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Prevalence of low birth weight, macrosomia and stillbirth and their relationship to associated maternal risk factors in Hohoe Municipality, Ghana

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ABSTRACT

Introduction: birth weight is vital to the development potential of the newborn. Abnormal birth weight (such as low birth weight and macrosomia) is an important determinant of child survival, disabilities, stunting, and long-term adverse consequences for the onset of non-communicable diseases in the life course and therefore demands appropriate public health interventions. Stillbirths are also considered one of the most important, but most poorly understood and documented adverse outcomes of pregnancy. Therefore, this study aimed to assess the prevalence of abnormal birth weight and related maternal risk factors, as well as pregnancy outcomes, such as stillbirth.
Methods: a retrospective study design was used to analyze 4262 delivery records for singleton pregnancies from January 2013 to December 2014 seen at the Hohoe municipal hospital, Volta region in Ghana. The data on birth weight and related factors were derived from the delivery book. Data was analyzed using STATA. Multinomial logistic regression was used to assess the association between maternal factors such as parity, age and intermittent preventive treatment of malaria, sex of infant and abnormal birth weight. Association between stillbirth and related factors was assessed using logistic regression.
Results: prevalence of low birth weight (<2.5 kg) was 9.69% and macrosomia (≥ 4.0 kg) was 3.03%. There was an increased risk of a first born being of low birth weight than second or third born (RR; 2.04, CI; 1.59–2.64, $p<0.0001$). There were also an increased risks of mothers <20 years giving birth to low-birthweight infants (RR; 1.46, CI; 1.11–1.93, $p=0.007$) compared to mothers who were within the age ranges of 20–30 years and also among those who took only one (RR; 1.57, CI; 1.02–2.39, $p=0.039$) or no intermittent preventive treatment for malaria during pregnancy (RR; 1.57, CI; 1.24–1.98, $p=<0.0001$) compared to those who took three doses. Risk of macrosomic birth was particularly high among 5th born (RR; 2.66, CI; 1.43–4.95, $p=0.002$) compared to first or second born. Stillbirth rate was 27/1000 births. Thirty-two percent of the stillbirths ($n=38$) had low birth weight whereas 6.8% ($n=8$) were macrosomic. There was a greater than fivefold (AOR; 5.6, CI; 3.6–8.7) and greater than twofold (AOR; 2.4, CI; 1.1–5.3, $p=0.025$) increase in odds for stillbirth among low birth weight and macrosomic infants respectively.
Conclusion: macrosomia and low birth weight co-existed among infants in Hohoe municipality, both of which are associated with adverse pregnancy outcome such as stillbirth. Given the apparent association between maternal age <20 years and increased risk, health promotion strategies aimed at preventing pregnancies among teenagers could be implemented to aid the reduction of stillbirth rates.

Introduction

The burden of adverse pregnancy outcomes (APOs), which consists of both stillbirths and abnormal birth weights (Beck et al., 2010; Lee et al., 2013), is considerably high in both developed and in low and middle-income countries (Beck et al., 2010; Blencowe

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et al., 2012; Lee et al., 2013). The WHO guidelines define an APO as an event of low birth weight, preterm birth, stillbirth, perinatal death or abortion (WHO, 2004).

Low birth weight (LBW) is defined by WHO as a birth weight less than 2500 g (WHO, 2010). Two processes determine it; duration of gestation and intrauterine growth (WHO, 1995, Urquia and Ray 2012). Therefore LBW is caused by either a short gestation period (< 37 weeks) or retarded intrauterine growth (or a combination of both) (Kramer, 1987, Urquia and Ray 2012). It is however important to state that, not all small babies/preterm births result from disease process and not all babies affected by IUGR are small (Urquia and Ray 2012). This notwithstanding the proportion of infants weighing less than 2.5 kg at birth in a particular country generally reflects the health status of the population (Maana et al., 2013). Low birth weight is an important determinant of child survival, disabilities, stunting, and long-term adverse consequences for the onset of non-communicable diseases in the life course and therefore demand appropriate public health interventions (Lee et al., 2013, Lawn et al., 2005). These morbidities are often chronic and have long-term repercussions on the child, family, schools and communities. It contributes to about 75% of deaths that occur in the first week of life (Kirch, 2008).

Globally, about 14 million infants are born at term (> 37 weeks gestation) with low birth weight due to intrauterine growth restriction (IUGR). Eleven percent (11%) of all newborns in developing countries are born at term with low birth weight, a prevalence which is six times more than in developed countries (Bergmann et al., 2008). According to UNICEF (UNICEF, 2013), the prevalence of LBW deliveries in Ghana is 13.0%. However in some parts of Ghana, the prevalence is higher. For instance, a study conducted in the Northern region in 2015 found prevalence of 26% (Abubakari et al., 2015) and in the Ashanti region of Ghana, a prevalence of 21% was found in 2013 (Michael et al., 2013).

Macrosomia is another pregnancy outcome associated with increased risk of adverse maternal and perinatal outcomes (Wendland et al., 2012) yet little attention is paid to this condition in most developing countries. Traditionally macrosomia is defined as birth weight greater than or equal to 4.0 kg (Lu et al., 2011; Koyanagi et al., 2013; Ye et al., 2015). Macrosomia prevalence in developed countries is between 5% and 20% although an increase of 15% to 25% has been reported in the past decades, which is driven by an increase in maternal obesity and diabetes (Henriksen, 2008). In developing countries however, published studies on the changing prevalence of macrosomia appear rare. For example, a study in China (Lu et al., 2011) reported an increase from 6.0% in 1994 to 7.8% in 2005. In Ghana, we could not find data on the overall prevalence though a recent study on macrosomic births among obese and overweight women in a specialist hospital in Kumasi reported a prevalence of 10.9% in this high-risk group (Addo, 2010). Macrosomia, which is linked to obesity later in life (Oken and Gillman, 2003), could lead to complicated delivery (Koyanagi et al., 2013). This could pose additional threat to mothers and newborns in resource-scarce Ghana because of the challenges associated with providing essential obstetric care services.

The high rate of stillbirths in many developing countries is a matter of concern (Lawn et al., 2005; Liu et al., 2012). For instance, almost all (97–99%) of the estimated 3 to 4 million stillbirths and 3 million neonatal deaths that occur each year globally are in low- and middle-income countries (Stanton et al., 2006; Liu et al., 2012). The causes of stillbirth and neonatal death are generally inseparable (Bhutta et al., 2011). The main risk factors for stillbirth include intrapartum complications, maternal infection in pregnancy, maternal disorders (such as hypertension and diabetes), fetal growth restriction and congenital abnormalities (Lawn et al., 2005). Other risk factors for neonatal death include preterm birth, low birth weight and neonatal infection (WHO, 2011; Liu et al., 2012).

The Volta region of Ghana is among the regions with better than average health indicators including antenatal care coverage, facility based deliveries, use of bed nets against malaria carrying mosquito and lower malnutrition indices such as stunting, wasting and underweight and these factors might be expected to mitigate against low birth weight. There is an apparent improvement in health indicators in the Volta region compared to other regions, observed in the Ghana demographic and health survey (GSS/GHS, 2014). However, the Volta region is one of the regions with the highest proportion of teenagers who start childbearing early (22%) (GSS/GHS, 2014), a recognised risk factor for low birth weight and stillbirth (UNICEF, WHO, 2009). Given apparent variation in the LBW rate between different regions in Ghana as revealed by previous research coupled with the limited research in the region on pregnancy outcomes it was important to study the prevalence of abnormal birth weight, stillbirth and the relative impacts of various risk factors, in order to inform preventive public health initiatives to improve pregnancy outcomes. Therefore the main aim of this study was to assess the prevalence of abnormal birth weight and related maternal risk factors, as well as pregnancy outcomes, such as stillbirth.

Materials and methods

Study area

The study was conducted at the Hohoe Municipal Hospital. Hohoe municipality, situated in the heart of the Volta region of Ghana, constitutes one of the 25 administrative districts in the region and is one of the fastest growing commercial hubs in the region. The Hohoe Municipal Hospital with a bed capacity of over 200 does not only serve the almost 200,000 inhabitants resident in the municipality but is also a referral facility providing secondary and sometimes tertiary health care services to clients outside the municipality. The total fertility rate for the municipality is 3.3 (Ghana Statistical Service, 2010; GSS/GHS, 2014). The reproductive and child health unit of the municipal hospital provides antenatal, perinatal including basic and comprehensive emergency obstetric services and postnatal services to the 42,220 women in their reproductive years (15–49 years). Annually, the facility provides antenatal care to about 2000 women, with an average of 6 antenatal consultations per women.

Study design and population

The cross-sectional study investigated all delivery records over a 2-year period from January 2013 to December 2014 in Hohoe municipal hospital, Ghana. The data covered 4359 pregnant women between the ages of 12 and 51 years who delivered 4477 babies in the Hohoe municipal hospital. All the pregnant women with a documented delivery record in the delivery book were reviewed. After excluding multiple births, 4262 infant-mother pairs were included in the study. Maternal information that was extracted from the labour ward delivery book included maternal age, gravidity (number of pregnancies in her lifetime), parity (number of live children), number of doses of Sulfadoxine–pyrimethamine (SP) taken as part of Intermittent Preventive Treatment (IPT) for Malaria in Pregnancy, HIV status, partner involvement during labour and mode of delivery. Newborn information extracted included birth weight, sex and whether alive or dead at birth. All the 4262 were considered in the analysis and no cases were left out because of missing information. The study did not include home deliveries because health professionals do not supervise home deliveries and for that matter records such as birth weight and other maternal records used in this analysis are not available.

Statistical analysis

According to the World Health Organization (Rasmussen, 1992), a low-birthweight infant is one born with birth weight <2.5 kg while macrosomia is defined as birth weight ≥ 4.0 kg. Therefore, this study considered all birth weights ≥4.0 kg as macrosomic births, birth weight ≥2.5 kg< 4.0 kg as normal and <2.5 kg as low birth weight. Data was entered into Statistical Package for the Social Sciences (SPSS version 20) and transferred to STATA 12.1 for analysis. Consistency and plausibility checks were done after the data entry to ensure that errors were reduced. Descriptive statistics including means and standard deviations (SD) were used for continuous variables and frequency distributions were used for categorical variables. Relationships between categorical variables and birth weight means were determined by independent *t*-test (For example between mean birth weight of male and female infants). One-way ANOVA was used to compare means where more than two categories were formed. Multiple testing was controlled for by the use of Bonferroni corrections (Bland and Altman, 1995).

Explanatory variables under investigation were maternal age, gravidity, parity, number of doses of Sulfadoxine/pyrimethamine taken for intermittent preventive treatment of malaria in pregnancy (IPTp), HIV status, partner involvement during labour and delivery and sex of the newborn. The outcome variables were newborn's birth weight (low birth weight, normal, macrosomia), the mode of delivery (spontaneous vaginal delivery, vaginal delivery with episiotomy, caesarean section and other forms of delivery such as forceps delivery) and the condition of the newborn at birth (live and still births).

A multinomial logistic regression model was used to determine the associations between maternal factors and abnormal birth weight. This model was used because the dependent variable in this study was nominal (birth weight: 1=LBW, 2=normal, 3=macrosomia). The Hausman test performed indicated no evidence of violation of the independent of irrelevant alternative (IIA) condition. A p-value of less than 0.05 at 95% confidence level was considered as statistically significant. Relative risk ratio (RRR) was used to measure the association between birth weight (low birth weight and macrosomia) and related factors whilst adjusted odds ratio (AOR) was used to measure the association between stillbirths and associated factors.

Ethical considerations

Written permission was obtained from the health administration to use the health records. However, because this study was done at the population level whereby data were extracted from medical records with no individual identifications or interviews, informed consent was not obtained.

Results

The data was available for 4262 infant-mother-pairs. Therefore, the analysis was carried on 4262 infant-mother-pairs.

The mean birth weight was 2.98±0.50 kg. Estimated prevalence of low birth weight was 9.69% (n=543, CI: 8.8–10.6) while macrosomia prevalence was 3.03% (n=120, CI: 2.6–3.6). The average age of mothers was 27 years (Table 1). Fifteen percent (n=664) were age over 35 years, 12.9% (n=577) were between 15–19 years and 0.2% (n=11) were <15 years. The mean gravidity was three while the mean parity was two children excluding the index child (the child that the mother is currently nursing).

Table 1
Maternal and infant characteristics.

Variables (continuous)	Mean ± SD	Median	Ranges
Birth weight (kg)	2.98 ± 0.50	3	0.9–5.2
Maternal age (years)	27.0 ± 6.0	27	12–51
Gravidity	3.01 ± 1.87	5	1–13
Parity	1.55 ± 1.57	3	0–10
IPT usage	3 ± 1	3	0–4

Table two shows the results of the independent *t*-test and ANNOVA analysis. Significantly higher birth weights were observed among infants who were born through caesarean section (0.15 kg), third or fourth born (0.10 kg), fifth born (0.14 kg) and those born by mothers aged 31–40 years old (0.10 kg). While significantly lower birth weights were observed among; infants who were delivered by vaginal delivery (−0.42 kg); first born (−0.18 kg); girls (−0.08 kg) and those who were born to mothers <20 years old (−0.21 kg) (Table 2).

The risk of being born LBW was 2.04 times higher for a first-born child compared to that for a second or third born. The risk of a teenage mother giving birth to a LBW infant was 46% higher compared with that for a mother aged between 20 and 30 years.

Table 2
Maternal and newborn factors associated with differences in birth weight.

Variables	Categories	*N*	%	Mean ± SD (kg)	*P*-value
Mode of Birth	Caesarean section	614	14.4	3.12 ± 0.54	<0.0001*, †
	Spontaneous vagina birth	3123	73.1	2.97 ± 0.48	
	Vagina birth with episiotomy	468	11.0	2.97 ± 0.43	
	Other forms	70	1.6	2.55 ± 0.76	
Parity	1–2 children	1997	46.5	3.01 ± 0.49	<0.0001*, §
	3–4 children	755	17.5	3.11 ± 0.49	
	>4 children	204	4.8	3.15 ± 0.53	
	No previous child	1342	31.2	2.83 ± 0.49	
Sex	Male	2182	50.8	3.02 ± 0.48	<0.0001¶
	Female	2115	49.2	2.94 ± 0.49	
Age of mother	<20	576	13.5	2.77 ± 0.47	<0.0001*, **
	20–30	2461	57.5	2.98 ± 0.81	
	31–40	1090	25.6	3.08 ± 0.51	
	>40	164	3.4	2.98 ± 0.67	
Intermittent preventive treatment	1 dose	241	5.6	2.93 ± 0.54	0.0057*,‡
	2 doses	535	12.5	2.95 ± 0.51	
	3 doses	2175	50.9	3.01 ± 0.48	
	Did not take	1321	30.9	2.96 ± 0.52	
Partner support	No	2725	86.7	2.97 ± 0.50	0.0761¶
	Yes	573	13.3	3.01 ± 0.51	
HIV status	Negative	4235	98.5	2.97 ± 0.50	0.5643¶
	Positive	63	1.5	2.94 ± 0.60	

* one way ANOVA.
† caesarean section, spontaneous birth, delivery with episiotomy, other forms.
§ 1–2 children, 3–4 children, >4 children, No previous child.
¶ independent *t*-test.
** <20, 20–30, 31–40, >40.
‡ 1 dose, 2 doses, 3 doses, did not take SP.

Moreover, the risk for a mother who did not take any dose of IPT during pregnancy or took just one dose giving birth to a LBW infant as against normal was 57% higher than that for mothers who took three doses of IPT (Table 3).

The risk of being born macrosomic for a fifth born was 2.66 times higher compared to a second or third born. The risk for a teenage mother given birth to a macrosomic baby as against normal was 78% lower compared to a mother aged 20–30 years as shown in the hand panel of table three.

One hundred and eighteen infants (2.77% of the study population) died before they were born or were born dead. The prevalence of stillbirth among low-birthweight infants while it was 9.2%; it was 1.94% among infants with normal birth weight and 6.2% among macrosomic infants (Table 4). The stillbirth rate was calculated to be 27 deaths per 1000 births. Infants born with LBW were 5.6 times more likely to be born dead or found to be dead in utero compare to those who were born with normal birth weight. Infants who were born by caesarean section and other forms of virginal delivery were 3.2 and 3.6 times respectively more likely to be born dead or found to be dead in utero compare to those born by normal virginal delivery (Table 4).

Discussion

The analysis showed that first-borns had a greater risk of low birth weight than second- or third-born infants. There was also an increased risk for mothers < 20 years giving birth to low birth weight infants and those who took only one or no intermittent preventive treatment for malaria during pregnancy. The risk of macrosomic birth was higher among 5th born infants. The study revealed a stillbirth rate was 27/1000 births. Thirty-two percent of the stillbirths (n=38) had low birth weight whereas 6.8% (n=8) were macrosomic. There was a more than fivefold and more than twofold increase in odds for stillbirth among low birth weight and macrosomic infants respectively.

This study appears to be the first of its kind in the Volta region of Ghana to systematical analyze pregnancy outcomes (low birth weight, macrosomia and stillbirths) and related factors, and establishes that the estimated prevalence of low birth weight in Hohoe municipality is low compared to the national prevalence (UNICEF, 2013) and almost within the WHO's target of < 10%. This may add significantly to the apparent improvement in health indicators in the Volta region compared to other regions, observed in the Ghana demographic and health survey (GSS/GHS, 2014). For example, the prevalence estimated in this study is about two times lower than that observed in the Ashanti (Michael et al., 2013) and Northern regions of Ghana (Abubakari et al., 2015). These differences might be expected since the Northern region is one of the poorest regions in Ghana (Ghana Statistical Service, 2010), but not in Ashanti region where most of Ghana's natural resources are found.

The estimated prevalence of macrosomia in the Hohoe municipality was found to be low compared to other regions in Ghana

Table 3
Risk factors for abnormal birth weight.

Maternal & infant factors	Low birth weight					Macrosomia				
	Prevalence n/N	%	RRR	P > z	95% CI	Prevalence n/N	%	RRR	P > z	95% CI
Parity										
1–2	169/1997	8.5	Ref.			60/1997	3.0	Ref.		
3–4	50/755	6.6	0.81	0.252	0.56–1.16	37/755	4.9	1.53	0.068	0.96–2.40
> 4	12/204	5.9	0.70	0.290	0.37–1.35	19/204	9.3	2.66	0.002	1.43–4.95
Nulliparous	208/1342	15.5	2.04	< 0.0001	1.59–2.64	14/1342	1.0	0.45	0.011	0.24–0.83
Sex of baby										
Male	207/2182	9.5	Ref.			79/2182	3.6	Ref.		
Female	232/2115	11.0	1.22	0.055	1.0–1.50	50/2115	2.4	0.65	< 0.023	0.45–0.94
HIV status										
Negative	429/4235	10.1	Ref.			127/4235	3.0	Ref.		
Positive	10/63	15.9	1.90	0.073	0.94–3.82	3/63	4.8	1.75	0.360	0.53–5.77
Age of mother										
21–30	226/2461	9.2	Ref.			65/2461	2.6	Ref.		
< 20	104/576	18.1	1.46	0.007	1.11–1.93	2/574	0.4	0.22	0.044	0.05–1.0
31–40	84/1097	7.7	1.07	0.632	0.80–1.45	49/1097	4.5	1.08	0.713	0.70–1.67
> 40	25/164	15.2	1.18	0.630	0.60–2.34	14/164	8.5	1.75	0.123	00.86–3.57
IPT intake										
3 doses	177/2175)	8.1	Ref.			70/2175	3.2	Ref.		
1 dose	30/241	12.5	1.57	0.038	1.02–2.39	9/241	3.7	1.37	0.386	0.67–2.83
2 doses	61/535(	11.4	1.37	0.053	1.0–1.88	12/535	2.2	0.69	0.259	0.37–1.31
Did not take IPT	171/1347	12.7	1.57	< 0.0001	1.24–1.98	39/1347	2.9	0.87	0.500	0.58–1.31
Mode of birth										
SVD	319/3123	10.2	Ref.			81/3123	26.0	Ref.		
C/S	41/614	6.7	0.61	0.005	0.43–0.86	37/614	6.0	2.56	< 0.0001	1.69–3.86
Forceps birth	23/70	32.9	3.97	< 0.0001	2.32–6.79	2/70	2.9	1.41	0.645	0.33–6.10
Vaginal birth with episiotomy	42/468	9.0	0.58	0.003	0.41–83	9/468	1.9	1.35	0.425	0.65–2.79

Data presented as % (n/N) unless otherwise indicated. Low birth weight defined as < 2.5 kg whereas macrosomia is defined as > 4.0 kg. RRR= relative risk ratio; CI= confidence interval. Estimates based on maximum-likelihood multinomial logistic regression models.
The final model was significant (Prob > X^2=0.0000).

Table 4
Risk factors for stillbirth.

Variables	Categories	Stillbirths			
		n/N	%	AOR (95%CI)	*P*-value
Birth weight	Low birth weight	38/413	9.20	5.6(3.6–8.7)	< 0.0001
	Normal	72/3720	1.94	Ref.	
	Macrosomia	8/129	6.20	2.4(1.1–5.3)	0.025
Mother's age/years	< 20	11/574	1.92	0.5(.3–1.0)	0.055
	20–30	70/2452	2.85	Ref.	
	31–40	32/1090	2.94	0.9(0.5–1.4)	0.540
	> 40	5/146	5.0	0.7(0.2–2.1)	0.547
Parity	1–2	45/1971	2.28	0.7(0.4–1.2)	0.152
	3–4	24/752	3.19	Ref.	
	Grand multi parity	9/201	4.48	1.5(.7–3.4)	0.343
	Nullparity	40/1338	2.99	0.9(0.5–1.7)	0.723
Mode of birth	C/S	37/606(6.11)	6.11	3.2(2.1–5.0)	< 0.0001
	SVD	70/3116	2.25	Ref.	
	Other forms	7/67	10	3.6(1.5–8.5)	0.004
	Vaginal birth with epis	4/467	0.86	0.4(0.1–1.2)	0.095
IPT usage	1-dose	11/241	4.56	2.0(1.0–3.9)	0.051
	2-doses	18/535	3.36	1.3(0.8–2.4)	0.299
	3-doses	51/2168	2.35	Ref.	
	Did not take	38/1309	2.90	1.0(0.7–1.7)	0.699
HIV/AIDS status	No	114/4199	2.71	Ref.	
	Yes	4/62	6.45	2.3(0.8–3.9)	0.116
Sex	Male	60/2159	2.78	Ref	
	Female	58/2103	2.76	0.9(0.7–1.4)	0.872

for which data is available. For example a study conducted in Kumasi found an estimated macrosomia prevalence of 10.5% (Addo, 2010) whilst in the Northern region 11.7% macrosomic births were found (Abubakari et al., 2015). The prevalence observed in the present study (2.7%) was also lower than that estimated in two other African countries. For example a study conducted in Port Harcourt, Nigeria estimated 14.65% prevalence (Ojule et al., 2010). Whilst in Algeria, an estimated prevalence of 14.9% was found (Koyanagi et al., 2013).

Besides this, another study conducted in the Northern Region of Ghana (including Tamale the regional capital and surrounding districts such as Sanerigu District and Savelugu-Nanton Municipality found low birth weight prevalence of 26.1% and 11.7% prevalence of macrosomia (Abubakari et al., 2015). The study was conducted among urban, peri-urban and rural areas and so there was variation in the study population in terms of socio-economic status. This may reflect in the high prevalence of both low birth weight and macrosomia as compared to this study. The study population (pregnant women delivering at the Hohoe Municipal Hospital) of the present study was fairly uniform and mostly middle-income group. Thus a reflection in the moderate prevalence of macrosomia and low birth weight observed.

The current study reveals that women aged 18 years or less were more likely to deliver LBW babies. This could be due to the fact that this age group is physical and emotional immature and their bodies are unable to withstand the stress of pregnancy. This observation may be in line with a study conducted in Vietnam, which showed that women who were less than 18 years had increased odds for LBW (Louangpradith Viengsakhone et al., 2010). In Gambia, a study revealed that mothers younger than 20 years were 1.8 times more likely to give birth to LBW babies than were older women (Jammeh et al., 2011).

Our study also shows that no or low utilisation (< 2 dose of SP) of IPT during pregnancy increases the risk of LBW compared to high utilisation (3 doses of SP). This finding was in conformity with a number of other studies conducted in Africa. For instance, a study conducted in Kenya (Van Ewijk et al., 2013) showed that IPT utilisation (> 1 dose of SP) was associated with decreased odds for LBW. This could be due to the effect of malaria parasites on intrauterine growth, influencing nutrient transport to the fetus. First, a high density of parasites and chronic parasitic infection in the placental blood and the related cellular immune response could result in consumption of glucose and oxygen that would have been utilised by the fetus (Umbers et al., 2011). Moreover histopathological studies of infected placentas showed a thickening of the cytotrophoblastic membranes, which may interfere with nutrient transport (Ataide et al., 2015).

Our study also tended to confirm risk factors for macrosomia established by other studies. For example, parity of two to three children was associated with increased risk for macrosomic births in this study, and consistent with the findings of the study conducted by (Koyanagi et al., 2013) in which higher parity was associated with an increased in odds ratio for macrosomia across 23 countries.

The overall stillbirth rate of 27 per 1000 deliveries identified in this study is higher than the national rate of 13/1000 deliveries (GSS/GHS/ICF Macro, 2009). It is also higher than the rate found in the study conducted in the Upper East region of Ghana which, reported a stillbirth rate of 23/1000 deliveries (Engmann et al., 2012), and lower than that in the Central region of Ghana reported as 35/1000 deliveries (Edmond et al., 2008). Nonetheless, the rate observed in the current study is over fourfold higher than is reported for high-income countries generally (Lawn et al., 2005; Stanton et al., 2006; Blencowe et al., 2012). The high rate of stillbirth might partly be explained by the high proportion of teenagers becoming pregnant at early ages in the study location (13.1%, $n=588$) compared to teenagers in the other regions of Ghana (GSS/GHS, 2014). It was observed in this study that teenagers were more likely to deliver LBW infants. This observation is consistent with the WHO report which reveals that globally LBW account for 31% of all neonatal deaths (UNICEF, WHO, 2009). Further infants with LBW were found to be fivefold more likely to be born dead in this study. This finding is consistent with (Bhutta et al., 2011) who found under nutrition and fetal growth restriction as important causes of stillbirth. Moreover, there was more than twofold increase in odds of stillbirth among macrosomic infants. This finding may be in agreement with the finding of (Bukowski et al., 2008) who found that fetal macrosomia was associated with a 3-fold increased risk of stillbirth.

An analysis of South African antenatal audit data for 2008/2009 showed that more than half of the intrapartum stillbirths without an identified cause were associated with abnormal labour or maternal hypertension (Lawn et al., 2005). This finding is in consistent with the findings of the present study as infant born by C/S and other forms of vaginal birth such as forceps birth and vacuum extraction were more likely to be born dead than those born by normal labour (SVD).

A key limitation of this study was that the study used routine data recorded by health professionals during birth. Therefore, measurements errors concerning recordings and readings parameters such as birth weight and other indices were likely to occur but the effect of these errors was random and unlikely to affect the result of this study. Also, the effect of gestational age on pregnancy outcomes could not be assessed because this information was unavailable in the records used. The findings should be interpreted with caution, as the records of infants delivered at the Hohoe Municipal Hospital were analyzed excluding home deliveries.

Conclusion

Our findings show that LBW and macrosomia, proxies for intrauterine under and over nutrition respectively co-existed among infants in Hohoe municipality. This reflects the 'double burden of malnutrition phenomenon', which is currently experienced by transition and developing countries, although the observed rate were low compared to some other regions in Ghana. This study reveals the prevalence of low birth weight and macrosomia are related to specific risk factors in Volta region of Ghana such as parity, age of the mother and intermittent preventive treatment of malaria during pregnancy. The unacceptably high rate of stillbirths coupled with concurrent LBW and macrosomia revealed by this study call for more research on these topics so as to provide empirical evidence that could assist development of policies and strategies to address these challenges. This is because LBW and macrosomia have adverse consequences later in life, and in this study, both ends of the birth weight spectrum were associated with increased risk of stillbirth. The study also provides empirical support to the links that exist between factors such as maternal age, parity, sex of infants, and intake of IPT during pregnancy on birth weight.

Implication for practice

Health promotion strategies including school health services aimed at preventing pregnancies among teenagers should be introduced, to aid in the reduction of stillbirth rates and their impact assessed. Similarly, family planning strategies should be intensified to reduce pregnancies among grand multiparous women.

Conflict of interest

We have no conflict of interest to declare.

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