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RESEARCH ARTICLE

Magnitude and Associated Risk Factors for Low Birth Weight in Bentiu State Hospital in Unity State, Republic of South Sudan

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Abstract:

Background: Low Birth Weight which is birth weight of less than 2500g remains a significant public health problem. It is responsible for significant neonatal morbidities, mortalities and disability in infancy, childhood which is associated with long term impact on health outcomes in later life.

Methods: The study used facility based cross sectional study design that involved 285 postpartum mothers and 285 newborns in Bentiu Hospital, South Sudan. Sample size was determined using Kish Leslie's formula of 1965. Data was entered into Epi-Info v3.3.1 and exported to SPSS version 20 for statistical analysis at 95% confidence interval. Statistically significant variables with probability values less than 0.05 were re-analyzed at multivariable logistic regression into odds ratios with subsequent 95% confidence intervals.

Results: At Multivariable logistic regression, mothers aged 25-29 (AOR=7.17, 95%CI: 1.176-43.765, p=0.033), those aged 30-34 (AOR=10.73, 95%CI: 1.629-70.743, p=0.014) and those ≥35 years (AOR=4.34 95%CI: 0.622-30.292, p=0.138) were significantly associated with LBW. Business women (AOR=0.19 95%CI: 0.055-0.682, p=0.011) and those in salaried employment (AOR=0.19 95%CI: 0.039-0.921, p=0.039) were less likely to have LBW babies. Low social support was significantly associated with LBW (AOR=3.65 95%CI: 1.77-7.525, p<0.001). Surprisingly, mothers with >4 ANC attendance were 68.99 times more likely to produce LBW compared to those with less than four visits (AOR=68.99 95%CI: 1.021-4661.183, p=0.049). Mothers with no pregnancy complication experience were less likely to bear LBW was (AOR=0.42 95%CI: 0.181-0.994, p=0.048). Mothers who did not take folic acid (AOR=4.82,

95%CI: 2.233-10.392 p<0.001) and antibiotics (AOR=8.7495%CI: 3.597-21.248 p<0.001) during pregnancy were 4.82 and 8.74 times more likely to give birth to LBW babies compared to those who were given and consumed it.

Conclusion: Low Birth Weight was high at 23.5%, late reproduction, low social support, pregnancy complications, lack of social support, not taking folic acid and antibiotics increased prevalence of LBW. Reproducing at right age, providing social support, preventing pregnancy complications, ensuring access and intake of folic acid and antibiotics during ANC at health facility and during community outreaches can have valuable influence on pregnancy outcome. Mothers who attended >4 ANC visits contrary many research findings were found to be more at risk than those who attended less, this could be due to some errors in data collection.

Keywords: Prevalence, Associated risk factors, Bentiu State Hospital, South Sudan

Introduction

Globally, the prevalence of LBW is at 15.5 percent which represents nearly 20 million LBW infants born annually, of which 96.5 percent of them are in developing countries (WHOb, 2018). According to WHOb, (2018), Low birth weight (LBW) remains a significant public health problem that ranged from short- and long-term consequences (WHOa, 2014). It contributes 60 to 80 percent of all neonatal mortalities, morbidity and disability in infancy and childhood and is associated with long term impact on health outcomes in adult life. The consequences of poor nutritional status and inadequate nutrient intake among expectant mother's impact negatively on birth weight as well as quality of early development (WHOc, 2018). Low Birth Weight is thus a major public health concern especially in developing countries which is related to child morbidity and mortality (Mahamud, et al, 2018). According to WHOd, (2012), the goal is to attain a 30 percent reduction of the infants born with less than 2,500g by the year 2025.

Regionally, prevalence of LBW varies across regions and within countries but the pronounced majority of low birth weight births occur in low-and middle-income countries, most particularly in vulnerable populations. The prevalence was 28% in South Asia, 13% in Sub Saharan Africa and 9% in Latin America (WHOa, 2014).

In Sub Saharan Africa, prevalence of LBW was estimated at 13 percent with 11 percent in Eastern and Southern Africa while 14 percent for Western and Central Africa (FAO, 2017). This means LBW is public health burden both in terms of health and expenditures. According to Teklehaimanot et al, (2014), weight at birth is a good indicator of the newborn's chances of survival, long-term health and psychological development. In addition, LBW is a strong indicator of maternal and newborn health and nutrition (UNICEF, 2014a).

Evidence shows that being undernourished in the womb increases the risk of death in early months and years of a child's life. Survivors tend to have impaired immunity and increased risk of disease; remain undernourished, have reduced muscle strength, cognitive abilities and IQ all over their lives and in adult, suffer incidence of heart disease and diabetes (UNICEF, 2014a).

South Sudan has maternal mortality of 2054 per 100,000 live births, infant mortality is extremely high at 79 per 1000 live births and under five MR at 108 per 1000 live births (UNICEF, 2015c) and the country generally has limited data on LBW. She is the youngest nation in the World that has suffered decades of civil wars resulting into massive displacements, loss of property, low literacy levels, high food insecurity etc.

This study aimed to determine the prevalence of LBW and associated factors among postpartum mothers in Bentiu State Hospital, South Sudan.

Method and materials

Study design; The study used health facility based descriptive and analytical cross-sectional design that involved the collection of both quantitative and qualitative data. The design allowed for collection of data at a point in time and determined the proportion of LBW babies in Bentiu State Hospital and associated factors. According to Uradhi (2009), a survey is a method of gathering information by interviewing a respondent through a questionnaire and is the most often used method for data collection on people's habits in a variety of education and social issues.

Data sources; Primary data was obtained through administering semi structured questionnaires and interviewing key informants. Both quantitative and qualitative data were collected. The primary respondents were postpartum mothers and health workers were interviewed as key informants.

Reference was made to secondary data by reviewing the health management information system of the hospital, related literatures published online, journals, articles etc.

Sample size determination; The sample size was determined using Kish Leslie formula of 1965. There is no reported data on prevalence of Low Birth Weight in South Sudan. Therefore, this study used the prevalence of LBW of 23% according to unpublished study conducted in Juba teaching hospital by Oleyo and Alege (2017).

$$n = \frac{z^2 \times p\,(1-p)}{d^2}$$

Where,
n = Sample size
z = Z-score corresponding to 95% Confidence Interval
p = proportion of LBW (<2,500 g)
(1-p) =q= is the proportion of newborn with birth weight of more than 2,500 g
d = acceptable margin of error
Therefore,

$$n = \frac{1.96^2 \text{ x } 0.23\ (1\text{-}0.23)}{(0.05)^2}$$

$$n = \frac{1.96*1.96*0.23*0.77}{0.05*0.05}$$

= 271.14, postpartum mothers.

Considering 5% (14) non-response, the required sample size is 285 postpartum mothers. The non-respondence is considered at 5% and not 10% because the majority of targeted population were within the hospital and could easily be traced in case of call backs, women in this situation are usually interested in issues that concern their health and the chances that they would refuse to participate were less.

Data analysis and presentation; The overall analysis was conducted using SPSS version 20 at 95% confidence level for quantitative data. For comparative purposes, the dependent variable in this study was low birth weight among postpartum mothers.

Uni-variate; Numerical data were summarized into descriptive statistics of mean, median, range and categorical data into frequencies and percentages.

Bivariate; Chi-square test with cross tabulation was used to show pattern of LBW distribution by socioeconomic, maternal nutritional and health system related factors and at this level, chi-square test was used to explain existence of statistically significant relationships between the dependent and independent variables.

The second analysis was done to determine association between independent variables and the dependent variable. At this stage, each independent variable was analyzed for the association with low birth weight. Binomial logistic regression was used and Crude odds ratios (COR) with their subsequent 95% confidence intervals and associated p-values were obtained and interpreted.

Multivariate; analysis was further performed in the third phase of analysis with Binomial Logistic Regression for all significant associations in second analysis and the results were expressed inform of Adjusted Odds Ratios (AOR) with their subsequent 95% confidence intervals and p-values to determine proportion of low birth weight among newborns.

In addition, to determine whether socioeconomic, individual, nutritional and health services related factors were independently associated with LBW. In all analyses, associations with p-values of less than 0.05 ($p<0.05$) were considered statistically significant.

Qualitative data were recorded and transcribed into verbatim, imported to ATLAS Ti (qualitative data analysis software). In addition, the information recorded was read several times and relevant data were coded, the codes were combined to form categories.

Data quality

The questionnaires were translated into local language for the ease of understanding, pretested. The research assistants were health workers who were trained on the key areas that included the purpose, objectives, methods and the data collection tools.

The questionnaires were coded and kept anonymous, consent was sought from each of the mothers before proceeding with the data collection.

Results

Prevalence of low birth weight; The study found LBW prevalence of 23.5% (67) [N=285, 95% CI: 0.187-0.287] while the majority of the postpartum mothers had normal birth weight which accounted for 218(76.5%). This 23.5% of LBW has significant public health challenges.

Sociodemographic factors; The mean age of the postpartum mothers was 25 years (Standard deviation=6.33). The age of the postpartum mothers ranged from 13-48 years.

The study found that most of the postpartum mothers were in the age bracket of 20-24 and 25-29 accounting for 84 (29.5%) and 83 (29.1%) respectively. The majority 219 (76.8%) were married, nearly half 141 (49.5%) of the mothers are not working with 79 (27.2%) being peasant farmers and only 40 (14.0%) were in salaried employment.

Less than half 131 (46%) of the postpartum mothers had no formal education and 110 (38.6%) attained only primary level of education and only 16 (5.6%) with tertiary education. The majority 201(70.5%) of the mothers are catholic, the least religion being Muslim accounting for 7(2.5%).

Generally, in South Sudan the majority of the citizens are Christians and mainly Catholic denomination hence this finding reflects the exact situation on ground.

Regarding income of the postpartum mothers, the study found that more than half of them earn nothing and this is in line with finding on the occupation status where the majority was not working. It emerged that only 76 (26.7%) earn less than 18,000 South Sudanese Pound on average per month and only 9(3.2%) earn more than 29,000 SSP.

In terms of social support, the majority 200 (70.2%) of the postpartum mothers get social support. This involves support from family members, relatives, friends and well-wishers among others. Finding on residence showed that more than half of the mothers reside in the rural areas compared to 121 (42.2%) for urban residence.

The above difference in the result however did not differ much, meaning the hospital under study in Bentiu also get many clients within the urban areas. The study also confirmed that the majority of the mothers come from extended families which accounted for 210 (73.7%) and these families have a range of 7-10 people 117(41.1%) in a household and those with more than ten (10) people accounted for 112(39.3%). The least number of people consisted of families with people ranging from 3-6 people represented 56(19.6%).

Individual factors; Most of the mothers were young, 54% were between (15 – 19years), 31% above 20years and 15% were below 15years.

Most mothers had normal birth weight babies before (67%), 79% pregnancies were wanted and 68% were planned and supported. There were 78% of babies born at full term, 50% of mothers started ANC attendance in the first trimester and most mothers did not have chronic illnesses. 55% experienced illness while 75% had pregnancy complications.

Nutritional factors; The result showed that the majority of them were taking 2-3 times meal per day mostly consisting of grains, 65% had normal body weight, 30% were under weight and 3% were obese.

Majority did not have fruits in their diet (52%) and less vegetable in the diet. Being animal keeping population majority had dairy products in their diet.

Health services factors; Majority of the mothers (99%) delivered through spontaneous vaginal delivery, fetal assessment was done in 90% of the mothers, 96% received education during ANC attendance with the same percentage receiving supplements and 92% receiving IPT. In terms of cost, 84.6% reported that heath care cost was cheap as services were provided for free except challenges of transport and distance to health facility. There were 96% mothers who attended ANC with 87.3% receiving antibiotics, 55.8% reported health worker's attitude to be good.

Triangulation of qualitative data at bivariate level

The key informants were asked to comment on some of the socioeconomic factors associated with low birth weight. The reasons mainly provided were low income, poverty and unemployment of the male partners.

"*Unemployment of pregnant women, low family income*" [Key Informant 4, 6th .08.2018]

"*Low family income, high illiteracy level among pregnant women who would not know which food is nutritious"* [Key Informant 6, 10th. 08.2018]

The key informants also noted that some of the LBW could be because of limited social support by the male partners which is due to unemployment.

"*Unemployment of husbands contributed to limited support to pregnant women*" [Key Informant 2, 9th .08.2018]

"*Lack of support from husband due to poverty, unemployment of pregnant women*", [Key Informant 5, 7th .08.2018]

In the qualitative study, few of the key informants also mentioned that low birth weight could be also be related to cigarette smoking and alcohol consumption.

"*Chronic illness, alcohol intake, smoking cigarette*", [Key Informant 8, 9th .08.2018]

"*Taking alcohol daily, smoking cigarette, chronic sickness*", [Key Informant 9...9th .08.2018]

"*Alcohol consumption during pregnancy, smoking and drug abuse*", [Key 1nformant 10, 9th .08.2018]

The study revealed that most of the key informants noted that the maternal related cause of low birth weight is maternal illnesses and poor feeding including low intake of food, low level of knowledge and food taboo.

"*Frequent attack from malaria, lack of support from spouse for feeding and late ANC visit*", [Key Informant 3, 7th .08.2018]

"*Occurrence of frequent maternal sickness, iron deficiency due to poor diet, lack of consumption of food rich in vitamin*", [Key Informant 5, 7th .08.2018].

"*It can result from frequent illness that will lead to low intake of food, low consumption of food rich in diet, late ANC attendance*" [Key Informant 6, 10th .08.2018].

"*.... sickness like malaria, lack of proper feeding like balance diet.... hormonal imbalance, iron deficiency*" [Key Informant 10, 9th .08.2018].

The poor feeding responses include;

"*Poor feeding during pregnancy, Iron deficiency and selective eating*" [Key Informant 2, .9th .08.2018]

"*Low intake of food, most pregnant women eat once a day, poor diet-eating one source only daily, lack of eating fruits"*, [Key Informant 4, 6th .08. 2018].

"*Lack of knowledge on proper feeding or poor feeding habit, food taboo, pregnant women not allowed to eat some food rich in protein, poor food preparation*" [Key Informant 1, 6th .08.2018].

"*Food taboo, some women deny good food, improper diet, low level of knowledge on diet*" [Key Informant 3, 37th 08.2018].

The key informants were also interviewed on the health education activities they conduct in relation to low birth weight including the information they usually disseminate. The majority of the key informants (ten in ten) reported that they mainly conduct health talk and counseling to the women on malaria prevention through consistent use of mosquito nets, proper feeding, early use of ANC and deworming during pregnancy.

"*I talk about early ANC visit, proper feeding during pregnancy, proper use of mosquito nets, counseling and HIV testing*", [Key Informant 1, 6th .08.2018]

"*I communicate about importance of proper diet during pregnancy, use of mosquito net, importance of deworming and early ANC visit*", [Key Informant 3, 7th .08.2018]

"*We educate the women on proper feeding during pregnancy, regular attendance of ANC services, sleeping under mosquito net and prompt treatment of illnesses*", [Key Informant 7, 10th .08.2018]

"*...in the hospital here, we educate them about eating balanced diet, eating fruits rich in vitamins, take Ferrous Sulphate, sleep under mosquito nets to prevent malaria and taking deworming tablet*", [Key Informant 10, 9th .08.2018]

The key informants were also interviewed in the interventions they provide for pregnant women during ANC to prevent low birth weight. The study found that the majority of the health care providers reported provision of iron and folic acid, ferrous sulphate, deworming, distribution of mosquito nets and malaria prophylaxis to prevent low birth weight among the expectant women. Below are some of the responses from the key informants.

"*Give them mosquito net to prevent malaria, deworming tablets and ferrous sulphate and folic acid*", [Key Informant 6, 10th .08.2018.]

"*Provision of iron and folic acid, deworming, prophylaxis with fansidar to prevent malaria*", [Key Informant 10, 9th .08.2018]

"*Give them fansidar to prevent malaria, deworm, and provide them with mosquito nets*", [Key Informant 2 9th .08 2018]

"*Giving iron and folic acid, deworming, giving vitamin and fansidar*", [Key Informant 9, 9th.08.2018]

"*Give them fansider to prevent malaria, deworming during ANC visit* [Key Informant 5, 7th .08.2018]

Multivariate analysis (Multiple Logistic Regression Analysis for significant variables)

Multivariable logistic regression analysis was conducted to control for the confounding variables found to be significantly associated with LBW at bivariate levels.

The socioeconomic factors that did not indicate statistically significant association with LBW were marital status, education level, and household size.

In terms of Individual factors of the mothers, the variables that had significant association with LBW include number of living children, parity, pregnancy status (wanted and unwanted pregnancy), type of pregnancy, gestational age, ANC attendance, trimester for beginning ANC attendance, chronic diseases, past suffering from illnesses, congenital conditions of the baby.

Regarding nutritional factor, at multivariate level of analysis, BMI did not show significant association with LBW.

The health system factors that showed no significant association with LBW at multivariate analysis were fetal assessment, provision of iron supplement during pregnancy, advice on extra intake of energy and protein foods, education on maternal health issues, distance to health facility and attitude of the health care workers.

On the other hand, the independent variables that had consistently indicated significant association with Birth weight status among socioeconomic factors were age (category), occupation and social support. The individual factors significantly associated with LBW were frequency of ANC attendance, pregnancy complication experience. The health system factors significantly associated with LBW were provision and consumption of folic acid tablets and antibiotics during pregnancy.

Sociodemographic factors and Low Birth Weight

This study found that mothers aged 20-24 years were 2.09 times more likely to produce LBW babies compared to those aged less than 19 years (Adjusted Odds Ratio=2.09 95%CI: 0.251-17.477, p=0.495). Mothers aged 25-29 years were also 7.17 times more likely to have LBW babies compared to the reference group (AOR=7.17, 95%CI: 1.176-43.765, p=0.033), those aged 30-34 years were 10.73 times more likely to have LBW compared to those less than 19 or 19 years old (AOR=10.73, 95%CI: 1.629-70.743, p=0.014). In addition, older mothers aged 35 and above were also 4.34 times likely to have LBW babies (AOR=4.34 95%CI: 0.622-30.292, p=0.138).

The study also revealed that the odds of having low birth weight increased with increasing age but from age of 35 and above, the odds reduced because of the fewer women producing in the age group.

In terms of occupation, mothers who were business women were less likely to have LBW babies compared to the peasant women and this revealed statistically significant association (AOR=0.19 95%CI: 0.055-0.682, p=0.011). This means

business women have better income hence have better access to want are required during pregnancy including food requirements unlike the peasant women who may be of low socioeconomic status. Similarly, salaried women were also found to be less likely to have LBW babies compared to the reference group and this association was also significant. A salaried employment status reduced LBW by 81% (AOR=0.19 95%CI: 0.039-0.921, p=0.039). On the other, women not working at all were 1.22 times more likely to deliver LBW babies compared to peasant women but this was not statistically significant (AOR=1.22 95%CI: 0.151-9.840, p=0.852).

This means women who are not farmers, not employed may even have no money or production land hence strive under support of husband or well-wishers hence would have reduced capacity to access adequate care, food and others.

Fosu et al., (2013) in their study did not find significant relationship between employment status and low birth weight (P=0.755). Similarly, Yadav et al., (2011) also found insignificnat results. This shows employment status does not matter in bearing of LBW babies.

The study also found that women who reported that they had no social support even during pregnancy were 3.65 times more likely to give birth to LBW babies compared to those who had social support from husbands, relatives and friends. Lack of social support was significantly association with LBW (AOR=3.65 95%CI: 1.77-7.525, p<0.001).

This result showed that with inadequate social support to pregnant women, they are likely to not or adequately attend ANC, have enough nutritional requirements, medication, financial support among others.

Maternal related factors and Low Birth Weight

Results on experience of part pregnancy complication showed that women who reported no pregnancy complication were found to be less likely to give birth to LBW babies compared to those who experienced pregnancy complications. The association between non-exposure to pregnancy complication and LBW was statistically significant (AOR=0.42 95%CI: 0.181-0.994, p=0.048). This means non-exposure to pregnancy complication reduced LBW by 68% among the women.

Health services factors and Low Birth Weight

Antenatal attendance up to four visits as recommended is very important for women to receive all the interventions in each visit.

This study found that women who attended ANC four times were less likely to have LBW babies compared to those who attended less than four times but not significant association was found (AOR=0.996, 95%CI: 0.017-57.126, p=0.999). However, in contrary, mothers who attended more than four ANC were found to be 68.99 times more likely to produce LBW babies compared to the reference group with significant association (AOR=68.99 95%CI: 1.021-4661.183, p=0.049). This finding did not hold true statistically this is because the reference category were mothers aged less than 19 or 19 years old and these mothers are adolescent as per the definition. The fact that the adolescents are growing hence have high competition for nutrients with off springs so they have

higher risk of bearing LBW. However, the actual study result showed those less than 19 or 19 to 20-29 years had many LBW babies.

Folic acid is usually provided to pregnant women during their ANC visits for them to consume which also contributes in preventing LBW among others. This study found that mothers who did not receive folic acid were 4.82 times more likely to give birth to LBW babies compared to those who were given and consumed it. The result also indicated significant association between not taking folic acid and LBW (AOR=4.82, 95%CI: 2.233-10.392 $p<0.001$).

This study found that 158 in 285 of the mothers reported that they suffered from illnesses and 48 of them had LBW babies. It's known that some of the infections causing illnesses are treated with antibiotics. Interestingly, this study found that mothers who did not get antibiotics for their illnesses were 8.74 times more likely to produce LBW babies compared to those who received or were treated with antibiotics against some of their illnesses during pregnancy.

Therefore, not receiving antibiotics for infection during pregnancy was significantly associated with LBW (AOR=8.74 95%CI: 3.597-21.248 $p<0.001$).

Discussion

Prevalence of low birth weight; The study in Bentiu State Hospital found LBW prevalence of 23.5% with normal mean weight of 2.784 ± 0.574 kg. The qualitative findings found that more than half of the Key informants associated the LBW to low income status and unemployment of most of the husbands as well as the postpartum mothers. This implies that the husbands were unable to provide adequate nutrition and health demands of the mother and the family at large hence this compromises their nutritional status. This study also found that the majority of the mothers who delivered LBW newborns were aged both less than 19 and 19 years to 29 years accounting for the majority 222 in 285 mothers in total.

From the qualitative data collected, more than half of the Key informants associated the LBW to maternal illnesses, poor feeding and low-income status and unemployment of most of the husbands as well as the postpartum mothers.

On the other hand, one of the participants said it is due to lack nutrients in the body during pregnancy. This implies that the husbands are unable to provide adequate nutrition and health demands of the mother and the family at large hence this compromises their nutritional status.

Several studies have reported increased risks LBW among offspring of adolescent mothers. With respect to adolescent mothers, it has been suggested that they are still developing and growing, and therefore, mother and offspring may compete for the supply of nutrients. This is however not limited to young women who are vulnerable or are malnourished or under frequent attack from illnesses may also be predisposed to higher odds of bearing LBW babies.

A hospital-based study conducted by Fosu et al., (2013) in Ghana found prevalence of low birth weight was at 21.1% with normal mean weight of 4.012±0.062 kg. The study in Bentiu however had slightly higher prevalence of LBW compared to that in Ghana. This difference could be due to the geographical differences. In Unity State in South Sudan, the influence of the war might have also played significant role in the difference in addition to the actual study setting.

Closely, another study conducted in tertiary hospital in Maseru City; Lesotho by Nwako (2018) found that LBW prevalence of 24.75% which was however higher than the LBW of this study by 1.25%. This implies that despite the population in this study being affected by war, there LBW prevalence was slightly lower than that in Maseru city. On the other hand, lower LBW prevalence compared to the one in this study was found in another hospital in Ethiopia by Zeleke et al (2012) whose LBW prevalence was at 17%. This result could also be attributed to the difference in the sample sizes, study design and geographical locations. Higher prevalence rates were found in study by (Kumar et al., 2018) at 27.5% and mean birth weight of 2677 29±454.59 grams and 28.8% by (Dasgupta & Basu, 2011). In regards to the drivers of LBW prevalence, several studies associated LBW to smoking, chronic illnesses (diabetes and hypertension), anemic mothers (Keram & Aljohani, 2016) pregnancy weight that of Murin et al (2011) and among other factors predicting LBW.

In regards to the above, in the present study LBW is associated with low income status and young mothers and this difference could be due to poor response of the mothers to certain questions like smoking and few had history of chronic illness especially of the non-communicable type.

Socioeconomic factors and Low Birth Weight

Age of mothers; this study found that mothers aged 20-24 years were 2.09 times more likely to produce LBW babies compared to those aged less than 19 years (Adjusted Odds Ratio=2.09 95%CI: 0.251-17.477, p=0.495). In a study by Fosu et al (2013), women who were aged less than 24 years were also confirmed to have higher likelihood of bearing low birth weight babies. Mothers aged 25-29 years were also 7.17 times more likely to have LBW babies compared to the reference group (p=0.033), those aged 30-34 years were 10.73 times more likely to have LBW compared to those less than 19 or 19 years old (p=0.014). A study by Yadav et al., (2011) in Nepal, also revealed that most of the mother of LBW newborns were between <19 and ≥30 years and was to some extent in line with this study because mothers aged 25-29 and 30-34 were found to have higher odds of having LBW.

In addition, older mothers aged 35 and above were also 4.34 times likely to have LBW babies (AOR=4.34 95%CI: 0.622-30.292, p=0.138). The study revealed that the odds of having low birth weight increased with increasing age but from age of 35 and above, the odds reduced because of the fewer women producing in the age group.

The present finding agreed with study by Fosu et al (2013) who found that women above 35 years likely to have LBW newborns and Mahumud et al (2017) who also confirmed mothers with advanced age ranging from 35 to 49 years had significantly higher risk of delivering LBW babies compared with younger mothers (p<0.01). Regarding age, as the age increases, the body's immunity also begins reduce as a result women who produce at old age become susceptible to various infections and have increased likelihood of bearing LBW babies.

Occupation of postpartum mothers; looking at occupation, mothers who were business women were less likely to have LBW babies compared to the peasant women and this revealed statistically significant association (p=0.011). This means business women have better income hence have better access to what is required during pregnancy including food requirements unlike the peasant women who may be of low socioeconomic status. Similarly, salaried women were also

found to be less likely to have LBW babies compared to the reference group and this association was also significant. A salaried employment status reduced LBW by 81% (p=0.039). On the other, women not working at all were 1.22 times more likely to deliver LBW babies compared to peasant women but this was not statistically significant (p=0.852). This means women who are not farmers, not employed may even have no money or production land hence strive under support of husband or well-wishers hence would have reduced capacity to access adequate care, food and others.

Fosu et al., (2013) in their study did not find significant relationship between employment status and low birth weight (P=0.755). Similarly, Yadav et al., (2011) also found insignificant results.

In contrast, Mahmoodi et al (2015) found that mothers who were employed were five (5) times more likely to have LBW compared to the unemployed (P<0.001).

According to them, this difference could be due to the unfavorable working status like contact with detergents, moist environment and long standing or sitting position for long hours also had statistically significant association with LBW.

The nature of employment and the related working conditions can be risk factor for LBW. According to Khojasteh et al., (2016), women involved in lifting heavy objects during pregnancy was significantly related to low birth weight (p=0.01).

In the current study in Bentiu, the nature of women's work was not investigated to make argumement in this regard and besides the finding indicated that women in business and employed were significantly less likely to bear LBW babies hence the above explanation on financial access and capacity to acquire requirements could have played significant role in the finding.

Social support to postpartum mothers during and after pregnancy; the study also found that women who reported that they had no social support even during pregnancy were 3.65 times more likely to give birth to LBW babies compared to those who had social support from husbands, relatives and friends. Lack of social support was significantly association with LBW (p<0.001). This result showed that with inadequate social support to pregnant women, they are likely to not or adequately attend ANC, have enough nutritional requirements, medication, financial support among others. In agreement with the above finding was also results from a study that found that lack of social support to women is likely to result to stress, depression and anxiety which was evidenced in findings that mental stress is related to adverse pregnancy outcome like low birth weight (Roy-Matton et al., 2011).

Similarly, a study by Almeida et al., (2014) found that low social support for women was associted with low birth weight babies. In addition, in terms of the perceived social support status, Straughen et al (2013) where high perceived spouse support was protective for for low birth weight.

On looking even specific support by male partners to the women, by Shah et al., (2013) who found an increased likelihood for LBW among adult and teen pregnancies with no paternal support.

Surprisingly studies comducted by Wado et al., (2014) and a meta-analysis performed by Hetherington et al., (2015) indicated that higher perceived social support was negatively associated with LBW. The differences between the above studies and that of Almeida could be due to the study design and study settings.

Individual factors and Low Birth Weight

Pregnancy complications; regarding experience of part pregnancy complication, women who reported no pregnancy complication were found to be less likely to give birth to LBW babies compared to those who experienced pregnancy complications. This study revealed that the association between non-exposure to pregnancy complication and LBW was statistically significant (p=0.048) and the study also indicated that non-exposure to pregnancy complication reduced LBW by 68% among the women. This finding is in conformity with study by Hailu & Kebede, (2018) who also found occurrence of any sign of pregnancy complications was significantly associated with low birth weight. Similar findings were also found in study by Mirzarahimi et al., (2013) in Iran.

This means that health care providers attending to expectant women during ANC to educate the women on the signs and symptoms of pregnancy complication. This allows for timely recognition and identification for prompt management of the cases. This implies that such complications become a risk factor during pregnancy as well as risk factor for low birth weight outcome.

Health services factors and Low Birth Weight

Frequency of ANC attendance; this study found that women who attended less than four ANC had lower odds of giving birth to low birth weight babies. The reason for attending less standing lower odds of LBW could be due to probably their lower risks of complication and illnesses during pregnancy. In any frequent ill health situation, then the woman is likely to often times visit the health facility because of the health status. As a result, mothers who attended more than four ANC were found to be 68.99 times more likely to produce LBW babies compared to the reference group with significant association (p=0.049). This study finding agreed with study conducted by Betew & Muluneh, (2014) who found that the number of antenatal care visits has a significant association with baby's size at birth. This agreement was only in attendance of the recommended four ANC visits. However, in regards attendance of more than four ANC during pregnancy disagreed because this study found mothers who attended more than four were likely to bear LBW babies and on the other hand, Mahumud et al (2017) also recognized the fact that inadequate ANC attendance was related to an increased risk of LBW.

This finding reveals that ANC attendance at least four during pregnancy is important in reducing LBW and Betew and Muluneh (2014) and Mahumud et al (2017) agreed that increasing number of ANC visits also translates to increased prevalence of LBW among babies.

In agreement with the above authors were also Fosu et al., (2013), Teklehaimanot et al (2014), Yadav et al (2011) and Bhattacharjya et al (2015), Gebrehawerya et al (2018), Bugssa et al (2014).

Similarly, Kaushal et al (2012) also noted mothers who did not attend antenatal care have higher changes of bearing LBW babies although their finding disagreed with a study among teenage mothers in Uganda that found ANC attendance was not significantly associated with LBW (P=0.280). The same study further revealed that even the number of times of ANC attendance was insignificantly associated with LBW (p=0.298).

This implies that during regular attendance of ANC, key interventions meant to be implemented during the visits are likely to be done hence this has significant influence on the outcome of birth weight. It is therefore important for health care providers to empower women and men about the significance of ANC attendance in reducing low birth weight through the services provided during the visits.

Folic acid provision and intake; folic acid is usually provided to pregnant women during their ANC visits for them to consume which also contributes in preventing LBW among others. This study found that mothers who did not receive folic acid were 4.82 times more likely to give birth to LBW babies compared to those who were given and consumed it. The result also indicated significant association between not taking folic acid and LBW (AOR=4.82, 95%CI: 2.233-10.392 $p<0.001$).

According to WHO (2016), it is recommended for daily oral iron and folic acid supplementation with 30mg to 60mg for elemental iron and 400 g (0.4mg) of folic acid for pregnant women to prevent low birth weight among other conditions maternal anemia, puerperal sepsis, and preterm birth. The fact that this recommendation was based on evidence, it thus becomes paramount for health care providers to ensure the tablets are made available and pregnant women be informed of the necessity of the supplementation during health education and promotion.

CDC (2017) also recognized the effort of preventing LBW through discussion with women the warning signs or symptoms of preterm labor and taking of daily multivitamin containing 400 micrograms of folic acid before and throughout pregnancy (CDC, 2017) as it contributes in prevention of LBW newborns.

Intake of antibiotics; expectant women are prone to bacterial infections during pregnancy because of their reduced body immunity. It is therefore important that they get timely and adequately treated for any bacterial infections during pregnancy. In this current study 158 in 285 of the mothers reported that they suffered from illnesses and 48 of them had LBW babies. It's known that some of the infections causing illnesses are treated with antibiotics. Interestingly, this study found that mothers who did not get antibiotics for their illnesses were 8.74 times more likely to produce LBW babies compared to those who received or were treated with antibiotics against some of their illnesses during pregnancy. Therefore, not receiving antibiotics for infection during pregnancy was significantly associated with LBW ($p<0.001$). According to WHO (2016) pregnant women should be given antibiotics for asymptomatic bacteriuria (ASB).

ASB is a seven-day antibiotic regimen recommended with all expectant women with ASB to prevent persisting bacteriuria, preterm birth and low birth weight. This recommendation by WHO thus reiterated the significance of antibiotics in contributing towards the reduction low birth weight prevalence among newborns.

Conclusion

The study found out that the prevalence of low birth weight in Bentiu State hospital stands at 23.5% which high and requires intervention in order to improve child health and maternal health indicators. The study found that mothers aged 20-24 years have higher likelihood of bearing Low birth weight babies than those of 19 years this could be because the majority mothers were in

that age group. Older women were more likely to give birth to low birth weight babies then younger ones, Business women and salaried women were less likely to give birth to low birth weight babies than peasants.

Age at first birth, no social support, pregnancy complication, less meals, not taking folic acid and antibiotics are significantly associated with Low birth weight.

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Table 1: Sociodemographic factors

Variable	Frequency (n=285)	Percentage (%)
Age category		
≤19	55	19.3
20-24	84	29.5
25-29	83	29.1
30-34	40	14.0
35+	23	8.1
Single	20	7.0
Married	219	76.8
Divorced	19	6.7
Widowed	27	9.5
Occupation		
Peasant	79	27.7
Business	25	8.8
Salaried employment	40	14.0
Not working	141	49.5
Education		
Normal formal education	131	46.0
Primary	110	38.6
Secondary	28	9.8
Tertiary	16	5.6
Religion		
Catholic	201	70.5
Anglican	55	19.3
Muslim	7	2.5
Others	22	7.7
Income		
<18,000 SSP	76	26.7
18,000-28,000	28	9.8
≥29,000	9	3.2
None	172	60.4
Social support		
Yes	200	70.2
No	85	29.8
Residence		
Rural	164	57.5
Urban	121	42.5
Family type		
Nuclear	75	26.3
Extended	210	73.7
Number of people in Household		
3-6 people	56	19.6
7-10	117	41.1
>10 people	112	39.3

Table 2: Individual factors

Variable	Frequency (n = 285)	Percentage (%)
Age at first birth		
<15 years	43	15
15-19	154	54
≥20 years	88	31
Pregnancy interval		
Less than 24 months	85	35.71
24 months	111	46.64
36 and above	42	17.65
Low Birth weight of past pregnancy		
Yes	48	20.2
No	190	79.8
Number of live children		
1-4 children	199	70
5-9 children	71	25
10 and above	15	5
Parity		
1-4 children	182	64
5-9 children	77	27
10 and above	26	9
Nature of pregnancy		
Wanted	226	79
Unwanted	59	21
Type of pregnancy		
Planned and supported	195	68
Unplanned and supported	48	17
Unplanned and unsupported	42	15
Gestational age		
Full term (37-41 weeks)	221	78
Preterm (<37)	61	21
Post-term (42 weeks and above	3	1
Sex of baby		
Male	142	50
Female	143	50

Trimester started ANC		
First trimester	143	52.4
Second trimester	112	41.0
Third trimester	18	6.6
Chronic diseases		
Yes	23	8
No	262	92
Total	285	100
Suffered from illnesses		
Yes	158	55
No	127	45
Congenital		
Yes	18	2.1
No	266	97.9
Physical trauma		
Yes	32	11
No	253	89
Experienced pregnancy complication		
Yes	71	25
No	213	75
Smoke cigarette		
Yes	23	8
No	262	92
Smoked during pregnancy		
Yes	12	52.2
No	11	47.8
Alcohol consumption		
Yes	39	14
No	246	86
Consumed alcohol during pregnancy		
Yes	25	69.4
No	11	30.6
Diabetic		
Yes	27	11
No	219	89
If yes, is it controlled?		
Yes	19	70.4
No	8	29.6

Table 3: Nutritional factors

Variable	Frequency (n = 285)	Percentage (%)
Number of meals		
Once a day	8	4.8
Twice	90	54.5
Three times	60	36.4
Four times or more	7	4.2
BMI		
Normal	184	64.6
Underweight	85	29.8
Overweight+Obese	16	5.6
Grains		
Never	74	26
1-2 times/month	66	23
1-3 times/week	52	18
3+ times/week	93	33
Fruits		
Never	148	52
1-2 times/month	77	27
1-3 times/week	32	11
3+ times/week	28	10
Vegetables		
Never	91	32
1-2 times/month	77	27
1-3 times/week	62	22
3+ times/week	55	19
Protein		
Never	60	21
1-2 times/month	71	25
1-3 times/week	60	21
3+ times/week	94	33
Total	285	100
Dairy		
Never	27	9
1-2 times/month	94	33
1-3 times/week	73	26
3+ times/week	91	32

Table 4: Health services factors

Variable	Frequency (n =285)	Percentage (%)
Mode of delivery		
Spontaneous vaginal delivery	281	99
Instrumental delivery	0	0
Caesarian section	4	1
Fetal assessment done		
Yes	257	90
No	28	10
Educated on dietary nutrition		
Yes	259	91.5
No	24	8.5
Iron supplement given		
Yes	259	93.8
No	20	7.2
Folic acid given		
Yes	224	80.9
No	53	19.1
Advised on extra intake of energy and protein foods		
Yes	247	90.1
No	27	9.9
Educated on maternal health issues		
Yes	240	89.6
No	28	10.4
IPT provided (Fansidar)		
Yes	263	93.9
No	17	6.1
Antibiotics given		
Yes	241	87.3
No	35	12.7
Healthcare cost		
Never costly	241	84.6
Costly	35	12.3
Very costly	9	3.1

Attended ANC		
Yes	273	96
No	12	4
Frequency of ANC		
< 4	150	54.9
4 times	87	31.9
>4	36	13.2
Distance to health facility		
< 5 Kms	121	42
5	97	34
>5 Kms	67	24
Attitude of health workers		
Poor	8	2.8
Fair	33	11.6
Good	159	55.8
Very good	85	29.8

Table 5: Bivariate analysis of sociodemographic factors;

Variable	Birth Weight Status		Total	χ2(df)/ Fisher's value	Unadjusted Odds Ratio UOR 95%CI	p-value
	LBW	**NBW**				
Age category				30.34(4) p=0.000**		
≤19	7(12.7)	48(87.3)	55		1	
20-24	23(27.4)	61(72.6)	84		12.9(3.997-41.358)	0.000
25-29	12(14.5)	71(85.5)	83		4.97(1.861-13.290)	0.001
30-34	10(25.0)	30(75.0)	40		11.09(3.867-31.823)	0.000
35 and above	15(65.2)	8(34.8)	23		5.63(1.840-17.194)	0.002
Marital status				14.90 (3) p=0.002*		
Single	6(30.0)	14(70.0)	20		1	
Married	42(19.2)	177(80.8)	219		2.51(0.743-8.498)	0.138
Divorced	5(26.3)	14(73.7)	19		4.54(1.986-10.371)	0.000
Widowed	14(51.9)	13(48.1)	27		3.015(0.847-10.736)	0.088
Occupation				13.55(3) p=0.004		
Peasant farmers	30(38.0)	49(62.0)	79		1	
Business	5(20.0)	20(80.0)	25		0.39(0.208-0.718)	0.003
Salaried employment	5(12.5)	35(87.5)	40		0.95(0.326-2.751)	0.921
Not working	27(19.1)	114(80.9)	141		1.66(0.595-4.628)	0.334
Education level				19.373 p=0.000**		
No formal	46(35.1)	85(64.9)	131		1	

education						
Primary	14(12.7)	96(87.3)	110		0.12(0.016-0.962)	0.046
Secondary	6(21.4)	22(78.6)	28		0.46(0.056-3.735)	0.465
Tertiary	1(6.2)	15(93.8)	16		0.24(0.027-2.243)	0.213
Religion				3.324 p=0.165		
Catholic	45(22.4)	156(77.6)	201		1	
Anglican	15(27.3)	40(72.7)	55		1.62(0.622-4.210)	0.324
Muslim	0(0.0)	7(100.0)	7		1.24(0.424-3.649)	0.690
Others	7(31.8)	15(68.2)	22		0.00(0.000)	0.999
Income				3.380 p=0.331		
<18,000 SSP	20(26.3)	56(73.7)	76		1	
18,000-28,000	5(17.9)	23(82.1)	28		0.91(0.488-1.678)	0.750
≥29,000	0(0.0)	9(100.0)	9		1.49(0.532-4.154)	0.450
None	42(24.4)	130(75.6)	172		0.00(0.000)	0.999
Social support				26.99(1) p=0.000**		
High	30(15.0)	170(85.0)	200		1	
Low	37(43.5)	48(56.5)	85		4.37(2.45-7.789)	0.000
Residence				2.37(1) p=0.124		
Rural	44(26.8)	120(73.2)	164		1	
Urban	23(19.0)	98(81.0)	121		0.64(0.362-1.132)	0.125
Family type				1.92(1) p=0.166		
Nuclear	22(29.3)	53(70.7)	75		1	
Extended	45(21.4)	165(78.6)	210		0.66(0.362-1.193)	0.168
Number of people in Household				7.81(2) p=0.020*		
3-6 people	7(12.5)	49(87.5)	56		1	
7-10	25(21.4)	92(78.6)	117		3.18(1.311-7.725)	0.011
>10 people	35(31.2)	77(68.8)	112		1.67(0.922-3.035)	0.091

p>0.05*, p>0.001** Fisher's test was reported whenever cell (s) equal less than 5

Table 6: Bivariate analysis of individual factors

Variable	Birth Weight		Total	χ2(df)/ Fisher's value	p-value	p-value
	LBW	NBW				
Age at first birth				1.29(2) p=0.526		
<15 years	13(30.2)	30(69.8)	43		1	
15-19	34(22.1)	120(77.9)	154		1.53(0.720-3.251)	0.269
≥20 years	20(22.7)	68(77.3)	88		1.47(0.649-3.345)	0.354
Pregnancy interval				5.28(2) p=0.071		
Less than 24 months	26(30.6)	59(69.4)	85		1	
24 months	28(25.2)	83(74.8)	111		0.31(0.108-0.869)	0.026
36 and above	5(11.9)	37(88.1)	42		0.40(0.143-1.119)	0.081
Low Birth weight of past pregnancy				7.06(1) p=0.008*		
Yes	19(39.6)	29(60.4)	48		1	
No	40(21.1)	150(78.9)	190		0.41(0.207-0.800)	0.009
Number of live children				20.93 p=0.000**		
1-4 children	36(18.1)	163(81.9)	199		1	
5-9	20(28.2)	51(71.8)	71		12.45(3.751-41.338)	0.000
10 and above	11(73.3)	4(26.7)	15		7.01(1.998-24.618)	0.002
Parity				40.52(2) p=0.000**		
1-4 children	30(16.5)	152(83.5)	182		1	
5-9	18(23.4)	59(76.6)	77		12.45(3.751-41.338)	0.000
10 and above	19(73.1)	7(26.9)	26		7.01(1.998-24.618)	0.002
Nature of pregnancy				7.86(1) p=0.005*		
Wanted	45(19.9)	181(80.1)	226		1	
Unwanted	22(37.3)	37(62.7)	59		2.39(1.286-4.448)	0.006
Type of pregnancy				20.45(2) p=0.000**		
Planned and supported	34(17.4)	161(82.6)	195		1	
Unplanned and supported	12(25.0)	36(75.0)	48		4.74(2.30-9.622)	0.000
Unplanned and unsupported	21(50.0)	21(50.0)	42		3.00(1.232-7.308)	0.016
Gestational age				66.72 p=0.000**		
Full term (37-41 weeks)	27(12.2)	194(87.8)	221		1	
Preterm (<37)	40(65.6)	21(34.4)	61		0.00(0.000)	0.999
Post-term (42 weeks and above	0(0.0)	3(100.0)	3		0.00(0.000)	0.999
Sex of baby				2.26(1) p=0.153		

Male	28(19.7)	114(80.3)	142		1	
Female	39(27.3)	104(72.7)	143		1.53(0.878-2.656)	0.134
Trimester started ANC				19.24(2) p=0.000**		
First trimester	19(13.3)	124(86.7)	143		1	
Second trimester	28(25.0)	84(75.0)	112		8.16(2.862-23.257)	0.000
Third trimester	10(55.6)	8(44.4)	18		3.75(1.348-10.434)	0.011
Chronic diseases				11.43(1) p=0.001*		
Yes	12(52.2)	11(47.8)	23		1	
No	55(21.0)	207(79.0)	262		0.24(0.102-0.582)	0.001
Suffered from illnesses				9.31(1) p=0.002*		
Yes	48(30.4)	110(69.9)	1580.7		1	
No	19(15.0)	108(85.0)	127		0.40(0.223-0.730)	0.003
Congenital				7.44(1) p=0.006*		
Yes	9(50.0)	9(50.0)	18		1	
No	58(21.8)	208(78.2)	266		0.28(0.105-0.731)	0.009
Physical trauma				0.43(1) p=0.513		
Yes	9(28.1)	23(71.9)	32		1	
No	58(22.9)	195(77.1)	253		0.76(0.333-1.734)	0.514
Experienced pregnancy complication				8.91(1) p=0.003*		
Yes	26(36.6)	45(63.4)	71		1	
No	41(19.2)	172(80.8)	213		0.41(0.228-0.745)	0.003
Smoke cigarette				0.09(1) p=0.761		
Yes	6(26.1)	17(73.9)	23		1	
No	61(23.3)	201(76.7)	262		0.86(0.325-2.277)	0.761
Smoked during pregnancy				p=0.069		
Yes	1(8.3)	11(91.7)	12		1	
No	5(45.5)	6(54.5)	11		9.17(0.860-97.694)	0.066
Alcohol consumption				2.43(1) p=0.119		
Yes	13(33.3)	26(66.7)	39		1	
No	54(22.0)	192(78.0)	246		0.56(0.271-1.168)	0.123
Consumed alcohol during pregnancy				p=1.000		
Yes	8(32.0)	17(68.0)	25		1	
No	4(36.4)	7(63.4)	11		1.21(0.274-5.379)	0.798
Diabetic				1.76(1) p=0.185		
Yes	9(33.3)	18(66.7)	27		1	
No	48(21.9)	171(78.1)	219		0.56(0.237-1.329)	0.189

If yes, is it controlled?				p=1.000		
Yes	6(31.6)	13(68.4)	19		1	
No	3(37.5)	5(62.5)	8		1.30(0.231-7.315)	0.766

p<0.05*, p<0.001** Fisher's exact test and p-values were used for cell values less than 5

Table 7: Bivariate analysis of nutritional factors

Variable	Birth Weight		Total	χ2(df)/ Fisher's value	Unadjusted OR 95%CI	p-value
	LBW	NBW				
Number of meals per day				3.85 p=0.225		
Once a day	0(0.0)	8(100.0)	8		1	
Twice	9(10.0)	81(90.0)	90		5.53(2.53-12.068)	0.000**
Three times	10(16.7)	50(83.3)	60		3.17(1.466-6.856)	0.003*
Four times or more	2(28.6)	5(71.4)	7		1.55(0.289-8.343)	0.607
BMI				43.57 p=0.000**		
Normal	24(13.0)	160(87.0)	184		1	
Underweight	42(49.4)	43(50.6)	85		0.44(0.056-3.519)	0.442
Overweight+Obese	1(6.2)	15(93.8)	16		0.07(0.009-0.540)	0.011*
Grains				2.45(3) p=0.484		
Never	18(24.3)	56(75.7)	74		1	
1-2 times/month	17(25.8)	49(74.2)	66		0.70(0.330-1.469)	0.342
1-3 times/week	15(28.8)	37(71.2)	52		0.65(0.301-1.382)	0.259
3+ times/week	17(18.3)	76(81.7)	93		0.55(0.248-1.225)	0.144
Fruits						
Never	44(29.7)	104(70.3)	148	6.35 p=0.091	1	
1-2 times/month	14(18.2)	63(81.8)	77		0.394(0.129-1.202)	0.394
1-3 times/week	5(15.6)	27(84.4)	32		0.75(0.224-2.506)	0.640
3+ times/week	4(14.3)	24(85.7)	28		0.90(0.216-3.743)	0.885
Vegetables				7.65(3) p=0.054		
Never	23(25.3)	68(74.7)	91		1	
1-2 times/month	18(23.4)	59(76.6)	77		0.36(0.137-0.956)	0.040*
1-3 times/week	20(32.3)	42(67.7)	62		0.40(0.148-1.089)	0.073
3+ times/week	6(10.9)	49(89.1)	55		0.26(0.094-0.700)	0.008*
Protein				3.285(3) p=0.350		
Never	13(21.7)	47(78.3)	60		1	
1-2 times/month	20(28.2)	51(71.8)	71		0.80(0.356-1.7191)	0.585
1-3 times/week	17(28.3)	43(71.7)	60		0.56(0.269-1.177)	0.127
3+ times/week	17(18.1(	77(81.9)	94		0.56(0.259-1.205)	0.138
Dairy				3.387(3) p=0.336		

Never	10(37.0)	17(63.0)	27		1	
1-2 times/month	20(21.3)	74(78.7)	94		0.54(0.217-1.356)	0.190
1-3 times/week	15(20.5)	58(79.5)	73		1.18(0.593-2.349)	0.638
3+ times/week	22(24.2)	69(75.8)	91		1.23(0.586-2.593)	0.581

p<0.05*, p<0.001** Fisher's exact test and p-values were used for cell values less than 5.

Table 8: Bivariate analysis of health services factors

Variable	Birth Weight Status		Total	χ2(df)/ Fisher's value, p	Unadjusted OR 95%CI	p-value
	LBW	NORMAL				
Mode of delivery				p=0.576		
Spontaneous vaginal delivery	67(23.8)	214(76.2)	281		1	
Instrumental delivery	0(0.0)	0(0.0)	0		0.00(0.00)	
Caesarian section	0(0.0)	4(100.0)	4		0.000.00)	0.999
Fetal assessment done				19.53(1) p=0.000**		
Yes	51(19.8)	206(80.2)	257		1	
No	16(57.1)	12(42.9)	28		0.19(0.083-0.417)	0.000**
Educated on dietary nutrition				14.43(1) p=0.000*		
Yes	52(20.1)	207(79.9)	259		1	
No	13(54.2)	11(45.8)	24		0.21(0.09-0.502)	0.000**
Iron supplement given				8.596 p=0.000**		
Yes	55(21.2)	204(78.8)	259		1	
No	10(50.0)	10(50.0)	20		0.27(0.107-0.680)	0.006*
Folic acid given				38.13(1) p=0.000**		
Yes	34(15.2)	190(84.8)	224		1	
No	29(54.7)	24(45.3)	53		0.15(0.077-0.284)	0.000**
Advised on extra intake of energy and protein foods				10.70(1) p=0.001*		
Yes	50(20.2)	197(79.8)	247		1	
No	13(48.1)	14(51.9)	27		0.27(0.121-0.618)	0.002*
Educated on maternal health issues				24.07(1) p=0.000**		
Yes	46(19.2)	194(80.8)	240		1	
No	17(60.7)	11(39.3)	28		0.15(0.067-0.350)	0.000**
IPT provided (Fansidar)				0.000**		
Yes	52(19.8)	211(80.2)	263		1	
No	10(58.8)	7(41.2)	17		0.17(0.063-0.475)	0.001*
Antibiotics given				39.832(1) p=0.000**		

Yes	38(15.8)	203(84.2)	241		1	
No	22(62.9)	13(37.1)	35		0.11(0.051-0.238)	0.000**
Healthcare cost				2.43 p=0.326		
Never costly	56(23.3)	185(76.8)	241		1	
Costly	7(20.0)	28(80.0)	35		1.21(0.502-2.921)	0.670
Very costly	4(44.4)	5(55.6)	9		0.38(0.098-1.457)	0.158
Attended ANC				24.99 p=0.000**		
Yes	57(20.9)	216(79.1)	273		1	
No	10(83.0)	2(16.7)	12		0.05(0.011-0.248)	0.000**
Frequency of ANC				18.59(2) p=0.000**		
< 4	44(29.3)	106(70.7)	150		1	
4 times	5(5.7)	82(94.3)	87		6.81(2.584-17.937)	0.000**
>4	8(22.2)	28(77.8)	36		1.45(0.614-3.436)	0.395
Distance to health facility				9.33(2) p=0.009*		
< 5 Kms	24(19.8)	97(80.2)	121		1	
5	18(18.6)	79(81.4)	97		1.09(0.550-2.142)	0.812
>5 Kms	25(37.3)	42(62.7)	67		0.42(0.213-0.810)	0.010*
Attitude of health workers				10.36(3) p=0.016		
Poor	1(12.5)	7(87.5)	8		1	
Fair	15(45.5)	18(54.5)	33		0.17(0.019-1.554)	0.117
Good	34(21.4)	125(78.6)	159		0.53(0.062-4.417)	0.553
Very good	17(20.0)	68(80.0)	85		0.57(0.066-4.963)	0.612

p<0.05*, p<0.001** Fisher's exact test and p-values were used for cell values less than 5.

Table 9: Multiple Logistic Regression Analysis of significant variables

Variable	Birth Weight Status		Adjusted Odds Ratio (AOR) 95%CI	p-value
	LBW	Normal BW		
Age category				
≤19	7(12.7)	48(87.3)	1	
20-24	23(27.4)	61(72.6)	2.09(0.251-17.477)	0.495
25-29	12(14.5)	71(85.5)	7.17(1.176-43.765)	0.033*
30-34	10(25.0)	30(75.0)	10.73(1.629-70.743)	0.014*
35 and above	15(65.2)	8(34.8)	4.34(0.622-30.292)	0.138
Marital status				
Single	6(30.0)	14(70.0)	1	
Married	42(19.2)	177(80.8)	0.00(0.00)	0.999
Divorced	5(26.3)	14(73.7)	0.00(0.00)	0.999
Widowed	14(51.9)	13(48.1)	0.00(0.00)	0.998
Occupation status				
Peasant	30(38.0)	49(62.0)	1	
Business	5(20.0)	20(80.0)	0.19(0.055-0.682	0.011*
Salaried employment	5(12.5)	35(87.5)	0.19(0.039-0.921)	0.039*

Not working	27(19.1)	114(80.9)	1.22(0.151-9.840)	0.852
Education level				
Normal formal education	46(35.1)	85(64.9)	1	
Primary	14(12.7)	96(87.3)	0.000(0.00)	0.999
Secondary	6(21.4)	22(78.6)	0.000(0.00)	0.999
Tertiary	1(6.2)	15(93.8)	0.000(0.00)	0.998
Social support				
Yes	30(15.0)	170(85.0)	1	
No	37(43.5)	48(56.5)	3.65(1.77-7.525)	0.000**
Number of people in Household				
3-6 people	7(12.5)	49(87.5)	1	
7-10	25(21.4)	92(78.6)	8.17(0.165-4.048)	0.805
>10 people	35(31.2)	77(68.8)	0.62(0.163-2.357)	0.482
Low Birth weight of past pregnancy				
Yes	19(39.6)	29(60.4)	1	
No	40(21.1)	150(78.9)	0.42(0.176-0.987)	0.047*
Number of live children				
1-4 children	36(18.1)	163(81.9)	1	
5-9	20(28.2)	51(71.8)	0.00(0.00)	0.998
10 and above	11(73.3)	4(26.7)	0.00(0.00)	0.996
Parity				
1-4 children	30(16.5)	152(83.5)	1	
5-9	18(23.4)	59(76.6)	0.00(0.00)	0.999
10 and above	19(73.1)	7(26.9)	0.00(0.00)	0.999
Pregnancy status				
Wanted	45(19.9)	181(80.1)	1	
Unwanted	22(37.3)	37(62.7)	0.95(0.196-4.607)	0.949
Type of pregnancy				
Planned and supported	34(17.4)	161(82.6)	1	
Unplanned and supported	12(25.0)	36(75.0)	0.87(0.058-13.021)	0.919
Unplanned and unsupported	21(50.0)	21(50.0)	0.39(0.040-3.719)	0.410
Gestational age				
Full term (37-41 weeks)	27(12.2)	194(87.8)	1	
Preterm (<37)	40(65.6)	21(34.4)	0.00(0.00)	0.997
Post-term (42 weeks and above	0(0.0)	3(100.0)	0.00(0.00)	0.997
Attended ANC				
Yes	57(20.9)	216(79.1)	1	
No	10(83.0)	2(16.7)	2.23(0.143-34.799)	0.566
Frequency of ANC				
<4	44(29.3)	106(70.7)	1	
4 times	15(15.2)	84(84.8)	0.996(0.017-57.126)	0.999

>4	8(22.2)	28(77.8)	68.99(1.021-4661.183)	0.049*
Trimester for beginning ANC				
First trimester	19(13.3)	124(86.7)	1	
Second trimester	28(25.0)	84(75.0)	2.09(0.143-30.549)	0.590
Third trimester	10(55.6)	8(44.4)	1.16(0.084-15.902)	0.914
Chronic diseases				
Yes	12(52.2)	11(47.8)	1	
No	55(21.0)	207(79.0)	0.36(0.090-1.430)	0.146
Suffered from illnesses				
Yes	48(30.4)	110(69.9)	1	
No	19(15.0)	108(85.0)	1.92(0.713-5.174)	0.196
Congenital				
Yes	9(50.0)	9(50.0)	1	
No	58(21.8)	208(78.2)	2.13(0.298-15.282)	0.450
Experienced pregnancy complication				
Yes	26(36.6)	45(63.4)	1	
No	41(19.2)	172(80.8)	0.42(0.181-0.994)	0.048*
BMI				
Normal	24(13.0)	160(87.0)	1	
Underweight	42(49.4)	43(50.6)	0.00(0.00)	0.998
Overweight+Obese	1(6.2)	15(93.8)	0.00(0.00)	0.998
Fetal assessment done				
Yes	51(19.8)	206(80.2)	1	
No	16(57.1)	12(42.9)	0.00(0.00)	0.999
Educated on dietary nutrition				
Yes	52(20.1)	207(79.9)	1	
No	13(54.2)	11(45.8)	1.27(0.165-9.843)	0.817
Iron supplement given				
Yes	55(21.2)	204(78.8)	1	
No	10(50.0)	10(50.0)	0.33(0.031-3.411)	0.350
Folic acid given				
Yes	34(15.2)	190(84.8)	1	
No	29(54.7)	24(45.3)	4.82(2.233-10.392)	0.000**
Advised on extra intake of energy and protein foods				
Yes	50(20.2)	197(79.8)	1	
No	13(48.1)	14(51.9)	0.12(0.010-1.333)	0.084
Educated on maternal health issues				
Yes	46(19.2)	194(80.8)	1	
No	17(60.7)	11(39.3)	2.52(0.799-7.931)	0.115
IPT provided (Fansidar)				
Yes	52(19.8)	211(80.2)	1	
No	10(58.8)	7(41.2)	0.45(0.058-3.568)	0.452

Antibiotics given				
Yes	38(15.8)	203(84.2)	1	
No	22(62.9)	13(37.1)	8.74(3.597-21.248)	0.000**
Distance to health facility				
< 5 Kms	24(19.8)	97(80.2)	1	
5	18(18.6)	79(81.4)	0.93(0.179-4.831)	0.931
>5 Kms	25(37.3)	42(62.7)	1.26(0.233-6.746)	0.792
Attitude of health workers				
Poor	1(12.5)	7(87.5)	1	
Fair	15(45.5)	18(54.5)	0.00(0.000)	0.999
Good	34(21.4)	125(78.6)	2393.99(0.000)	1.000
Very good	17(20.0)	68(80.0)	1.22(0.00)	0.996

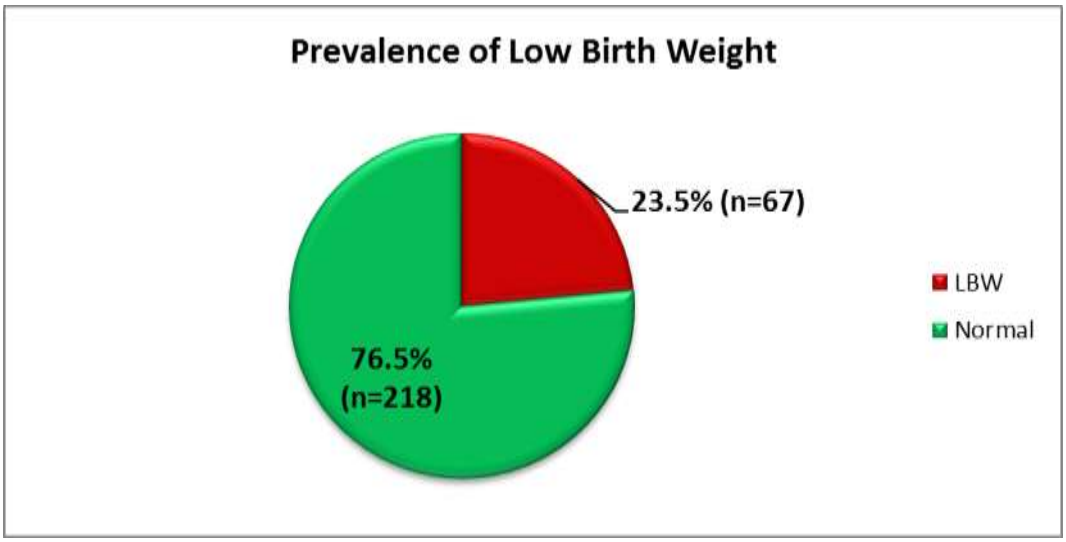

Figure 1: Prevalence of Low Birth Weight