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Determinants of Low Birth Weight in the Nabdam District of the Upper East Region, Ghana

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background: The incident of low birth weight and its associated implication has become a great public health concern. Low birth weight is the birth weight of a child less than 2.5 kg. several factors have been implicated in the development of low birth weight. The purpose of the study was to assess the determinant of low birth weight.
Methods: A quantitative cross-sectional design was conducted with a sample size of 183 post-natal women who had delivered 12 months and below in the district. The participants were interviewed using structured questionnaire. Purposive sampling technique was used in recruiting the participants for the study and ethical approval sought from the Nabdam District Health Directorate. An SPSS version 20 was used to process the data and generated the descriptive statistics such as frequencies, percentages, mean, mode and standard deviations.
Results: Out of 183 new born babies, 146 (79.8%) were normal whiles 37 (20.2%) had low birth weight. The impact of marriage, education, place of stay, planned pregnancy employment and health insurance were significant with a p-value of < 0.001. Maternal and obstetric factors such as parity, gestational age at delivery and mode of delivery had p-values of <0.001 which were significant. The effect of gestational age at ANC, number of ANC visits anemia in pregnancy, religion and age had no association with low birth weight.
Conclusions: This study shows that among babies born to mothers with increased parity, low level

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of education, unemployed and short gestational ages were at risk of low birth weight. Therefore, in order to reduce the high prevalence of low birth weight in the community, every pregnant woman should be encouraged to obtain the national health insurance cards that will enable them attend regular antenatal clinics.

Keywords: Anaemia; pre-term; parity; low birth weight; gestational age.

1. INTRODUCTION

"A newborn's birth weight is their initial weight after delivery. Early newborn mortality, morbidity, and long-term health consequences can all be predicted by it [1]. Most term babies weigh between 2.5 kg and 4.0 kg at birth. To prevent newborn death, individuals with abnormally low or abnormally high birth weights need specific care. Low birth weight (LBW) is birth weight of less than 2.5kg irrespective of the gestational age" [2]. "Together with premature births, LBW is a significant predictor of infant death during the first month of delivery and serves as a warning sign for possible long-term effects on individuals, families, and entire communities" [3]. "An accurate predictor of a population's reproductive and general health status is a baby's birth weight. This indicator is not only about the baby's health and nutritional state but also the physical and psychosocial growth and development of babies and their chances of survival" [3].

"More over 20 million babies each year, or 15% to 20% of all births worldwide, are thought to be low birth weight. The 2012 World Health Assembly set a target of reducing by 30% by 2025 the number of newborns born weighing less than 2.5 kg. This would result in a drop from roughly 20 million to 14 million newborns with low birth weight, or a relative reduction of 3% per year between 2012 and 2025". [2]. Low birth weight is prevalent in sub-Saharan Africa between 13 and 15%. In low- and middle-income countries (LMIC), 32 million babies were born with LBW in 2010, of which 2.8 million were preterm.

"Additionally, according to the 2014 Ghana Demographic and Health Survey, 10% of neonates that were weighed at delivery had an LBW" (GDHS, 2014). "According to the Ghana Multiple Indicator Cluster Survey (MICS), the prevalence of LBW was 9.1% in 2006 and 11% in 2011" [4]. "Low birth weight has been linked to both short gestation (less than 37 full weeks) and intrauterine growth restriction, according to studies. These two primary causes of LBW have various etiologies and mortality and morbidity risks" [5]. "In addition, of the 18 million low birth weight newborns delivered annually, roughly 59% are the result of intrauterine growth restriction in term infants and 41% are caused by preterm" [5]). "There is a significant burden of foetal growth restriction worldwide, and low birth weight in term infants is associated with intrauterine growth restriction. For instance, in low- and middle-income nations in 1998 and 2010, respectively, 13.7 million and 10.6 million infants were born at term with low birth weights; these low birth weights were ascribed to intrauterine growth constraints" [6].

"LBW is linked to poorer socioeconomic status, female sex, rising parity, young maternal age, inadequate maternal education, low calorie intake, malaria, and general illness in many low- and middle-income countries" [6,7]. Additionally, research has shown a connection between the ABO blood type and birth weight [8,9]. For instance, Beyazit et al. [8] showed that "type B blood group pregnant women in Turkey had significantly lower birth weight babies compared to women with other ABO blood groups".

"Additionally, a case-control study conducted in Nepal revealed that having maternal blood type AB had some protective effects against having a kid that was born underweight" (Kumar Bhaskar et al., 2015). Maternal hemodynamics, prenatal care appointments, folic acid consumption, and the standard of antenatal care are other potential contributing variables in determining baby weight [6,7]. "There is empirical evidence to support the relationship between socio-demographic characteristics, maternal and obstetric factors, and birth weight, according to a number of research conducted in low- and middle-income countries" [10,11]. However, there has not been any research done on what causes LBW in Ghana's Nabdam district. Understanding the drivers of LBW in the district is necessary to alter the risk factors for LBW and prevent the life-long difficulties linked to it. In order to prevent low birth weight and its sequelae, this study set out to identify socio-demographic, maternal, and obstetric risk factors that are linked to it in that

district. It also attempted to provide empirical data for clinical and public health interventions.

2. METHODS

2.1 Study Setting

The study was conducted in the Nabdam district. The district is one of the 260 Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana, and forms part of the fifteen (15) Municipalities and Districts in the Upper East Region. It was carved from Talensi Nabdam and forms part of the new 46 Districts and Municipalities created in the year 2012 under the legislative Instrument (LI) 2105. The district has Nangodi as its administrative capital. The district lies between latitudes 100 47° and 10057° North and Longitudes 0031° and 1015° west. It has a total land area of 244.94km2. It is bordered to the north by the Bongo District, south by the Talensi District, to the east by the Bawku West District and to the west by the Bolgatanga Municipality. The district has two distinct seasons, the rainy season, which is erratic, and runs from May to October each year and dry season which is long and stretches from October to April. Temperatures can range from maximum of 45℃ in March and April with a minimum of 12℃ in December. Their main occupation is farming.

Nabdam is a rural district with a total population of 41,646 out of which 9,995 are women of the reproductive age. There are four health centers, two clinics and 18 functional Community-based Health Planning and Services (CHPS) Compounds. One of the two clinics is privately owned. There is only one medical doctor who works for the private clinic in the district and there are approximately 100 nurses and midwives in the district. However, the midwife to women in reproductive age ratio is 1:5. Meanwhile trained community health nurses assist in the provision of ANC services in the district. ANC services are provided at all health centers, clinics and functional CHPS compounds.

2.2 Study Design

In this study, the design used was cross-sectional, with data collected at a single point in time. The study seeks to look at determinants of LBW among mothers attending postnatal care, who previously attended ANC in Nabdam District for their last child.

2.3 Target Population

The target population for the study are lactating mothers who have delivered babies within 12months from the healthcare facilities in the district.

2.4 Inclusion Criteria

- Mothers of reproductive age who delivered a live birth in the past 12 months and have attended antenatal care within the period of pregnancy within the same District.
- Mothers with maternal health record at the time of survey.
- Mothers who agree to participate in the survey.

2.5 Exclusion Criteria

- Mothers without their maternal health record.
- Those who had a still birth did not also participate in the study.
- Mothers who do not consent to participate in current study.

2.6 Sample Size

The sample size was calculated using the prevalence of low birth weight of 13.8% (Awintuen et al., 2018). Cochran (1977) formula below is used for the estimation of the population sample size for this study.

$$n = \frac{Z^2 1\text{-}\alpha/2 P(1-P)}{d^2}$$

where n: number of infants to be enrolled,
Z (at 95% confidence interval): 1.96
Margin of error (d): 5%
Population proportion of low-birth-weight babies (P): 13.8%

$$n = \frac{(1.96)^2 \times 0.138(1-0.138)}{(0.05)^2}$$

n= 183

A sample size of 183 participants were recruited for the study.

2.7 Sampling Procedure

Purposive sampling technique was used for the study. In all 183 mothers were interviewed using questionnaires which was administered to mothers to fill. Mothers who could not read and

write were assisted by interpreters. All mothers who met the inclusion criteria were conveniently sampled for the study. Data was collected from mothers at the premises of all the selected health facilities according to their postnatal care scheduled dates. In all there are four sub district health facilities that were used as sites for this study.

2.8 Data Collection Tools

Structured questionnaires were used in the collection of data. In designing the instrument, the three objectives guiding this study were used as indicators. Similarly, gaps realized during literature review in the content of this study served as rich sources of identifying items to be included in the instruments. The systematic procedure of composing the instruments is; the objectives are revisited and critically analyzed to arrive at the final questionnaire. Item pool is composed through brain storming to elicit any thought that could be necessary in addressing the objectives of the study. These are written in the form of questions and statements. The item pool is then subjected to scrutiny and as such items that are judged to be inappropriate for this study were eliminated. Data such as occupation of husbands, number of visits by mother, number of SPs, immunizations and child's birth weight was also obtained from the antenatal card.

2.9 Data Analysis

Statistical Package for Social Sciences (SPSS) version 20 was used to process the data and to generate descriptive statistics such as frequencies, percentages, mean, mode, and standard deviation.

2.10 Data Management

The data collection method is purely quantitative with well-structured questionnaires containing eighteen (18) questions which were made of close ended and open-ended questions. Data collected were then analyzed using Microsoft excel presented using tables, bar charts and pie chart.

2.11 Pretest

A pretest of 20 participants were done at the Nabdam District to test the proficiency of the instruments used for the study and the participants' response to the questionnaire. This enabled all necessary corrections to be done.

3. RESULTS

3.1 Socio-demographic Characteristics

A total of 183 women participated in the study. The age distribution was similar among women aged 15-24 years (40.4%) and those aged 25-34 years (39.9%). Most of the women (70%) were married, 69.4% were Christians while Muslims and Traditionalist were equally distributed (13.3%) each. More than half of the women (54.7%) had no formal education, 64.5% were from rural area and about three-quarters (75.4%) of them did plan for their pregnancy. Less than half (40.4%) of the women were employed, 70% of them had a valid health insurance and majority of their partners (44.8%) had no formal education.

3.2 Maternal and Obstetric Characteristics

About three-quarters (74.9%) of the women were between parity one to three while 25.1% were parity four and above. Approximately half (50.3%) of the women registered for ANC in their first trimester and 74.9% had ANC four or more visits. More half (59.6%) of the women had taken SP three or more doses, 44.8% of them had low HB, and 82.5% of the women delivered at term (≥ 37 weeks). Most of the women (82.5%) had vaginal delivery and 55.2% of the babies were females while 44.8% were males.

3.3 Distribution of Birth Weight

The prevalence of low birth weight according to this study was 20.2%. Low birth weight was 16.4%, very low birth weight was 2.7% and extremely low birth weight was 1.1%. However, babies with normal birth weights were 79.8%.

4. DISCUSSION

4.1 Prevalence of Low Birth Weight

"This study found that the prevalence of low birth weight in Nabdam District to 20.2%. The study findings are higher compared to other previous studies in Ghana. For example," [12], in a study in the metropolis of Tamale found that the prevalence of low birth weight was 11.9%. Another study in Sunyani by Mohammed et al., [13], also found that "the prevalence of low birth weight was less than

10%. However, the prevalence is higher in some regions of Ghana. For instance, a 2015 study in the Northern area reported a frequency of 26%" [7], and "a study conducted in the Ashanti region of Ghana found a prevalence of 21%" [14].

Table 1. Socio-demographic factors associated with birth weight

Variables	Normal birth weight (%)	Low birth weight (%)	Chi-Square	p-value
Age			**3.46**	**0.177**
15-24	64 (43.8)	10 (27.1)		
25-34	55 (37.7)	18 (48.6)		
35-49	27 (18.5)	9 (24.3)		
Marital status			**19.93**	**<0.001**
Single	55 (37.7)	00 (0)		
Married	91 (62.3)	37 (100)		
Religion			**7.11**	**0.029**
Traditional	19 (13.0)	9 (24.3)		
Christianity	108 (74.0)	19 (51.4)		
Islamic	19 (13.0)	9 (24.3)		
Educational level of mother			**38.49**	**<0.001**
No formal education	63 (43.1)	37 (100.0)		
Primary	27 (18.5)	0 (0.0)		
Secondary	28 (19.2)	0 (0.0)		
Tertiary	28 (19.2)	0 (0.00		
Place of stay			**25.55**	**<0.001**
Rural	81 (55.5)	37 (100.0)		
Urban	65 (44.5)	0 (0.0)		
Planned pregnancy			**14.48**	**<0.001**
Yes	120 (82.2)	18 (48.6)		
No	26 (17.8)	19 (51.4)		
Employed			**31.48**	**<0.001**
Yes	74 (50.7)	0 (0.0)		
No	72 (49.3)	37 (100.0)		
Health insurance			**45.92**	**<0.001**
Yes	119 (81.5)	9 (24.3)		
No	27 (18.5)	28 (75.7)		
Partner's educational level			**57.12**	**<0.001**
No formal education	45 (30.8)	37 (100.0)		
Primary	45 (30.8)	0 (0.0)		
Secondary	18 (12.3)	0 (0.0)		
Tertiary	38 (26.1)	0 (0.0)		

Table 2. Maternal and obstetric factors associated with birth weight

Variables	Normal birth weight (%)	Low birth weight (%)	Chi-Square	p-value
Parity			**16.94**	**<0.001**
0-3	119 (81.50)	18 (48.6)		
4+	27 (18.5)	19 (51.4)		
Gestational age at ANC registration			**4.39**	**0.111**
1st trimester	73 (50.0)	19 (51.4)		
2nd trimester	55 (37.7)	9 (24.3)		
3rd trimester	18 (12.3)	9 (24.3)		
Number of ANC visits			**0.01**	**0.899**
1-3	37 (25.3)	9 (24.3)		
4+	109 (74.7)	28 75.7)		

Variables	Normal birth weight (%)	Low birth weight (%)	Chi-Square	p-value
Number of SP doses taken			**2.29**	**0.130**
0-2	55 (37.7)	19 (51.4)		
3+	91 (62.3)	18 (48.6)		
Haemoglobin level during pregnancy			**0.28**	**0.599**
< 11g/Dl	64 43.8)	18 (48.6)		
≥ 11g/Dl	82 (56.2)	19 (51.4)		
Gestational age at delivery			**80.62**	**<0.001**
< 37 weeks	7 (4.8)	25 (67.6)		
≥ 37 weeks	139 (95.2)	12 (32.4)		
Mode of delivery			**17.08**	**<0.001**
Vaginal delivery	137 (89.0)	14 (48.3)		
Caesarean section	17 (11.0)	15 (51.7)		
Sex of child			**7.87**	**0.005**
Male	73 (50.0)	9 (24.3)		
Female	73 (50.0)	28 (75.7)		

4.2 Socio-demographic Factors Associated with Birth Weight

Numerous studies have shown a connection between low birth weight and a mother's marital status. Marriage status and birth weight were shown to be strongly correlated in the current study. Children with low birth weights were more likely to be born to mothers who were married or in any other type of partnership. This result conflicts with a Tampah-Naah study from 2016, which found that marriage can be a protective factor against low birth weight and that unmarried moms are more likely to have babies who are underweight [15]. The importance of family support in the nation may be an argument. In Ghana, some married women also receive support from their extended family, such as their grandparents, uncles, and aunts, in addition to their spouses or immediate family. The roles that these people play may create an environment where married women are less likely to give birth to low-birth-weight babies. Some religious and cultural beliefs which bar women from eating certain types of foods during pregnancy such as eggs, can contributes significantly to low birth weight.

“The study also found that the level of education of the women and their partners were significantly associated with birth weight of a child. This finding is in line with several studies which link low birthweight to non-formal education” [16]. The improvement in ANC attendance, nutritional status, health-seeking behaviour, and maternal experiences with pregnancy and childrearing that results from more maternal education may be one explanation for this. Additionally, a longer period of maternal education may delay sexual beginning or result in a greater usage of contraception to avoid pregnancy. Inadvertently, this may result in a higher maternal age at the time of the first birth and a lower probability of low birth weight due to adolescent pregnancy.

Place of stay was also associated with birth weight. Women from rural areas were more likely to give birth to low-birth-weight children compared to those from urban areas. Rural areas are associated with high socio-economic hardship and also lacks basic health facilities which might predispose them to giving birth to low birth weight. The results also showed that women who planned their pregnancy were more likely to give birth to a normal birth weight child compared to those who did not plan their pregnancy. Planning before becoming pregnant is likely to put women in a comfortable position to be able manage pregnancy related issues from nutrition, to ANC attendance and to delivery. This might help reduce the incidence of low birth weight.

Employment status was associated with birth weight according to this current study. This study corroborated the Dooley & Prause [17] finding that there is a substantial relationship between maternal jobless status and outcomes related to low birth weight. Employed moms had a decreased risk of giving birth to low-birth-weight babies than jobless mothers, according to similar findings by Casas et al. (2015). Maternal unemployment can result in stressful circumstances brought on by low or no income, and these stressors heighten a range of

physiological markers connected to the delivery of babies with low birth weights. Kozhimannil et. al. [18] research, on the other hand, found no link between maternal work status and newborn birth weight. The results of the study also show that women with a health insurance are more likely to deliver a baby with normal birth weight. Previous studies have shown that maternal health insurance increases the utilization of ANC services among women, and this will likely lead to improve pregnancy outcomes.

4.3 Maternal and Obstetric Factors Associated with Birth Weight

"The study found that preterm delivery was significantly associated with the of low birth weight. Pre-term newborns are frequently underweight, as seen in earlier research; hence, once delivery takes place at term, there is a substantial possibility that the baby will weigh more than 2.5 kg. According to the findings, which are consistent with those of other writers, the likelihood of having a baby with low birth weight dramatically rises with increasing parity" [7]. "There is currently no discernible mechanism for how parity affects LBW" [19]. "The risk of chronic anaemia, diabetes mellitus, and hypertension in multiparous women, as well as the higher incidence of placenta previa, abruption, aberrant presentation, and haemorrhage in grand multiparous women, have all been linked to reduced foetal growth and duration of pregnancy, which may incline to low birth weight" [19].

"Mode of delivery was also found to be associated with birth weight of children. The results of this study found that babies born through caesarean section were more likely to be born with low birth weight compared to normal vaginal deliveries. The finding is corroborated by other previous studies. For example, according to a Chinese study, the number of caesarean sections performed on low-birth-weight babies increased as the number of gestational weeks increased" [20]. According to the data, low birth weight infants had a higher caesarean section rate (61.14%) than normal birth weight infants (52.947%).

This study found neonatal sex as a very significant risk factor since it was closely related to children's birth weight. Compared to male newborns, female neonates were more likely to have low birth weights. In southern Ghana, Manyeh (2016) discovered that being born a woman protected against having a low birth weight. In contrast, Abubakari [7] discovered that being a male neonate was actually very protective against having a low birth weight in rural Northern Ghana. Geographically and racially distinct regions of Ghana's south and north may account for the differences seen. To establish the variance in newborn sex as a risk factor for low birth weight in the northern and southern regions of Ghana, additional research will be required in this area.

5. CONCLUSION

This study shows that among babies born to mothers with increased parity, low level of education, unemployed and short gestational ages were at risk of low birth weight. Therefore, in order to reduce the high prevalence of low birth weight in the community, every pregnant woman should be encouraged to obtain the national health insurance cards that will enable them attend regular antenatal clinics. These findings add to the growing body of research on low birth weight in resource-constrained environments and the effects of sociodemographic and maternal obstetric variables.

CONSENT AND ETHICAL APPROVAL

An introductory letter from University for Development Studies was obtained and the research proposal submitted to the Nabdam District Health Administration for ethical consideration. Following approval, the permission letter was sent to the heads of the various health centers to allow the enrollment of participants who met the inclusion criteria of the study. Written informed consent was sought from participants after a detailed explanation was given to ensure the right of self-determination and autonomy before each interview began. The purpose of the study, risk, and benefits as well as voluntary participation was properly elaborated to every study participant before they consented to partake in the study. Code numbers were assigned to study participants to ensure their anonymity. The participants were treated with respect and their rights to privacy and confidentiality.

Responses to this survey was anonymous and participants were be asked not to write any personal information. Codes numbers were assigned to participants and were used on all research notes and documents. Participant data

was being kept confidential at all time in a computer under password protection.

Researcher's contact number was given to participants who would like to call for assistance. Participants were made aware that their participation in this study is voluntary and they have the rights to opt out anytime they so wish, and their withdrawal will not affect the provision of service given. Participants were made to sign a consent form after they have read and understood the benefits and risks associated with the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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