between dependent and independent variables. **Results:** Of the 1208 women, 90(7.5%) had babies with LBW, with 12.1% among primigravidae and 6.2% among multigravidae (χ^2=10.53, p=0.001). The prevalence of LBW babies was also higher among women who took < 2 doses of SP-IPTp than those who took ≥ 2 doses (11.5% vs. 5.6%) (χ^2=13.26, p<0.001). Prevalence of neonatal or stillbirths was 63(5.2%) and this was significantly associated with LBW (χ^2 =4.50, p=0.034). Women aged 30-39 years, those with parity 4-6 children, those who visited ANC 5-6 times and those who slept inside LLIN were 77%, 83%, 65% and 51% less likely to have babies with LBW (AOR=0.33, p=0.028), (AOR=0.17, p=0.033), (AOR=0.35, p=0.050) and (AOR=0.49, p=0.021) respectively. Women with hypertension were 3.74 times more likely to have LBW babies (AOR=3.74, p<0.001). **Conclusion:** Prevalence of LBW babies was relatively low as compared to other parts of Ghana. This is probably due to increased number of ANC visits, intake of high doses of SP-IPTp and high LLIN utilisation. Primigravidity, parity and hypertension are risk factors for LBW; and LBW is a risk factor for neonatal death or stillbirth. Implementation of control measures for malaria in pregnancy has reduced the prevalence of LBW babies in the Hohoe Municipality.

KEYWORDS: Low birth weight, Focused ANC, Neonatal/stillbirth, SP-IPTp, LLIN, Paucigravid women, Hohoe Municipality, Ghana.

INTRODUCTION

Low birth weight (LBW) is an outcome measure associated with maternal malaria infection. It has been defined by the World Health Organization (WHO) as weight at birth less than 2500g.[1] The global prevalence of LBW is 15.5% which amounts to about 20 million LBW infants born each year, 96.5% of them in developing countries. Intermittent Preventive Treatment for Pregnant women (IPTp) is a key component of malaria control in pregnancy. This is defined as administration of full curative doses of an effective antimalarial drug at predefined intervals during pregnancy. Intermittent Preventive Treatment with Sulphadoxine-Pyrimethamine (SP-IPTp) is being implemented in most malaria endemic countries as a standard two-dose regimen as it reduces the risk of LBW and the prevalence of maternal anaemia. Where the risk of infection is high because of intense transmission, up to 3-5 SP-IPTp doses may further reduce the negative effects of malaria on pregnancy outcome.[2]

Risk factors in the mother that may contribute to LBW delivery include maternal age,[3] multiple pregnancies,[4] nutritional status (Body Mass Index [BMI]),[5] hypertension,[6] drug addiction,[7] alcohol abuse,[8,9] anaemia[10] and malaria.[11,12] Evidence shows that

maternal malaria infection during pregnancy adversely affects development and survival of fetuses and newborns. Low birth weight is an important risk factor for neonatal-related deaths and morbidity and other chronic diseases which might occur later in life. In sub-Saharan Africa (SSA), the burden of LBW is very high, which could be attributed to *Plasmodium falciparum* malaria, contributing to 20% of LBW cases.[13,14] Substantial gains in minimizing LBW in SSA could be achieved by scaling up IPTp.[15] A study in Burkina Faso also showed that maternal malaria contributed to 13.4% (n=139) LBW out of 1034 live births.[16]

Studies in West Africa have confirmed that SP-IPTp is effective in preventing malaria and anaemia in pregnant women.[17-19] Prior to the introduction of IPTp in Gabon in 2004, the overall prevalence of peripheral *P. falciparum* infection at delivery was 10.5%.[20] Post-implementation evaluation in 2006 saw a significant drop in prevalence to 1.7%. A study in southern Ghana reported on the pregnancy outcomes in women in 2006 one year following the implementation of SP-IPTp. The outcomes were compared with those obtained in 2000 when the use of Chloroquine for prophylaxis was being implemented. It was found that in 2000, the prevalence of low birth weight among primigravidae was 26% and in 2006 it was 16.2% (26.0 vs 16.2) OR= 0.41 (95%CI: 0.19–0.93; p=0.03).[21] Following favourable results from the SP-IPTp, WHO now recommends that intermittent preventive treatment with an effective, preferably one-dose anti-malarial drug delivered as part of focused antenatal care (ANC) be made available to pregnant women as an appropriate and effective method for reducing the consequences of malaria in highly endemic areas.[22]

The use of SP-IPTp given during pregnancy became operational as part of focused ANC in 2005. The current standard of care for preventing malaria during pregnancy in Ghana is SP-IPTp administered between 16 (or after quickening) to 37 weeks gestation. After quickening, women receive up to 7 doses of IPTp with SP (single dose of three tablets of 500 mg Sulphadoxine and 25mg Pyrimethamine) with a minimum interval of 4 weeks between courses. The third and final dose of three tablets of SP should be taken one month after the second dose and before 36 weeks gestation. Women who attend ANC clinic after 32 weeks gestation are not given IPTp.[23]

As part of the package for ANC, pregnant women undergo laboratory examinations for Haemoglobin concentration (Hb) measurement, Hb genotype, Glucose 6-phosphate-dehydrogenase (G6-P-D) status, blood grouping, blood film for malaria parasites, urine sugar and albumin during the first ANC visit between 16 and 32 weeks gestation. When the gestational age is >32 weeks the women are again examined for Hb concentration, blood film for malaria parasites, urine sugar and albumin. The test could also be done any time it is requested by a clinician free of charge. The use of Long-Lasting Insecticide-treated Nets (LLINs) is also being promoted among pregnant women alongside SP-IPTp. Midwives at ANC receive training on how to administer IPTp drugs to pregnant women at the clinic under direct observation. Laboratory results and SP doses administered are recorded into the ANC card and register.

Review of delivery data at the Hohoe Municipal Health Directorate indicated that approximately 3,500 babies are delivered at the health facilities per year within the Hohoe Municipality and most (2,800) of the deliveries occur at the Municipal hospital.[24] The current study assessed the impact of SP-IPTp and used of LLIN on delivery outcomes among paucigravid women after ten years of implementation as part of focused ANC in the Hohoe municipality of Ghana. The primary objective was to investigate whether SP-IPTp improves the birth weight of newborn babies in the current context of increasing SP resistance. We also looked at the whether there is any additional benefit of using LLINs.

MATERIALS AND METHODS

Study Area

The study area is Hohoe Municipality which is one of the twenty-five administrative districts of the Volta Region. The Municipality is located in the Volta region of Ghana. There are two main seasons, the wet and dry seasons. The major wet season lasts from April to July and the minor one from September to November. The rest of the year is relatively dry. The average recorded annual rainfall in the district is 1,592 mm with approximately 1,296 mm rain falling between April and October. Malaria is hyper-endemic but with seasonal peaks. The entomological inoculation rate (EIR) for the study area is approximately 65 (95% CI: 0-143) infectious bites per person per year. In the study area, malaria transmission occurs throughout the year with seasonal peaks, coinciding with the period of the rains. The Municipality has one hospital situated at Hohoe. Typical of the health system in Ghana, the Municipal Hospital is the only referral facility that provides secondary and tertiary care. There are 14 health centres, clinics and 7 CHPs compounds that are manned by medical assistants, nurses/midwives and community health officers respectively in various sub-district communities. The Municipal Hospital at Hohoe and eight health centres located at Akpafu Mempeasem, Santrokofi Bume, Gbi Wegbe, Alavanyo Wudidi, Lolobi Kumasi, Likpe Bakwa, Fodome Ahor and Fodome Helu provide ANC and postnatal care (PNC) services. The municipal hospital and health centres provide daily ANC and delivery services. The midwives also promote the use of LLIN during pregnancy.

Study population

The study population was primigravidae and secundigravidae (paucigravid) women who attended ANC clinic within the Hohoe municipality and delivered at the Hohoe Municipal Hospital during the study period.

Study design

This was an exploratory study comparing the effect of SP-IPTp on birth weight. The study was carried out from March 2015 to February 2017 at the Hohoe Municipal Hospital. This involved extraction of data from clients' ANC cards and registers at the post-delivery ward. Information on socio-demographic characteristics (age, place of residence [urban/rural], educational level, marital status), ownership and usage of LLIN were obtained from the participants using a questionnaire. Information on obstetric history (parity, gravidity, previous delivery outcomes [live/stillbirth, neonatal deaths, preterm delivery]) and medical conditions (presence of malaria parasites in blood, haemoglobin level, blood pressure measurements), number of SP-IPTp doses received and at what gestational age, were extracted from the antenatal booklet of the participants. Birth weight of newborn babies was measured by Midwives at the labour ward immediately after delivery.

Inclusion and exclusion criteria

Paucigravid women who delivered at the Hohoe Municipal Hospital within the period of the study, consented to participate and were not seriously ill (pulmonary Tuberculosis and HIV). The main exclusion criteria were newborns delivered at preterm (<37 gestational weeks), newborns of multiple pregnancies (twins, triplets), no consent by the mother of the baby and seriously ill women (pulmonary tuberculosis and HIV).

Sample size

The required sample size was determined using a formula.[25] Reliability coefficient (z) of 1.96 at 95% confidence level, the margin of error (e) of 2.89% and the proportion of 50% were substituted into the formula to determine a minimum sample size of 1149. However, the minimum sample size was increased to 1206considering a non-response rate of 5%. Therefore, a total of 1208 mothers were recruited into the study.

Enrolment and consent

Eligible women/mothers were approached for consent to participate in the study. This process was carried out by trained Midwives using the local language (Ewe) in the municipality. All women who gave consent to participate appended their signatures or right thumbprint to two copies of the consent form. The Midwife also signed to indicate that she had adequately informed the participant about the study and answered all the questions posed by the participants.

Data collection

Two Midwives and research assistants were trained to administer the questionnaire at the post-delivery ward, extract information from the ANC book and complete case record form.

Data management and analysis

Data from participants were recorded on specified forms. All forms were checked by the principal investigator (PI) for consistency before data entry. Data was entered using EPI Info software (Epi data). The accuracy of data input was checked and the cleaned database was exported to STATA version 14.1 (Stata Corporation, Texas, USA) for analysis. The primary analysis for the study was the proportion of babies with low birth weight (<2500gm). Analysis of the secondary endpoints such as women with malaria parasitaemia, anaemia (Hb<11.0g/dl), stillbirths and neonatal deaths was also performed. Some of the variables at enrolment age, malaria parasitaemia at first and last visit and LLIN usage) were in the analysis of the primary endpoints. Descriptive statistics was used for background characteristics. Chi-square was used to determine associations between variables. Risk factors identified during the Chi-square analysis were fitted into logistic regression models to determine the strength of the association. All reported p-values were two-sided with significance levels of < 0.05.

Ethical issues

A written approval for the study was obtained from the Ghana Health Service/Ministry of Health (GHS/MoH) Ethical Review Committee (ERC) (GHS/MoH-ERC) before the commencement of the study with approval number GHS-ERC: 13/07/2014. The study was conducted in accordance with accepted principles of Ethics in Human Experimentation and Good Clinical Practice (GCP). Before inclusion into the study, written individual informed consent was obtained from the women/mothers of the babies on a standard consent form. Women were informed about the duration and purpose of the study. They were also informed that they were free to withdraw from the study anytime, and that was not going to affect their subsequent treatment at the hospital. Prior to the start of the study, the nature of the evaluation was discussed with the study population at the individual level. The benefits and risks of taking part in the study were explained to them and an individual written consent was obtained before enrolling into the study. They were also informed that they were free to withdraw at any time from the study and it would not affect them in any way.

RESULTS

Background characteristics of respondents

Table 1 shows that a total of 1208 mothers (participants) with their babies were recruited with mean age 27.6±6.7. Only 111 (9.2%) of the participants had a tertiary level of education. The majority 693 (57.4%) of the participants were married. About 273 (22.6%) of the participants were unemployed. The majority 1017 (84.2%) of the participants were Christians. Most, 715 (59.2%) of the participants had parity of 1-3 children, and the majority 697 (57.7%) had gravidity of 2-5.

Table 1: Background characteristics of the respondents.

	Frequency [N=1208]	Percentage (%)
Mean age (SD)	27.6 (6.7)	
Age group (years)		
<20	162	13.4
20-29	590	48.8
30-39	404	33.4
40-49	52	4.3
Educational level		
No education	123	10.2
Primary	190	15.7
JHS	582	48.2
SHS	202	16.7
Tertiary	111	9.2
Marital Status		
Single	234	19.3
Co-habiting	252	20.9
Married	693	57.4
Divorced	29	2.4
Occupation		
Unemployed	273	22.6
Trader	423	35.0
Farmer	84	7.0
Artisan	332	27.5
Civil servant	96	8.0
Religion		
Christian	1017	84.2
Muslim	191	15.8
Parity		
0	298	24.7
1 and above	910	75.3
Gravida		
Primigravida	265	21.9
Multigravida	943	78.1
Number of visits		
1-2	89	7.4
3-4	305	25.3
5-6	419	34.7
>6	395	32.7
SP dose		
< 2	383	31.7
>2	825	68.3
More than 4 dose	72	6.0
Malaria at first visit		
Negative	847	70.1
Positive	361	29.9
Malaria at last visit		
Negative	915	75.8
Positive	293	24.2
LLIN use at first Visit		
No	211	17.5
Yes	997	82.5
LLIN use at last Visit		
No	198	16.4
Yes	1010	83.6
Hb at first visit		
Normal (Hb≥11.0g/dl)	310	25.7
Anaemia (Hb<11.0g/dl)	898	74.3
Hb at last visit		
Normal (Hb≥11.0g/dl)	241	20.0
Anaemia (Hb<11.0g/dl)	967	80.0
Hypertension status at first visit		
Normal	1165	96.4
Hypertensive	43	3.6
Hypertension status at last visit		
Normal	1107	91.6
Hypertensive	101	8.4
Sickling test		
Negative	1147	94.9
Positive	61	5.1
Birth weight		
Low Birth weight	90	7.5
Normal Birth Weight	1118	92.5

Obstetrics and medical characteristics and LLIN usage

Table 1 shows that the majority 419 (34.7%) of the participants visited ANC 5-6 times and the majority, 825 (68.3%) received 2 or more doses of SP.

At registration, 361 (29.9%) of the participants had malaria parasitaemia, whilst at the last visit before delivery, 293 (24.2%) had malaria parasitaemia. Haemoglobin level, measured at first visit showed that 898 (74.3%) of the pregnant women had anaemia and at the last visit before delivery, 967 (80.0%) had anaemia. Hypertension among participants at first visit was 43 (3.6%) and at the last visit, it was 101 (8.4%). Approximately 61 (5.1%) of the mothers were positive for sickling test. At the first visit, 211 (17.5%) of the participants did not use LLINs and at the last visit, 198 (16.4%) did not use LLINs.

Prevalence of low birth weight

Figure 1 shows that out of the 1208 women surveyed at delivery, 90 (7.5%) had babies with low birth weight.

Of the 383 women who took less than 2 doses of SP, 44 (11.5%) had babies with LBW. Of the 825 women who took 2 or more doses of SP, 46 (5.6%) had babies with LBW (Figure 2). Out of the 211 mothers who did not use LLINs at the first visit to the ANC, 24 (11.4%) had babies with LBW whilst of the 997 who used LLINs, only 66 (6.6%) had babies with LBW. Of the 177 mothers who did not use LLINs at the last visit, 21 (11.9%) and of the 1010 who used LLINs only 69 (6.8%) had babies with LBW (Figure 2).

Figure 2 shows that of the 265 mothers who were primigravidae, 32 (12.1%) had babies with LBW whilst of the 943 who were multigravidae, 58 (6.2%) had babies with LBW. Of the 298 women with parity 0,36 (12.1%)

had babies with LBW whilst of the 910 with parity 1 or more, 54 (5.9%) had babies with LBW.

Prevalence of neonatal/still births and LBW

Figure 3 shows that of the 1208 women, 1145 (94.8%) delivered live births and 63 (5.2%) had neonatal or still births. Of the 1145 live births delivered, 81 (7.1%) had LBW, While of the 63 neonatal/stillbirths delivered, 9 (14.3%) had LBW (Figure 4).

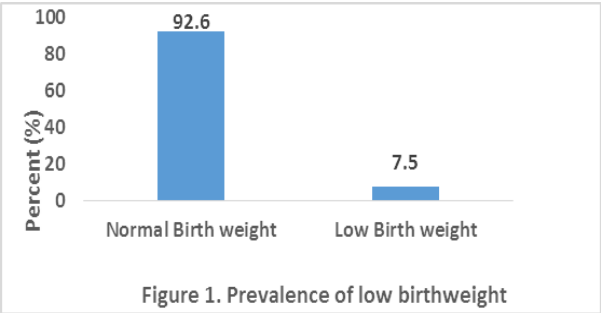

Figure 1. Prevalence of low birthweight

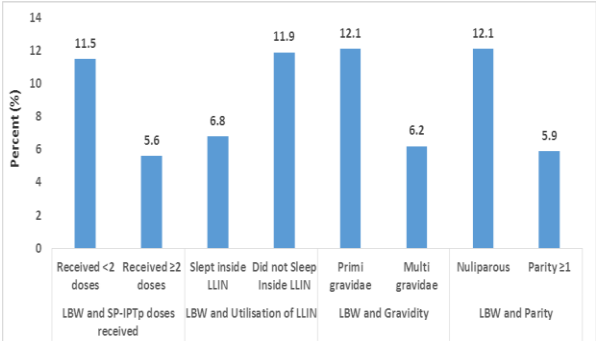

Figure 2. Prevalence of LBW among women in relation with SP-IPTp doses received, usage of LLIN, Gravidity and Parity

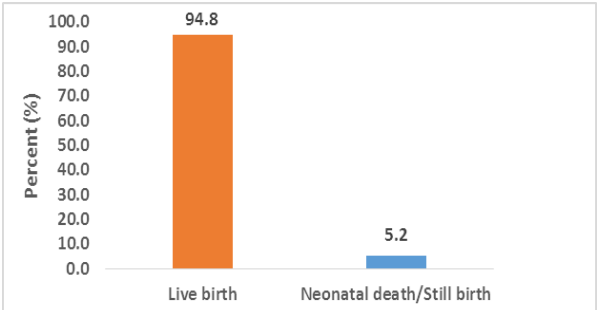

Figure 3. Prevalence of neonatal death and still birth

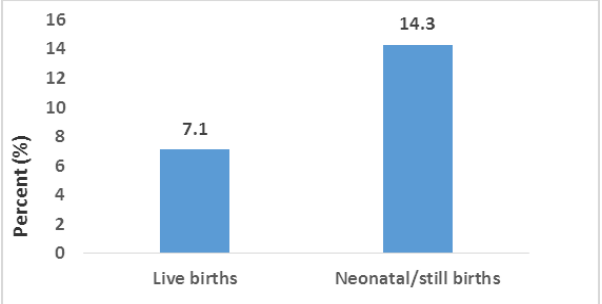

Figure 4. Prevalence of LBW among live births and neonatal/still births

Association between socio-demographic characteristics and the odds of low birth weight

Table 2 shows that there was a significant association between age of mother, occupation, parity and gravidity and LBW (χ^2=16.80, p<0.001), (χ^2= 9.48 p=0.050), (χ^2=20.79, p<0.001) (χ^2=13.52, p<0.001) respectively. There was a significant association between the number of visits to ANC, SP doses received, LLIN usage at first visit and hypertension status at last visit and LBW (χ^2=19.80, p<0.001), (χ^2= 14.15, p<0.001), (χ^2=5.71, p=0.017) and (χ^2=8.75, p=0.003) respectively.

Women aged between 30-39 years were 0.33 times less likely to have babies with LBW as compared to those aged less than 20 years [AOR=0.33 (95% CI: 0.12, 0.89), p=0.028]. Even though not statistically significant women with parity 1-3 were 0.59 times less likely to have baby babies with LBW as compared to those with parity 0 [AOR=0.59 (95% CI: 0.31, 1.09), p=0.093]. Mothers with parity 4-6 were 0.17 times less likely to have baby babies with LBW as compared to those with parity 0 [AOR=0.17 (95% CI: 0.03, 0.86), p=0.033] (Table 2).

Women who visited ANC clinic 5-6 times and those who visited more than 6 times were 0.34 and 0.35 times less likely to have baby babies with LBW as compared to those who visited ANC clinic only 1-2 times ([AOR=0.34 (95% CI: 0.12, 0.91), p=0.031] and [AOR=0.35 (95% CI: 0.12, 1.00), p=0.050]) respectively. Even though not statistically significant, women who took 4 or more doses of SP were 0.67 times less likely to have babies with LBW as compared to those who took 0-1 dose [AOR=0.67 (95% CI: 0.23, 1.99), p=0.482].

Association between clinical measurement and the odds of low birth weight

Women who slept inside an LLIN the night before their last visit to ANC clinic were 0.50 times less likely to have babies with LBW as compared to those who did not [AOR=0.50 (95% CI: 0.27, 0.92), p=0.027]. Women who were hypertensive during pregnancy at their last ANC clinic visit were 3.54 times more likely to have babies with LBW as compared to those who had normal blood pressure [AOR=3.54 (95% CI: 1.71, 7.30), p<0.001]. Even though not statistically significant, women who experienced neonatal deaths or still births were 2.14 times more likely to have babies with LBW as compared to those who had live births [AOR=2.14 (95% CI: 0.69, 6.59), p=0.184] (Table 2).

Table 2: Association between socio-demographic characteristics, clinical measurement and the odds of low birth weight.

	Birth weight n (%)					
	Low Birth weight [90]	**Normal Birth weight [1118]**	**Total**	**χ^2 (p-value)**	**COR (95% CI) p-value**	**AOR (95% CI) p-Value**
Age group (years)						
<20	22 (24.4)	140 (12.5)	162 (13.4)			
20-29	49 (54.4)	541 (48.4)	590 (48.8)		0.58 (0.33, 0.98) 0.044	0.72 (0.36, 1.45) 0.358
30-39	16 (17.8)	388 (34.7)	404 (33.4)	16.80 (<0.001)	0.26 (0.13, 0.51) <0.001	0 .33 (0.12, 0.89) 0.028
40-49	3 (3.3)	49 (4.3)	52 (4.3)		0.38 (0.11, 1.35) 0.139	0.96 (0.22, 4.17) 0.954
Educational level						
No education	8(8.9)	115(10.9)	123(10.2)			
Primary	12(13.3)	178(15.9)	190(15.7)		0.97 (0.38, 2.44) 0.947	
JHS	44(48.9)	538(48.1)	582(48.2)	8.69 (0.069)	1.18 (0.54, 2.56) 0.684	
SHS	23(25.6)	179(16.0)	202(16.7)		1.84 (0.79, 4.26) 0.151	
Tertiary	3(3.3)	108(3.7)	111(9.2)		0.39 (0.10, 1.54) 0.183	
Marital Status						
Single	27(30.0)	207(18.5)	234(19.3)			
Co-habiting	17(18.9)	235(21.0)	252(20.86)		0.55 (0.29, 1.04) 0.069	
Married	44(48.9)	649(58.1)	693(57.4)	7.08 (0.069)	0.52 (0.31, 0.86) 0.011	
Divorced	2(2.2)	27(2.4)	29(2.4)		0.57 (0.13, 2.52) 0.457	
Occupation						
Unemployed	31(34.4)	242(21.7)	273(22.6)			
Trader	24(26.7)	399(35.7)	423(35.0)		0.47 (0.26, 0.82) 0.008	
Farmer	8(8.9)	76(6.8)	84(7.0)	9.48 (0.050)	0.82 (0.36, 1.86) 0.638	
Artisan	20(22.2)	312(27.9)	332(27.5)		0.50 (0.28, 0.89) 0.021	
Civil servant	7(7.8)	89(8.0)	96(8.0)		0.61 (0.26,1.44) 0.264	
Religion						
Christian	77(85.6)	940(84.1)	1017(84.2)			
Muslim	13(14.4)	178(15.9)	191(15.8)	0.01 (0.712)	0.89 (0.48, 1.63) 0.712	
Parity						
0	36 (40.0)	262 (23.4)	298 (24.7)			
1 and above	54 (60.0)	856 (76.6)	910 (75.3)	12.29 (<0.001)	0.46 (0.29, 0.72)< 0.001	0.58 (0.31, 1.07) 0.081
Gravidity						
Primi gravida	32 (35.6)	233 (20.8)	265 (21.9)			
Multigravida	58 (64.4)	885 (79.2)	943 (78.1)	10.53 (<0.001)	0.48 (0.30, 0.75)< 0.001	
Number of visits						
1-2	14 (15.6)	75 (6.7)	89 (7.4)			
3-4	31 (34.4)	274 (24.5)	305 (25.3)	19.80 (<0.001)	0.60 (0.31, 1.19) 0.149	0.63 (0.26, 1.54) 0.313
5-6	30 (33.3)	389 (34.9)	419 (34.7)		0.41 (0.21, 0.82) 0.011	0.43 (0.17, 1.12) 0.085
>6	15 (16.7)	380 (34.0)	395 (32.7)		0.21 (0.10, 0.46) <0.001	0.46 (0.16, 1.21) 0.110

SP doses						
< 2 doses	44 (48.9)	339 (30.3)	383 (31.7)			
≥2 doses	46 (51.1)	779 (69.7)	825 (68.3)	13.26 (<0.001)	0.45 (0.29, 0.70) <0.001	(0.67 (0.36, 1.24) 0.199
Malaria at first visit						
Negative	61(67.8)	786(70.3)	847(70.1)			
Positive	29(32.2)	332(29.7)	361(29.9)	0.25 (0.614)	1.13 (0.71, 1.78) 0.615	
Malaria at last visit						
Negative	70(77.8)	845(75.6)	915(75.8)			
Positive	20(22.2)	273(24.4)	293(24.2)	0.22 (0.640)	1.12 (0.65, 1.95) 0.664	1.34 (0.75, 2.39) 0.316
LLIN use at first Visit						
No	24(26.7)	187(16.7)	211(17.5)			
Yes	66(73.3)	931(83.3)	997(82.5)	5.71 (0.017)	0.55 (0.33, 0.90) 0.018	
LLIN use at last Visit						
No	21(23.3)	177(15.9)	198(16.4)			
Yes	69(76.7)	941(84.2)	1010(83.6)	3.42 (0.064)	0.62 (0.37, 1.03) 0.067	0.49 (0.26, 0.89) 0.021
Hb at first visit						
Normal	19 (21.1)	291 (26.0)	310 (25.7)			
Anemic	71 (78.9)	827 (74.0)	898 (74.0)	1.06 (0.304)	1.31 (0.78, 2.21) 0.305	
Hb at last visit						
Normal (Hb≥11gm/dl)	18 (20.0)	223 (20.0)	241 (19.9)			
Anaemic(Hb<11gm/dl)	72 (80.0)	895 (80.0)	967 (80.1)	0.00 (0.990)	1.0 (0.58, 1.71) 0.990	1.06 (0.54, 2.01) 0.855
Hypertension status at first visit						
Normal	86(95.6)	1079(96.5)	1165(96.4)			
Hypertensive	4(4.4)	39(3.5)	43(3.6)	0.22 (0.638)	1.29 (0.44, 3.69) 0.639	
Hypertension status at last visit						
Normal	75(83.3)	1032(92.3)	1107(91.6)			
Hypertensive	15(16.7)	86(7.7)	101(8.4)	8.75 (0.003)	2.4 (1.32, 4.36) 0.004	3.74 (1.82, 7.68) <0.001
Sickling test						
Negative	82(91.1)	1065(95.3)	1147(94.9)			
Positive	8(8.9)	53(4.7)	61(5.1)	2.99 (0.084)	1.96 (0.90, 4.26) 0.089	
Delivery Outcome						
Live births	81 (90.0)	1064 (95.2)	1145 (94.8)			
Neonatal deaths/Still births	9 (10.0)	54 (4.83)	63 (5.2)	4.50 (0.034)	2.19 (1.04, 4.59) 0.038	2.09 (0.68, 6.44) 0.198

DISCUSSIONS

The Government of Ghana has introduced measures to improve maternal and child health by making antenatal care services free for pregnant women. This study assessed the prevalence of LBW and its associated factors in the Hohoe Municipality. It was found that the prevalence of LBW was low (7.5%). This finding is an improvement upon what was found in a study conducted in the same area in which the prevalence of LBW of 9.7% was reported.[26] Another study conducted in Malaysia showed the prevalence of LBW to be 11.1%.[6] Other studies reported a higher prevalence of LBW. A study conducted in Northern Ghana in 2015 revealed the prevalence of LBW to be 29.6%.[27] A study conducted in Ghana at Agogo in 2006 reported 19.0% prevalence of LBW.[21] Another study in Ghana at Dodowa found 17.7% prevalence of LBW.[28] A study conducted in India reported 21.5% prevalence of LBW.[29] Also, a study in Ethiopia reported 22.5% prevalence of LBW.[30]

One major factor which could explain the low prevalence of LBW in the current study could be linked a good nutrition among pregnant women in the Municipality. Another plausible reason could be due to adequate access to health services including antenatal services thereby, enabling the women to receive SP-IPTp, free LLIN, education and counselling on nutritional requirements for themselves and their babies and monitoring and identification of maternal/foetal problems, which could reduce adverse pregnancy outcomes including LBW.[5]

The found the prevalence of neonatal mortality and stillbirths in this study to be 5.2%. This is slightly higher than the 2.7% reported in Pakistan,[31] and the 2.0% reported by Wardlaw et al.[32]

In the current study, the prevalence of LBW among those who took a 0-1 dose of SP was 13.2%. This is lower than what was found by Chico et al, 25.4%.[33] A study in Ghana also reported 18.0% prevalence of LBW among those who took less than 2 doses of SP.[34]

In the current study, among primigravidae, the prevalence of LBW was found to be 12.5%, which is similar to the 11.3% obtained by Dandekar et al.[35] The prevalence of LBW among those who did not use LLINs was found to be 11.9% in the current study, which is lower than the 19.7% prevalence reported by Kayode et al.[36] The low prevalence in the current study could be attributed to the high (83.6%) utilisation of LLINs to prevent malaria.

In the study, maternal age was found to be associated with LBW. Women between the ages of 30 and 39 were 67% times less likely to have LBW babies (AOR=0.33, p=0.028), which is similar to a study conducted in the same area in 2016.[26]

Hypertension in the current study was found to be a significant risk factor for LBW. The current study revealed that pregnant who were hypertensive were 3.74 times more likely to have babies with LBW (AOR=3.74, p<0.001). Similar findings were reported in Malaysia where pregnant women with hypertension were 4.52 times more likely to deliver babies with.[6]

The findings from the current study are also in agreement with a study conducted by Rahman et al[37] who also found that women with pregnancy-induced hypertension were 5 times more likely to give birth to babies with LBW. This could be as a result of hypertension, preventing the placenta from getting enough blood, which results in the baby not getting enough oxygen and food.[38]

The use of LLIN was identified in the current study as a protective factor in reducing LBW. The current study found that pregnant women who used LLIN were 51% times less likely to deliver LBW babies. A study in Nigeria revealed that the non-use of LLIN was significantly associated with malaria infection.[39] Hence, the use of LLIN by mothers in the current study serves as a protection leading to a reduction in LBW.

Limitation of the study

Information on BP, malaria parasitaemia, Hb, utilisation of LLIN, SP-IPTP doses received were extracted from the ANC book and not observed.

CONCLUSION AND RECOMMENDATIONS

Prevalence of LBW babies was relatively low as compared other studies conducted in other parts of Ghana. This is probably due to increased number of focused ANC visits, intake of high doses of SP-IPTp and high LLIN utilization. Primigravidity, parity and hypertension are risk factors for LBW; and LBW is a risk factor for neonatal death or stillbirth. With the increased risk of LBW among women aged less than 20 years, health promotion strategies aimed at preventing pregnancies among teenagers could be implemented to aid in the reduction of stillbirth rates.

The implementation of malaria control measures such as SP-IPTp, free LLIN distribution for malaria in pregnancy, free ANC and screening has reduced LBW in the Hohoe Municipality.

List of abbreviations

LBW: Low Birth Weight, LLIN: Long Lasting Insecticide Treated Net, SP: Sulphadoxine-pyrimethamine, IPTp: Intermitted Preventive Treatment of malaria in pregnancy, ANC: Antenatal Clinic, WHO: World Health Organization, BMI: Body Mass Index, G6-P-D: Glucose 6-phosphate-dehydrogenase, GHS: Ghana Health Service, ERC: Ethical Review Committee, GHS-ERC: Ghana Health Service Ethical Review Committee, MoH: Ministry of Health, GCP: Good Clinical Practice.

Availability of data and material

Available upon request

Competing interests
The authors declare that they have no competing interests.

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Authors' contributions
MK and MO conceived the study, MK, MA, WT, RO, PP and WA did the data analysis and wrote the methods section. MK, MO, MA, WT and ET and were responsible for the initial draft of the manuscript. All authors reviewed and approved the final version of the manuscript.

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