PREVALENCE AND ASSOCIATED RISK FACTORS FOR LOW BIRTH WEIGHT IN BENTIU STATE HOSPITAL, UNITY STATE, SOUTH SUDAN

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DECLARATION

I **John Bosco Alumai** declare that this dissertation is my original work and has not been presented elsewhere for the same or other. In all areas where other people's work has been used, this has been duly acknowledged and referenced in accordance with Harvard reference style as required by Clarke International University.

Signature: _____ Date: _____

APPROVAL

This dissertation has been fully developed under my guidance and has met the standard of Clarke International University.

Signature: _____ Date: _____

(JOHN BOSCO ALEGE)

DEDICATION

This piece of work is dedicated to my Parents Mr. William Dralu and Mrs. Andruo Rose Palma for their tireless effort and guidance throughout the struggle amidst all the challenges.

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Thanks to the Almighty God for the opportunity and blessings that he continues to shower upon me.

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DEFINITIONS OF KEY TERMS

Low Birth Weight	Low birth weight is weight at birth of less than 2500 grams or 5.5 pounds (WHO, 2014)
Maternal Mortality	Refers to the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related or aggravated by the pregnancy or its management, but not from accidental or incidental causes" (WHO, 1994)
Infant Mortality	Means deaths of children under one year of age
Parity	Number of times a woman has given birth with a gestational age of 24 weeks or more, regardless of whether the child was born alive or was stillborn.
Primiparity	Refers to condition of having borne one child (Medical dictionary)
Gravida	Number of times a woman has been pregnant regardless of pregnancy outcome
Asymptomatic Bacteriuria	Refers to bacteria in the urine without symptoms of urinary tract infection or pyelonephritis (Screening is recommended for pregnant women at 12-16 weeks gestation (Medical Dictionary: https://medicaldictionary.thefreedictionary.com/asymptomatic+bacteriuria

LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired immune deficiency syndrome
ANC	Antenatal care
AOR	Adjusted odds ratio
BMI	Body mass index
BMJ	British Medical Journal
CDC	Centre for Disease Control and Prevention
CeMONC	Comprehensive emergency maternal obstetric and neonatal care
COR	Crude odds ratio
CORDAID	Catholic organization for relief and development aid
EPI	Expanded program on immunization
FAO	Food and Agriculture Organization
HIV	Human immune deficiency virus
HPF	Health pooled fund
IQ	Intelligence quotient
IRB	Institutional review board
LBW	Low Birth Weight
MUAC	Mid upper arm circumference
OPD	Outpatient department
PMTCT	Prevention of mother to child transmission
SPSS	Statistical package for social scientist
TB	Tuberculosis
UOR	Unadjusted Odds Ratio
UNICEF	United Nations international Children's Emergency Fund
US	United state
USAID	United States Aid for International Development
WHO	World Health Organization

ABSTRACT

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

General Objective: The general objective of this study was to determine the factors influencing low birth weight among postpartum mothers in Bentiu State Hospital.

Methodology: 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. Purposive sampling technique was used to sample postpartum mothers at birth. Key Informants (10) were purposively selected from the hospital and data was collected using semi-structured questionnaire and key informant interview guide (KIIG). Data was entered into Epi-Info v3.3.1 and exported to SPSS version 20 for statistical analysis at 95% confidence interval. Chi-square test and Fisher's exact test were used to analyze the relationship between independent and dependent variables. 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. Meanwhile, qualitative data were organized in ATLAS Ti and content analyzed into themes to aid triangulation.

Results: There were 285 mothers studied with mean age of 25 years, most mothers were aged between 20-24 and 25-29, 84(29.5% and 83(29.1%) respectively. Majority 219(76.8%) were married. LBW prevalence of 23.5% (67) [N=285, 95% CI: 0.187-0.287] while the majority 218(76.5%) of the postpartum mothers had normal weight babies.

In 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=8.74 95%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.

CHAPTER ONE: INTRODUCTION

1.0. Introduction

Low birth weight is weight at birth of less than 2500 grams or 5.5 pounds. This definition is founded on the epidemiological evidence that infants born less than 2,500 g are about 20 times more likely to die compared with those more than 2,500 grams (*UNICEF & WHO, 2004*).

1.1. Background to the Study

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*). LBW 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*).

The risk factors of LBW can be prevented by lifespan approach that is before, during and post-birth to the health of women all in socioeconomic and environmental as well as medical issues and public education campaigns (*UNICEF, 2002b*), micronutrient supplementation, prevention and treatment of infections, reduction of teenage pregnancy and maternal education (*WHO, 2011*). According to *WHO (2014a*), LBW incidence reduction should improve maternal nutritional status, treating pregnancy related conditions and provision of adequate maternal care, perinatal clinical services including social support.

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

1.2. Statement of the problem

Bentiu state hospital (BSH) has very poor data in general and especially on LBW. The data between June 2017 to May 2018 (*SMOH*) shows that 254 deliveries were conducted in the hospital but no clear records on the number of low birth weight babies, available records are from Feb 2018 which indicated only a single case reported in March 2018. A study conducted in Juba Teaching Hospital by *Aleyo and Alege (2017, Unpublished*) indicated LBW prevalence of 23% (29 out of 125).

The global nutrition goal is to reduce LBW prevalence by 30% by the year 2025 (*WHOd, 2012*), LBW is a strong indicator of maternal and newborn health and nutrition (*UNICEF, 2014a*), it is therefore an important indicator for monitoring progress in achieving the internationally agreed goals (*WHO/UNICEF, 2012*).

Overall, data on LBW remains limited or unreliable since many deliveries occur at home or at small health facilities and are not reported in official figures, which may result in an underestimation of the prevalence of LBW (*WHO, 2014a*). In addition, limited data is available to explain the LBW status at hospital levels especially in Bentiu State Hospital.

Despite government interventions to provide maternal health services, there is still Low birth weight due to prematurity or restricted growth which leads to newborn and child death including disability and communicable deaths (*USAID, 2015*) and cardiovascular disease in later life (*WHO, 2014a*). According to *CDC, (2018*), LBW newborns may be at more risk compared to those with normal weight and the LBW babies may become sick in the first six days or develop infections, suffer from problems related to delayed motor and social development including learning disabilities.

It is therefore significant to ensure these consequences are to greater extent averted. A review for 13 relevant studies in 12 countries that had experienced armed conflict including Iraq, Libya, Israel and Bosnia showed that mothers were at increased risk of giving births to low birth weight babies (*British Medical Journal, 2017*). However, very limited data or study related to the above is available in South Sudan despite South Sudan being among the countries greatly affected by protracted conflict.

Therefore, this study aimed to establish the determinants of low birth weight among postpartum mothers in Bentiu State Hospital in Unity State, South Sudan.

1.3. Objectives of the study

1.3.1 Overall objective

To assess the factors influencing low birth weight in Bentiu State Hospital, South Sudan.

1.3.2 Specific objectives

i. To determine the prevalence of low birth weight among babies born in Bentiu State hospital, South Sudan.

ii. To determine the socioeconomic factors influencing low birth weight in Bentiu State Hospital, South Sudan.
iii. To determine the individual factors influencing low birth weight in Bentiu state hospital, South Sudan.
iv. To determine nutritional factors influencing low birth weight in Bentiu State Hospital, South Sudan.
v. To determine health services factors influencing low birth weight in Bentiu State Hospital, South Sudan.

1.4 Research Question

What are the factors determining low birth weight among mothers delivering in Bentiu State Hospital?

1.4.1 Specific Questions

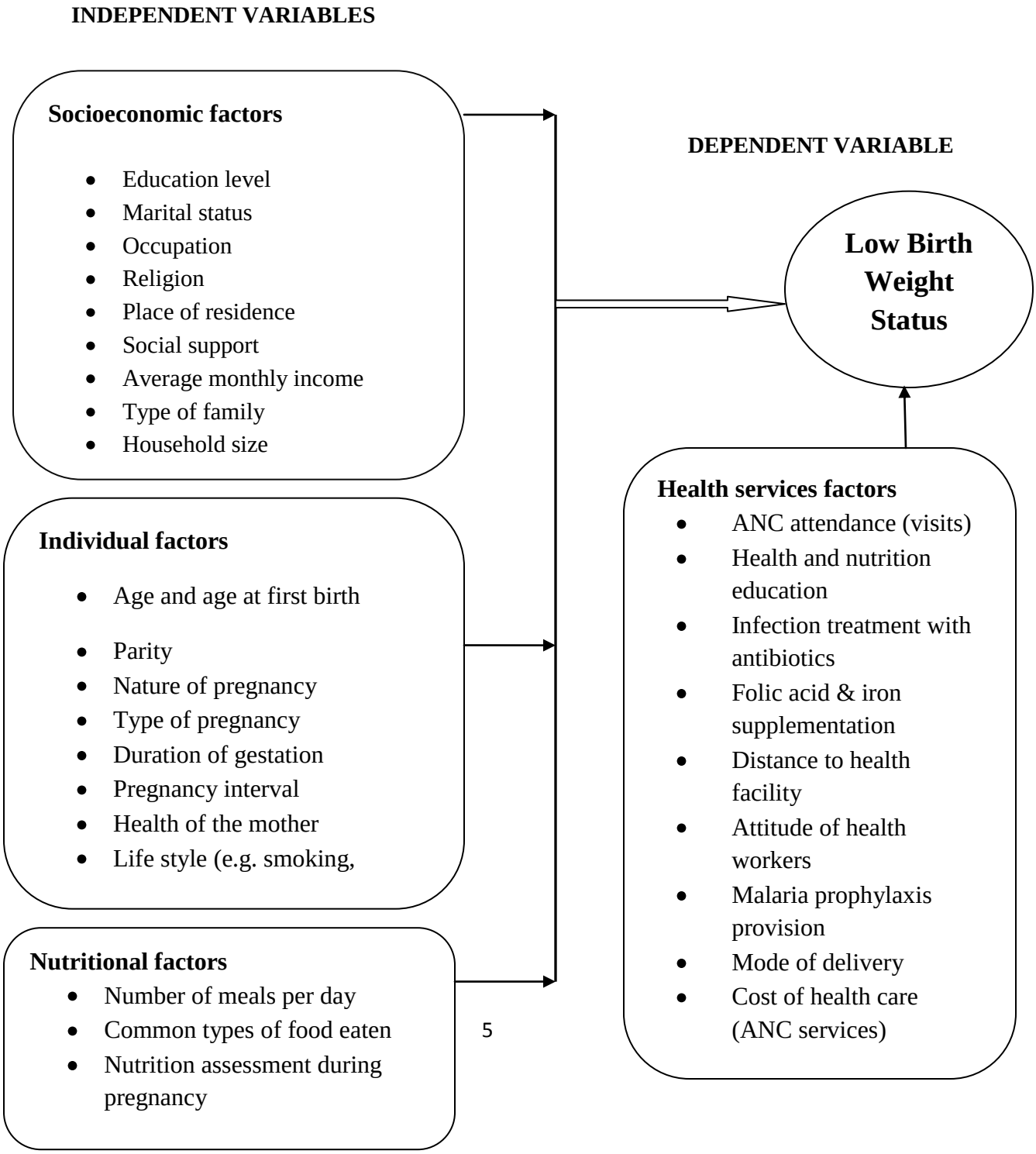
i. What is the proportion of babies born with low birth weight in Bentiu State Hospital?
ii. What are the socioeconomic and demographic factors influencing low birth weight among postpartum mothers delivering in Bentiu State Hospital?
iii. What are the individual factors influencing low birth weight among postpartum mothers delivering in Bentiu state hospital?
iv. What are the nutritional factors influencing low birth weight among postpartum mothers delivering in Bentiu State Hospital?
v. What are the health service factors influencing low birth weight among postpartum mothers delivering in Bentiu State Hospital?

1.5. Significance of the Study

The study determined the proportion of Low Birth Weight among postpartum mothers in Bentiu State Hospital. In addition, the key factors associated with low birth weight which will inform the health facility management on the findings, academia, and policy makers among others.
The study results may be used to improve nutritional and other maternal interventions as well as scaling up of community-based campaigns on low birth weight.

The findings will add to existing literature on prevalence and knowledge base on low birth weight and factors associated with it among the postpartum mothers so that further research to close the gaps that this study would not have addressed. The study results may also inform policy makers and hospital managers to plan and implement context specific strategies that will appropriately prevent and reduce the incidence and burden of low birth weight.

***Figure 1**: Conceptual framework*



1.6. Description of the Conceptual framework

The conceptual framework illustrates the relationship between low birth weight with socioeconomic, individual, nutritional and health service related factors and how those factors may contribute to LBW.

The framework specifically shows that the socioeconomic variables like marital status, education level, and occupation, place of residence, average monthly income, type of family and social support may influence low birth weight among postpartum mothers.

Secondly, the individual variables that may also influence the prevalence of LBW include; age, age at first birth, duration of gestation, pregnancy interval, marital status, size of family, health of the mother, life style, and tribe/religion.

Nutritional factors that may influence LBW like regular intake of breakfast, number of meals per day, common types of food taken and nutritional assessment during pregnancy.

Health system factors may also contribute significantly in determining or influencing the low birth weight of the postpartum mothers. In this study, the variables being studied are; ANC attendance (Recommended at least 4 visits per pregnancy), health and nutritional education, folic acid and iron supplementation, distance to health facility, attitude of health workers, malaria prophylaxis during pregnancy, mode of delivery and cost of health care.

This study found out the prevalence of low birth weight at Bentiu State Hospital was at 23.5%.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

The literature review consists of what is already known from various studies conducted on low birth weight and associated factors to it. The literature categorically gathered on regarding the; socio-demographic characteristics of mothers, individual, socioeconomic, nutritional and health services related factors. The study also reviewed the views of the key informants on low birth weight and associated factors.

2.1. Prevalence of Low Birth Weight

Nearly 22 million newborns, an estimated 16% of all babies born globally were of low birth weight. Among regions south Asia has the greatest incidence of low birth weight 28% followed by West and central Africa including other least developed countries at 14% and sub Saharan Africa at 13% (*UNICEF & WHO, 2013*).

A hospital-based study conducted by *Fosu et al., (2013*) in Ghana found prevalence of low birth wieght was at 21.1% with normal mean weight of 4.012±0.062 kg. This study result conducted with reproductive age group mothers had small difference with a study in Uganda Bayo et al., (2016) who found LBW prevalence of 25.5 percent. This study however focused on the teenage mothers in Mulago National Referral Hospital. Another facility-based study in Ethiopia by *Hailu & Kebede, (2018*) that reviewed records of 441 newborns and mothers found LBW prevalence of 33.3%. The prevalence in Ethiopia was higher than that in Uganda.

The difference could be due to the study location, the study in Ethipia was conducted in a rural area with poor socioeconomic conditions as compared to that conducted within the city in Uganda.

In a similar finding, a study in Ethiopia that used *2011 Demographic and Health Survey data of Ethiopia* found LBW prevalence of 32.1% and 68.8% had larger size at birth Betew & Muluneh, 2014**).** The prevalence of LBW in the EDHS and the facility-based study were close but the health facility-based study was slightly higher than that of EDHS of 2011. The mothers who gave birth at health facility were likely to have attended ANC where counseling and health education is provided including maternal nutrition. This means women will have access to knowledge including nutrition education. The EDHS study was population-based study where some mothers in the community do not attend ANC and other health services hence, they become more predisposed to bearing of low birth weight babies.

In Ethiopia, a study by *Teklehaimanot et al., (2014*) that was in two districts showed LBW prevalence of 9.9% in Axum and 6.3% in Laelay Maichew districts. The community-based study appears to have low prevalence of LBW compared to health facility-based studies. However, a community-based study in India in 66 villages in West Bengal found high LBW prevalence of 29% (*Dasgupta & Bavu, 2011*). This difference could be due to study design, sociodemographic characteristics of the community members and accessibility status to preventive and health care services. A study conducted in tertiary hospital in Maseru City; Lesotho by *Nwako (2018*) found LBW prevalence of 24.75%. Another hospital based study in Ethiopia had slightly lower LBW prevalence of 17% compared to that in Lesotho which was partly attributed to a higher prevalence of complicated pregnancies which led to increased LBW babies (*Zeleke et al., 2012*). The difference in the two studies could be due to the sample sizes, weighing scales and study design that may be related to the difference as well as the quality or package of services available to the expectant women at the hospitals.

2.2. Socioeconomic factors and Low Birth Weight

Sex of newborn

Teklehaimanot et al., (2014) found female newborns were 6 times more likely to have LBW than their male counter parts. Similarly, in a population-based studies in different countries, **Mahumud et al., (2017**) also found female babies were prone to have LBW than males in Tanzania (OR=1.4), Indonesia (OR=1.2), Armenia (OR=1.4) and Jordan (OR=1.6). Similarly, a study showed that birth weight has consistently been indicated to be higher among male newborns than females (*Kramer, 1987*). This reason could be due to either genetic, enviromental or nutritional factors that may interact to have this outcome. However, it was also explained that the difference is due to the action of the androgen (*de Zegher et al., 1998*). However, the above studies were not in conformity to a study carried in Uganda among teenage mothers that found no significant association between sex of the baby and LBW (P=0.932).

Age of postpartum mother

The age of the mother during time of birth was found to have some difference in the LBW. *Fosu et al., (2013*) in their study found that LBW among women aged 25-34 years were 1.106 times likely better compared to those aged less than 24 years and above 35 years. 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 yet the normal age range for mothers with normal birth weight lies between 20-29 years.

In contrary, *Mahumud et al., (2017*) found mothers with advanced age from 35 to 49 years had significantly higher risk of delivering LBW babies compared with younger mothers ($p<0.01$). In old age, women are exposed to many medical conditions which in turn increases the likelihood of having LBW babies.

Marital status

Bayo et al., (2016 in their study did not find significant association between marital status and LBW. This implies marital status does not matter in LBW outcome because any expectant mother irrespective of marital status once predisposed to the risk factors can give birth to LBW newborns.

Education level

The maternal education level may be a key determinant of health outcomes of mothers and their infants. A study conducted by *Fosu et al., (2013*) in Ethiopia revealed that maternal education appears to be a very significant predictor of the baby's size at birth and it emerged that risk of small size at birth was found to be significantly higher for children whose mothers have no education than children whose mothers have secondary and higher level of education (*Betew & Muluneh, 2014).* This implies that it is important to ensure girls go to school because the value of education appears to be enormous in health.

According to *Yadav et al., (2011*), literate mothers had low number of babies with LBW. They further explained that this difference could be due to increased awareness of educated women on health services. *Agarwal et al., (2011*) in their study also found higher proportion of LBW (65.5 percent) among uneducated mothers and the risk appears to reduce linearly as the education status improved. In addition, the study elucidated significant association between mother's education and birth weight was statistically significant ($p<0.0000$).

In general, education level appears to have influence on reducing LBW; therefore, it is valuable to have interventions that should improve education levels of women as well as for female children in order to realize reductions in the prevalence of LBW.

Occupation

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. 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 (*Mahmoodi et al., 2015*). In related finding, *Ohlsson et al (2008*) also confirmed that standing and hard physical work, lifting objects, long working hours, and shift working have important roles in many pregnancy outcomes including preterm delivery, LBW, and as prenatal and infant mortality determinant which was also in agreement with finding from *Niedhammer* et al *(2009*) who reported that working more than 40 h/week and shift working are associated with increased incidence of LBW.

On the other hand, they also found that occasional jobs are a preventative factor in premature births (*Niedhammer et al., 2009*). It was also noted that hard work that is associated with changes in women's dietary habits has a role in subsequent negative pregnancy outcomes (*Behrouzian et al., 2009*).

Place of residence

A study by *Fosu et al., (2013*) also indicated that mothers who reside in rural areas tend to bear low birth weight children compared with women who live in urban areas. This difference could be due to the differences in socioeconomic status among those who live in the two locations, the women in urban Centre's appears to be more educated, with access to financial resources, information and to healthcare services compared to women in rural areas.

Similarly, in contrast, a study by *Teklehaimanot et al., (2014*) disagreed with finding of *Fosu et al (2013)* but found higher LBW prevalence in urban area than in Rural areas. *Gebremedhin et al., (2015*) study was in agreement with finding of *Teklehaimanot et al (2014*) where mothers living in rural area were found to be more than four times likely to have LBW babies than those residing in urban places. The households in rural areas have limited access to proper health care services, health information and goods from markets that may increase on their dietary diveristy compared to the women in urban areas.

Average monthly income

The income of the mother is very important because it's important tool for access to services among others. The study in Ethiopia indicated that socioeconomic status of mothers appears to be a significant determinant in size of baby at birth (*Betew & Muluneh, 2014*).

This implies that babies born to mothers who have low- or medium-income levels are at increased risk for low birth weight compared to those with higher income levels.

Mahumud et al., (2017) in their study found low socioeconomic status was a risk factor of LBW, which was in agreement with study results that the poorest women in developing countries are at a significantly greater risk of producing LBW babies (*Sebayang et al., 2012*).

This means that women of low socioeconomic factors have limited financial potential to access basic goods and services that may reduce their risk factors unlike the women of high socioeconomic status.

Social support

It is recognised that during pregnancy, women become vulnerable to infections and complications hence there is need to support them socially by their partners, relatives friends and am others.

During this period, the woman is dependent on her family and surrounding both physically and mentally. In terms of its tentacular effect, social support affects the pregnancy outome through emotional and moral support which reduces the emotional stress and aids the women to cope with stress during pregnancy. In addition, helping the women in domestic chores and in health related behaviors like dietary habits, substance abuse prevention and control, and deliver plans are supports that can translate to desired pregnancy outcomes including low birth weight (*Berkman et al., 2014*). Therefore, it is of paramount significance that male partners should provide adequate physical, mental and emotional support to their spouses during pregnancy so as to reduce pregnancy depression, stress, amxiety among others responsible for subsequently causing low birth weight babies.

A study found that lack of social support to women is likely to reult 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*). This means that it is vital to provide all the neceesary and psychological support to women before, during pregnancy to promote desired and positive pregnancy outcome.

A study by *Almeida et al., (2014*) found that low social support for women was associated with low birth weight babies. However, 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 the actual study settings. The finding by Almeida

was interestingly supported by results from study by *Straughen et al (2013*) where high perceived spouse support was protective for low birth weight (*Straughen et al., 2013*).

This finding however showed support by the spouse which holds true because for married women, the spouse is expected to contribute the greatest social support to the wife. The above finding was in agreement with study conducted by *Shah et al., (2013*) who found an increased likelihood for LBW among adult and teen pregnancies with no paternal support.

2.3. Individual factors and Low Birth Weight

Pregnancy interval

Agarwal et al., (2011) found the proportion of LBW was 38.5 percent among the mothers who had inter-pregnancy interval of less than 2 years and 31.0 percent for those with interval of more than 2 years. However, there was insignificant association between low birth weight and inter-pregnancy interval.

Although the difference in the above proportion was not much, it is important to ensure couples adopt birth spacing of at least 2 years and above. During pregnancy, the mothers share the nutrients obtained with the unborn child. This means that from birth, postpartum mothers begin to regain their natural body state but having another early pregnancy before total recovery at least for 2 years predisposes them to more risks of giving birth to LBW babies.

A study by *Kader & Perera, (2014*), however found no significant association between short inter-pregnancy intervals and LBW despite the fact that short inter-pregnancy intervals may lead to exhaustion of maternal nutrient reserves hence reduced birth weight. Therefore, this strengthens the recommended 2 years' pregnancy interval.

Nature of recent pregnancy

It is very important for pregnancy to be planned and supported. A study by *Teklehaimanot et al., (2014*) revealed that babies born from unwanted and unplanned pregnancies were 4 times more likely to be LBW than those from wanted and planned pregnancies. This implies that unwanted pregnancy and unplanned pregnancies are risk factors for giving birth to LBW. There may also be high likelihood of delays in seeking and using maternal health services among mothers whose pregnancies are unplanned and unwanted.

Although *Shah et al., (2011*) in their study found significant association between unwanted pregnancy and LBW, but a study by *Noureddine & Abdellatif, (2015*) disagreed with their finding. The differences in the above studies could be attributed to the socioeconomic factors, study location or the study designs. In addition, mothers giving birth to children whose pregnancy was unwanted could be associated with LBW because the mother could be in financial crisis and psychological torture hence may lack the capacity to improve or maintain better nutritional status during pregnancy or have limited access to health services.

Mother's Parity (Primiparity & Gravida)

The parity of mothers appears to be important factor in determining low birth weight. The study in Ethiopia showed that mothers of parity 1 were 1.483 more likely to have low birth weight babies than mothers with parity four (4) (*Betew & Muluneh, 2014*).

In another study by *Yadav et al., (2011*), 27 percent of primiparous women gave birth to LBW babies. On the other hand, a study by *Hailu & Kebede, (2018*) however found no significant association between parity and low birth weight. This difference could be due to design of the study in the two studies.

Further review showed that the study conducted by *Yadav et al (2011*) was a facility based cross sectional study that had 306 mothers while the study by *Hailu & Kebede (2018*) was an unmatched case-control study conducted among deliveries that occurred in referral hospital where birth records and mothers' ANC files were reviewed.

Gebrehawerya et al., (2018) in their study found Primigravida mothers were about five times more likely to give low LBW than multi parous mothers. Similarly, *Bugssa et al., (2014*) also found lower mean 1.41+ 0.41 BW among primi-para mothers than grand multi-parous of 2.17+ 0.18 (P=0.0001). Primigravida mothers have usually given birth for the first time hence are young and had poor pre-pregnancy nutrition and the on-going maternal growth tends to have singificant impact on the fetal growth. As a result, the woman's chances of producing LBW is increased.

Gestation duration

The study in Uganda by *Bayo et al., (2016*) showed that the gestational age of 37 completed weeks was significantly associated with LBW (p= 0.001). In a study in Ethiopia by *Hailu &*

Kebede, (2018) babies born preterm were found to be more likely to be of low birth weight when compared to their full-term counterparts. Another study in Iran similarly showed that preterm birth was found to be a risk factor of low birth weight (*Mirzarahimi et al., 2013*).

As preterm birth is found to be a risk factor, conformity was also established in *Gebremedhin et al., (2015*) study where babies born before gestational age of 37 weeks were 18 times more likely to have LBW compared to those born after gestational age of 37 weeks.

Gestational age at 1st ANC visits

A study conducted in Nigeria by *Agarwal et al., (2011*) revealed 68.5 percent of the mothers had ANC checkup in the last trimester while 31.5 percent and 37.5 percent among the mother reported for ANC checkups during first and second trimester, respectively. It also indicated significant association between early ANC in first trimester or second and lower prevalence of LBW ($p<0.0000$). This implies that it is very important for women to attend ANC from first trimester for them to realize desired birth weight of their children. Although significant difference was found with even first attendance from second trimester, but the recommended should be in the first trimester. When expectant women make early ANC visit in the first trimester, they are likely to access and use the recommended services required in the first trimester including counseling and health education. Therefore, the interventions provided may have significant influence on the outcome of the pregnancy.

Age at first birth

Betew & Muluneh, (2014) in their study in Ethiopia found that mother's age at first birth emerged to be an important predictor of baby's size at birth. In the same study, mothers who gave birth to their first child at age of less than 15 years and 15 to 19 years were more likely to produce low birth weight babies than mothers aged 20 and above years. This same study was in conformity with that of *Oladipupo & Ipadeola, (2013*).

Many factors may contribute to this outcome including the fact that the body of an adolescent girl has not fully matured to have normal birth weights. In addition, the risk is added further especially when the adolescent girl was born to a woman of poor nutritional status.

Maternal illness or complications

Yadav et al., (2011) found 40 percent of the mothers in their study had significant illness and 23 percent had complication during pregnancy. Among the mothers who had maternal illness, up to 53 percent of them had low birth weight.

Bayo et al (2016) in their study determine whether malaria incidence during pregnancy had significant association with LBW. The result however emerged that malaria was not associated with birth weight (P = 0.675).

In *Hailu & Kebede, (2018*) study, babies born to mothers having history of chronic diabetes mellitus were less likely to be born with low birth weight than those without DM history. This result however could be an incidental case. However, it emerged in a hospital-based study in Ethiopia by *Gebremedhin et al., (2015*) that presence of chronic medical illness instead increased the risk of low birth weight and similar results by *Noureddine & Abdellatif, (2015*).

Congenital syndromes

Congenital abnormality was investigated by *Bayo et al., (2016*) in their study among teenage mothers in Mulago, Uganda. The result however showed not significant association (p=0.704). This implies that there is insignificant influence of congenital abnormality of birth weight.

Physical trauma or Placental factors

Babies born to mothers who had previously encountered or experienced physical trauma during pregnancy were more likely to be born with LBW. This result may imply that physical trauma that could occur during strenuous work or any accidental injury could have a direct effect on birth weight of the baby (*Hailu & Kebede, 2018*).

Similarly, a study conducted at a tertiary care hospital in Uttar Pradesh, revealed that severe physical work was one of the significant determinants of low birth weight. Similarly, *Sharma et al., (2015*) found hard physical work during pregnancy (AOR=1.48).

Pregnancy complication

Complication during pregnancy may have negative birth outcomes. A study by *Hailu & Kebede, (2018*) found occurrence of any sign of pregnancy complications (any one or more of bleeding, gush, headache, blurred vision, fever, and severe abdominal pain) was significantly associated

with low birth weight. This implies that such complications become a risk factor during pregnancy as well as risk factor for low birth weight outcome. It emerged that this study finding was in agreement with 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.

2.4. Nutritional factors and Low Birth Weight

Mothers' nutritional status (Nutrition assessment)

A study conducted by *Thomre et al., (2012*) found weight of mother showed no significant risk of low birth weight. However, a study by *Gebremedhin et al., 2015*) instead found mothers who had body weight of less than 50 kg had two fold higher chances of giving birth to LBW babies compared to those with weight of 50 and more kgs.

The body mass index (BMI) of mothers was not found to be significantly associated with low birth weight.

In regards to the above, a study by *Kader & Perera, 2014*) disagreed with the finding of *Nwako (2018)* but found women with BMI (<18.5) had 49% higher odds of having LBW babies than those with BMI 18.5-24.5kgm^2. In addition, *Nwako (2018*) study did not also found significant association between MUAC measure for nutritional status and low birth weight.

Height of the mother

Nwako (2018) found 47 in 389 mothers had short stature and 342 had normal stature. The same study showed significant association between low birth weight and mothers' height (p=0.0015). In another similar study by *Kader & Perera (2014*), the risk estimates for having a baby with LBW was significantly higher for women with short stature (height <145 cm).

Frequency of meals

A study conducted by *Paneru et al., (2014*) in India found that frequency of meals per day was found to be significantly associated with LBW and similar finding by *Elhassan et al., (2010*).

In another study in Ethiopia, *Gebremedhin et al., (2015*) found mothers who had three or les times meals a day were about 2.5 times more likely to deliver LBW baby compared to those who had four or more meals a day. This is because during pregnancy both the mother and the unborn baby require sufficient intake of food nutrients in balanced proportions to remain healthy therefore unhealthy eating habits or insufficient intake of the right amounts of food is associated with LBW.

2.5. Health services related factors and Low Birth Weight

ANC attendance

A study by *Betew & Muluneh, (2014*) found the number of antenatal care visits has a significant association with baby's size at birth. It also emerged that, women who had 4 and above antenatal care gave birth to higher birth weight babies as compared to mothers who received less than 4 antenatal care visits. Similarly, *Mahumud et al., (2017*) in their country-based study also found ANC visits were associated with significant reductions in LBW, while inadequate ANC attendance was related to an elevated risk of LBW (OR, 1.7; 95% CI, 1.1 to 2.8; $p<0.01$).

This means the more ANC attendance, the adequate services utilization during those visits because each stage of visit has new interventions provided in addition to what has been previously provided. This therefore ensures women have access to a number of interventions that have both preventive and protective measured against LBW.

A study conducted *Fosu et al., (2013*) revealed that mothers who did not attend antenatal care were 1.222 times more likely to bear LBW newborns compared with those who attended ANC. This 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). A study conducted by *Agarwal et al., (2011*) in Nigeria showed that the proportion of LBW was 70.5% among the mothers who had irregular ANC checkup compared with 29.5% of regular attendants. 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.

In addition, irregular attendance predisposes women to non-compliance to medications and healthy and preventive practices or behaviors. In *Teklehaimanot et al., (2014*) study, in adequate

utilization of ANC in urban area was found to be significantly associated with LBW. It emerged in the same study that mothers who had four or more ANC visits were 71% less likely to bear LBW babies compared with those who had equal to three or greater times of ANC visits. Similarly, a study by Yadav et al., (2011) also was in conformity with that of *Teklehaimanot et al., (2014*) including studies by *Bhattacharjya et al., (2015*) and *Kaushal et al., (2012*).

Gebrehawerya et al., (2018) in another facility-based case control study in India; mothers who had ANC visit of three or less were 40 times more likely to bear LBW newborns than those who have greater than three visits. A similar finding was found by *Bugssa et al., (2014*).

ANC interventions

WHO (2016) recommended that 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 means utilization of ANC among pregnant women becomes important so that diagnosis can easily be undertaken and treatment provided where necessary.

According to *US Department of Health and Human Services et al., (2014*), in order to reduce or prevent LBW, there is need to screen and counsel women to reduce smoking, alcohol, and substance use during pregnancy. In addition, healthcare providers should provide comprehensive care before, during, and between pregnancies to identify and address chronic health conditions and to prevent unintended and rapid repeat pregnancies and communicate on social predictors like housing and employment.

This reiterates the fact that all ANC interventions have the potential to prevent LBW if expectant mothers utilize the services from the recommended time right from first trimester up to four or more visits during pregnancy.

Provision of folic acid and iron supplementation

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 maternal anemia, puerperal sepsis, preterm birth and low birth weight. It is therefore important to ensure the tablets are made available and pregnant women be informed of the necessity of the supplementation during health education and promotion. The absence of the

supplementation would lead to anemia among the women which in turn affects the fetus because same blood is used hence aggravating low birth weight.

Low Birth Weight can be prevented when healthcare providers discuss with women the warning signs or symptoms of preterm labour and taking of daily multivitamin containing 400 micrograms of folic acid before and throughout pregnancy (*CDC, 2017*).

During pregnancy, women are usually given iron supplementation in order to treat anemia and increased dietary nutrient is advised for them.
In study *Hailu & Kebede, (2018*) however found significant association between iron supplementation and low birth weight (p=0.194). This means iron supplementation does not matter much on weight at birth because even without iron supplementation, an expectant mother who feeds well has the potential to develop adequate blood.

Mode of delivery

Mode of delivery appears to be related with low birth weight. The study by *Hailu & Kebede, (2018*) revealed that babies born through caesarian and instrumental deliveries (forceps and vacuum delivery) were less likely to be of low birth weight compared to those via spontaneous vaginal delivery. This implies that LBW was not common in caesarian and instrumental deliveries unlike spontaneous vaginal delivery. In most cases, caesarian and instrumental deliveries are indicated for babies with bigger size or any other factor related to the mother. It is also an indication that the mother should have fed well during pregnancy.

Medical checkup and disease control

In addition, health care providers should ensure women access medical checkup before pregnancy and control diseases such as high blood pressure or diabetes as well as preconception health care and early prenatal care in throughout the pregnancy *(CDC, 2017*). Similarly, *Promising Practices Network (PPN), (2014*) also recommended that Healthcare providers should encourage women on healthy preconception, fertility planning and screening for medical conditions. These checkups allow for early detection of medical conditions or nutritional status that can be prevented or treated before it becomes a risk factor to LBW.

Nutritional education

World health organization recommended it is necessary to conduct nutrition education on energy and in undernourished populations, there is need to conduct nutrition education that should focus on increasing daily energy and protein intake for expectant women to reduce the risk of low birth weight (*WHO, 2016*). It is therefore recognized that expectant women who do not have adequate energy and protein foods have higher chances of increasing their risk to bearing LBW babies.

According to study by *Ota et al., (2015*) that reviewed findings from 9030 women from 17 Randomised Controlled Trials (RCTs) and Cluster-RCTs that focused on ANC dietary education to improve maternal and infant health outcomes. The result showed that LBW was reduced by 96% for women who received nutritional education to increase energy and protein intake compared with those who had no education during their pregnancy period. Conducting nutrition education for mothers especially during ANC attendance imparts knowledge among the women on what they should eat, exercise and prevent diseases. This means women educated on nutrition aspects make desired and informed decission in order to have better newborn outcomes.

Provision of antimalarial drugs

WHO (2016) recommended that intermittent preventive treatment with Sulfadoxine-pyrimethamine (IPT_P-SP) in for all pregnant women is important in malaria endemic areas in Africa including South Sudan.

It is recommended that treatment should begin in the start of second trimester, and doses should be provided at least one month apart, with objective of ensuring that at least three doses are received. da *Lopes et al., (2017*) reviewed RCTs and quasi-RCTs that evaluated the effect of antimalarial drugs for preventing malaria during pregnancy and the risk of LBW.

It emerged that the two reviews revealed a 27% reduction of LBW for women receiving antimalarial drugs compared with women not receiving these drugs during pregnancy. Therefore, it is important for healthcare providers to avail antimalarial drugs at health facilities so that women have access to them because malaria has the potential to weaken one's immunity as appetite for food is also antagonized hence risk of LBW.

CHAPTER THREE: METHODOLOGY

3.0. Introduction

This chapter describes the methodology used in determining the proportion of low birth weight among postpartum mothers in Bentiu State Hospital. The study also determined socioeconomic, maternal nutritional and health system related factors associated with low birth weight among postpartum mothers. This chapter therefore explains the study design used including; the sources of data, study population, study area, sample size determination, sampling technique and procedure, study variables, selection criteria, data collection methods and tools, quality control measures, ethical considerations, dissemination of results and limitations of the study.

3.1. 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.

3.2. Sources of Data

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.

3.3. Study Population

The study population consisted of mothers who delivered in Bentiu State hospital South Sudan and mothers coming for postnatal care with cards that had clear records of the baby at birth especially the weight.

Inclusion criteria; all mothers who delivered in the hospital and those who attended post-natal care who consented to participate in the study.

Exclusion criteria; mothers who gave birth to preterm babies, post-natal mothers who did not bear cards with weight of the baby and mothers who did not consent to participate in the study.

3.4. Sample size Calculation

The sample size was determined using formula for single population proportion. 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*).

From

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

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,

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

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

= 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.

3.5. Sampling procedure

The study was facility based that involved census method of data collection, where all postpartum mothers who gave birth in Bentiu Hospital and consent to participate in the study were interviewed subsequently until the required sample size was reached.

The study respondents were asked to consent and those who accepted to participate in the study were interviewed. 10 health care providers participated in the study as key informants.

Study Variables

3.6. Dependent variable

In this study, the dependent variable was low birth weight of the newborns among the postpartum mothers. The weight of the babies born were obtained within 2 hours after delivery and recorded. The newborns with birth weight of <2.500 grams were coded 1 and those with >2,500 grams were coded 0.

3.7. Independent variables

The study has four main independent variables and these included; socioeconomic/demographic variables which consisted of occupation, education, place of residence, social support.

The second was individual factors which looked into; age at 1st birth, duration of gestation, pregnancy interval, marital status, size of family, health of the mother, life style, and tribe/religion.

The third variable looked at nutritional factors like regular intake of breakfast, number of meals per day, common types of food eaten and nutritional assessment during pregnancy.

The last variable looked at health services factors like ANC attendance, health and nutrition education, folic and iron supplementation, distance to health facility, attitude of health workers, malaria prophylaxis, mode of delivery and cost of health care.

3.8 Data collection techniques

Researcher administered questionnaire method was used to collect data from postpartum mothers and key informant interview technique was used for the key informants.

Questionnaires were administered to the postpartum mothers serially except if the mother did not consent to participate until the required sample size was attained and,

Face to face interviews held with the key informants who were the health workers working in maternity and postpartum wards of the hospital except support staff. 10 technical heath care workers participated in the study.

3.9. Data collection tools

Structured questionnaire and key informants interview guide were used for data collection.

The study used researcher administered semi-structured questionnaire to collect quantitative data among postpartum mothers in Bentiu State Hospital and key informant interview guide to collect qualitative information.

3.10. Data Analysis procedure

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.

3.11. Quality Control Issues

Translation; The data collection tools were translated form English to Arabic and back to English to check whether the meaning of the questions was maintained and to ensure the equal participation of those who did not understand English.

Pretesting; the questionnaire was pretested to check understanding before using it to collect data for the research.

Training; the researcher ensured the study met the required standards and quality. The research assistants knowledgeable in both Arabic and English were recruited.

The research assistants thereafter were trained on the key aspects of the research mainly the purpose, objectives, methodology and then the contents in the questionnaires.

3.12. Ethical Issues

Prior to data collection, the researcher obtained research approval through the supervisor from Clarke International University (Formerly International Health Sciences University).

The County leadership of Bentiu and the hospital management were informed of the study through a formal letter that was obtained from the faculty of health sciences.

Consent: The study participants were informed about the purpose of the study thereafter both verbal and consent were obtained from the study participants.

In addition, the participants were informed that all the information they provided will be kept confidential and no third party would have access to their information except the principal investigator for the purpose of the study. The study did not bear names of the participants so as to maintain the participants' anonymity.

Confidentiality: The participants were informed that their participation was voluntary and were free to withdraw from the study at any time. The right of the participants and respect was granted to each regardless of status, race, origin etc. All collected data were safely checked and locked in for later review and management by the principal investigator.

3.13. Limitations to the Study

The study was not able to determine causal relationships between the factors under study and low birth weight among postpartum mothers. The respondents were at some points subjected to recall situations hence the study was limited by recall bias. The study results were not generalized to a larger population in South Sudan because it was conducted in one state hospital. The analysis at multivariate level gave high confidence intervals that might have compromised on the precision of the significant variables.

3.14. Plan for dissemination

The study report will be submitted to the Institute of Public Health and Management for future reference as well as for use by other students in the library. Abstract and Manuscript will be prepared for conference presentation and publication respectively. Copies to Bentiu state hospital and state ministry of health respectively.

CHAPTER FOUR: PRESENTATION OF RESULTS

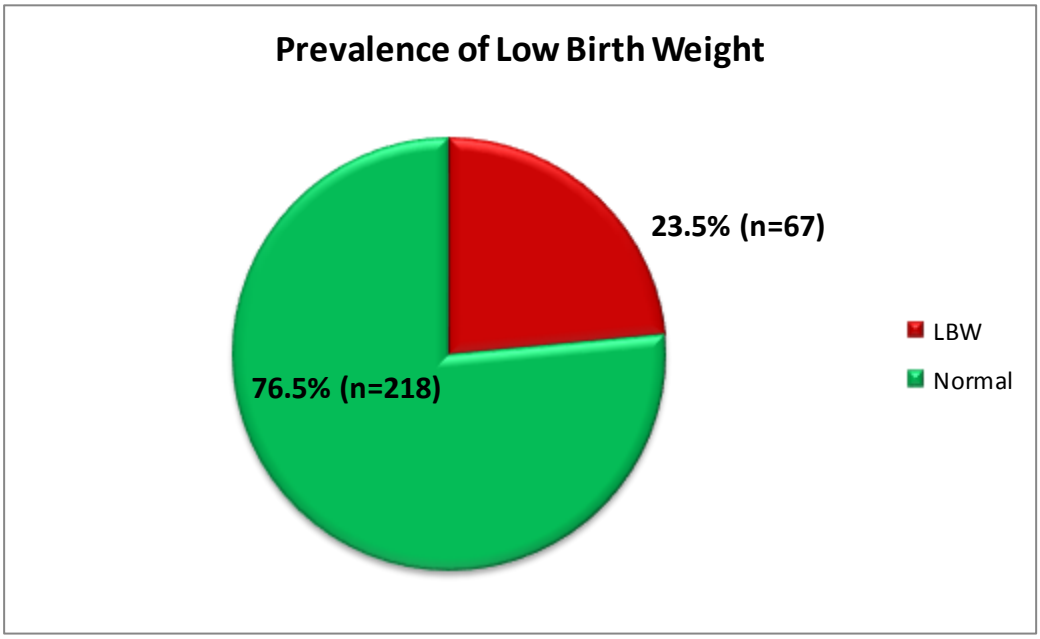
4.0. Introduction

This chapter presents the study findings according to the specific objectives namely; the socioeconomic, individual, nutritional and health services factors. The result consist of findings from postpartum mothers who delivered in Bentiu State Hospital and their newborns' characteristics. The response rate was 100% except some opted not to respond to some question in the questionnaire.

4.1. 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.

Figure 2: Prevalence of Low Birth Weight



4.2.1. Univariate analysis of socioeconomic 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%).

Table 1: Univariate analysis of Socioeconomic 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

4.2.2. Bivariate Analysis between socioeconomic factors and Low Birth Weight

Bivariate analysis was performed between the categorical independent variables and the low birth weight status using chi-square test (χ^2) and Fisher's exact test results were reported for cell values of less than five (5).

The study result showed that mothers aged less than or equal to 19 to 29 years were 222 (77.9%) in total and also 42 in 67 LBW were among the above age group. Mothers aged between 20-24 years had the higher number of mothers who delivered LBW babies and this accounted for the 23(27.4%) out of 84 mothers, the majority age group followed by those aged 25-29 years (83). The age category of the mothers had statistically significant relationship with Low birth weight (χ^2=30.34 df =4, p<0.001). This implies that age is an important factor in determining LBW.

On analysis for strength of association, the mothers aged 20-24 years were 12.9 times more likely to have LBW babies compared to those less than or equal to 19 years but this could be due to the fact that those aged 20-24 were more in number (UOR=12.9 95%CI: 3.997-41.358 p=<0.001). The odds of LBW reduced among those aged 25-29 years. The study revealed that the mothers aged 30-34 were further 11.1 times likely to have LBW. This implies that the older the women, the higher their increased likelihood of bearing LBW (UOR=11.09 95%CI: 3.867-31.823 p<0.001). It can be seen that mothers aged 35 and above were also 5.63 times likely with reduction in odds but this could be due to few mothers producing at late age (UOR=5.6 95%CI: 1.840-17.194 p=0.002).

Marital status of the postpartum mothers was also associated with low birth weight (χ^2=14.898 df=3, p=0.002). Furthermore, married women were 2.5 times more likely to have LBW compared to single mothers (UOR=2.51 95%CI: 0.743-8.498 p=0.138). Likewise, divorced mothers were 4.54 times likely to have LBW and this was found to be significantly associated (UOR=4.54 95%CI: 1.986-10.371 p=0.000). Similarly, widowed mothers were also found to be about 3 times likely to bear LBW newborns (UOR=3.015 95%CI: 0.847-10.736 p=0.088).

Looking at occupation of the mothers, the majority of the babies born with LBW were for peasant mothers and those were not working at all which accounted for 30(38.0%) in 79 mothers

and 27(19.1%) in 141 mothers. Occupation of the mothers was significantly associated with low birth weight of the babies (χ^2=13.55 df =3, p=0.004).

In using logistic regression, mothers who do their own business were found to be less likely to have LBW babies and this was significantly associated with LBW status.

On the other hand, mothers who reported not working were 1.66 times more likely to have LBW babies compared to the peasant farmers (UOR=1.66 95%CI: 0.595-4.628 p=0.334).

Education level of women in this study was also considered as one of the important factors that determine an individuals' knowledge and skills. The mothers with no formal education 131 and those with primary education 110 constituted the majority 241 of the population. In terms of LBW, 46(35.1%) in 131 and 14(12.7%) in 110 of the mothers had LBW newborns (Fisher's exact =19.373, p<0.001). The study found that mothers who completed primary, secondary and tertiary education were less likely to have LBW babies compared to those who had no formal education. The majority of the mothers completed primary education and significant association was found (UOR=0.12 95%CI: 0.016-0.962 p=0.046*).

Regarding religion, 45(22.4%) in 201 of the Catholic mothers gave birth to low birth weight babies, followed by Anglican at 15(27.3%) in 55. The association between Religion of the postpartum mothers and low birth was found to be not significant (Fisher's exact test=3.324, p=0.165).

In overall, more than half 172 (60.4%) in 285 mothers reported that they earn nothing on monthly basis and the group had the higher number of those with LBW 42 (24.4%) followed by those who earn less than 18,000 South Sudanese Pounds on average per month 20(26.3%) in 76. This study found income status of the postpartum mothers had no significant relationship with low birth weight of the babies (Fisher's exact test=3.38, p=0.331).

Although financial capacity is important in access of goods and services, the above statistics appears to indicate income status does not matter in the birth weight status of the babies.

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]

In term of the social support status, 200 in 285 of the mothers reported that they receive social support and 30(15.0%) of them had LBW newborns. This study revealed that social support to the postpartum mothers during pregnancy was significantly associated with low birth weight status of the babies (χ^2=26.99 df=1 p<0.001). Mothers who had low social support were 4.37 times more likely to have LBW compared to those who reported high social support (UOR=4.37 95%CI: 2.45-7.789 p<0.001). Social support by male partners is important for the women during pregnancy and after. 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]*

The study however found no statistically significant relationship between residence status and giving birth weight status of the babies (χ^2=2.37, df =1, =p=0.124). The mothers who reside in urban areas were less likely to have LBW babies compared to those who live in rural areas (UOR=0.64 95%CI: 0.362-1.132 p=0.125).

Similarly, family type also had no significant relationship with birth weight status of the newborns (χ^2=1.92, df =1, p=0.166). The result also indicates that mothers who come from extended families were less likely to have LNW babies compared to those in Nuclear (UOR=0.66 95%CI: 0.362-1.193 p=0.168). This could be due to the fact that in extended family where there are a number of working adults, the expectant women are exposed to better support.

Regarding household size, it is known that the number of people in the household also determines the quantity of food required in the household but availability of adequate food may not be reliable for any family size due to various circumstances. Interestingly, this study revealed that the number of low birth weight increased in increase with the number of people in the house hold. This increased from 7 (12.5%) in a household with 3-6 people to those with 7-10 people to those greater than 10 accounting for 35(31.2%) people. This study confirmed that relationship between number of people in a household and low birth weight was statistically significant (χ^2=7.81 df =2, p=0.020). Further analysis via logistic regression confirmed that mothers from the households with 7-10 people were found to be 3.18 times likely to have LBW babies compared to those who had 3-6 people. (UOR=3.18 95%CI: 1.311-7.725 p=0.011*) It is known that a small family is easy to manage and provide. However, families with high potential of labour in various occupations could still provide adequate livelihood for such household.

Table 2: Bivariate Analysis between Socioeconomic factors and Low Birth Weight

Variable	**Birth Weight Status**		**Total**	**χ^2(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 education	46(35.1)	85(64.9)	**131**		1	
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*

4.3.1 Univariate analysis of individual factors of the postpartum mothers

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.

Table 3: Univariate analysis of Individual factors of the postpartum mothers

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

4.3.2. Bivariate Analysis between Individual factors and Low Birth Weight

This study found that more than half 154 (54.03%) of the postpartum mothers gave their first birth within age bracket of 15-19 years and out of this, 34(22.1%) had low birth weight babies. However, age at first birth was not significantly associated with birth weight status (χ^2=1.29 df=2, p=0.526).

The mothers aged 15-19 years were 1.53 times more likely to have LNBW babies compared to those less than 15 years (UOR=1.53 95%CI: 0.720-3.251 p=0.269). However, the Odds reduced among those aged 20 years and above where they were 1.47 times more likely to bear LBW babies compared to the reference group (UOR=1.47 95%CI: 0.649-3.345 p=0.354).

Regarding pregnancy interval, less than half 111(46.63%) in 238 of the postpartum mothers who gave birth earlier reported their birth interval was 24 months apart. Of the 111, 28 (25.2%) who gave birth to low birth weight babies.

However, there was no statistically significant relationship between pregnancy interval and birth weight status (χ^2=5.28, df =2, p=0.071). Mothers who had birth interval of 24 months were less likely to have LBW babies compared to those who have less than 24 months and this was statistically significant (UOR=95%CI: 0108-0.869 p=0.026*).

In terms of low birth weight of previous birth, only 48 (20.17%) of the mothers had the births with 19 (39.6%) in 48 of them had low birth weight babies for the current birth. This study found that past child birth of low birth weight was significantly related to current low birth weight

status (χ^2=7.06 df=1, p=0.008). Mothers who reported having no past pregnancy of LBW were less likely to have LBW babies compared to those who had. The association between no experience on past LBW was significant (UOR=0.41 95%CI: 0.207-0.800 p=0.009). This means the factors related to the past birth to low birth weight could have likely influenced the subsequent pregnancies if they are not corrected. This study found more than half 199 69.82%) of the postpartum mothers had 1-4 live children and of these, 36 (18.1%) had low birth weight babies in the current birth and significant relationship was found between the variables (Fisher's exact value=20.93, p=<0.001).

Similarly, parity of the mothers was also significantly associated with low birth weight status (χ^2=40.52 df=2, p=<0.001). Mothers who have 5-9 live children were 12.45 times more likely to have LBW babies compared to those with 1-4 children and this was significantly associated (UOR=12.45 95%CI: 3.751-41.338 p<0.001). Similarly, mothers with 10 or more live children were also 7 times more likely to bear LBW babies (UOR=7.01 95%CI: 1.998-24.618 p=0.002).

This study found that most of the pregnancies for the current births were wanted 226 (79.30%) with 45(19.9%) who gave birth to low birth babies.

Nature of pregnancy indicated significant relationship with low birth weight status (χ^2=7.86 df =1, p=0.005). Mothers who reported unwanted nature of pregnancy were 2.39 times more likely to have LBW compared to those with wanted pregnancy (UOR=2.39 95%CI: 1.286-4.448 p=0.006*).

Similarly, type of pregnancy also revealed that more than half 195 (68.42%) of the pregnancies for the current births were planned and supported whereby 34 (17.4%) of them had low birth weight babies (χ^2=20.45 df =2, p<0.001). In addition, mothers with unplanned and supported were 4.74 times more likely to have LBW babies compared to those with planned and supported pregnancies (UOR=4.74 95%CI: 2.30-9.622 p=0.000**). Similarly, mothers with unplanned and unsupported women were also 3.0 times more likely to have LBW babies compared to the reference group (UOR=3.0 95%CI: 1.232-7.308 p=0.016*).

Regarding the gestational age, the majority 221 (77.54%) of the postpartum mothers had full term GA (37-41) and interestingly, 27(12.2%) of them had low birth weight babies.

On the other hand, 40(65.6%) in 61 of mothers with preterm birth of gestational age of less than <37 weeks) had low birth weight babies. The result revealed that short gestational age at child birth can be associated to low birth weight because more than half of those with preterm GA had low birth weight babies. In addition, statistically significant association existed between gestational age and birth weight status (Fisher's exact=66.72 p<0.001).

Looking at the sex of the newborn, nearly equal numbers were obtained. There were 143 females and 142 males. However, regarding low birth weight, there were 39 (27.3%) females and 28(19.7%) males who had low birth weight. This study however found no significant relationship between sex of baby and low birth weight (χ^2=2.26 df=1, p=0.133).

This study showed that female babies were 1.53 times more likely to be born with LBW compared to male babies (UOR=1.53 95%CI: 0.878-2.656 p=0.134).

Postpartum mothers were also asked and verified against their debut of ANC during their pregnancy. Slightly more than half 143 (52.38%) started ANC in the first trimester and 19(13.3%) had low birth weight babies. This study revealed that the trimester in which women begin their ANC attendance was significantly related with low birth weight status of the babies (χ^2=19.24 df =2, p<0.001). Mothers who started ANC in second and third trimesters were more likely to bear LBW babies compared to those who started from first trimester (UOR=8.16 95%CI: 2.862-23.257 p=0.000 and UOR=3.75 95%CI: 1.348-10.434 p=0.011 respectively).

Although mothers who started ANC in first trimester were slightly more than those who began in second trimester, the mothers who had it in second trimester had more low birth weight babies 28(25.0%).

This means that late beginning of ANC makes women to miss significant interventions provided for them during first trimester which could be important for the mother and unborn child.

Chronic diseases among women can have significant effect on the unborn child. This study found that few 23 (8.07%) of the mothers had chronic diseases and more than half of them had low birth weight babies. It also emerged that significant relationship exists between chronic diseases and low birth weight among babies (χ^2=11.43 df =1, p=0.001). Mothers who reported

they did not experience chronic diseases were less likely to have LBW compared to those who had chronic diseases (UOR=0.24 95%CI: 0.102-0.582 p=0.001).

In terms of suffering from illnesses, more than half 185 (55.43%) of the mothers suffered and out of 67 with LBW, 48 suffered from illness. The association between suffering from illnesses and low birth weight was found to be statistically significant (χ^2=9.31 df =1 p=0.002). The mothers who did not suffer from illnesses were also found to be less likely to bear LBW babies and this was significantly associated (UOR=0.40(0.223-0.730 p=0.003).

This study found 18 (6.33%) in 284 of the newborns had congenital conditions and half 9(50%) had low birth weight babies. Congenital condition was found to be significantly related to low birth weight (χ^2=7.44 df =1, p=0.006). Mothers whose newborns had no congenital condition were less likely to have LBW compared to those who had (UOR=0.28 95%CI: 0.105-0.731 P=0.009). The postpartum mothers were also asked whether they had any physical trauma during pregnancy. Only 32 in 285 of them had it. However, there was no statistically significant relationship between physical trauma encountered during pregnancy and LBW (χ^2=0.43 df=1, p=0.513). Mothers who did not encounter physical trauma during pregnancy were also less likely to have LBW compared to those had (UOR=0.76 95%CI: 0.333-1.734 p=0.514).

Regarding pregnancy complication experience, 71 (25%) in 284 had experienced it and 26(36.6%) of them had low birth weight nearly by half less to those who never had it. It emerged that significant association existed between pregnancy complication encountered and LBW (χ^2=8.91 df =1, p=0.003). In addition, mothers who did not experience pregnancy complication were less likely to have LBW babies compared to those who did (UOR=0.41 95%CI: 0.228-0.745 p=0.003).

In terms of smoking, only 23 in 285 of the postpartum mothers were smokers and only 1 smoked during pregnancy. Smoking not or during pregnancy were not significantly related to low birth weight (χ^2=0.09 df =1 p=0.761 and Fisher's p=0.069 respectively). Mothers who were not cigarette smokers were less likely to have LBW babies compared to mothers who were smokers (UOR=0.86 95%CI: 0.325-2.777 p=0.761). Mothers who were smokers but did not smoke during

the pregnancy were 9.17 times more likely to bear LBW babies compared to those who smoked during pregnancy (UOR=9.17 95%CI: 0.860-97.694 p=0.066).

On the other hand, 39 in 285 consumed alcohol and 36 responded to question regarding alcohol consumption during pregnancy where 25 in 36 of them did so with 8 whose babies measured low birth weight. However, no significant association were also found between alcohol consumption and its consumption during pregnancy (χ^2=2.43 df=1, p=0.119 and p=1.000 respectively). Mothers who reported not consuming alcohol were less to have LBW babies compared to alcohol consumers (UOR=0.56 95%CI: 0.271-1.168 p=0.123). Mothers who did not consume alcohol during pregnancy were found 1.21 more likely to bear LBW babies compared to those who did during pregnancy (UOR=1.21 95%CI: 0.274-5.379 p=0.798).

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 diabetic status was also confirmed among 246 postpartum mothers whereby 27 (10.98%) were diabetic and 9 (33.3%) delivered low birth weight babies and association between diabetes in pregnancy was found to be not significant (χ^2=1.76 df=1, p=0.185). Of the 27 diabetic mothers, 19 responded to the question regarding its control. It emerged that less than half 6 (31.6%) of the mothers reported its control out of the 19 mothers. Mothers who reported were not diabetic were less likely to produce LBW babies compared to those who were diabetic (UOR=0.56 95%CI: 0.237-1.329 p=0.189). The study revealed that among the diabetic patients, mothers whose diabetic status was not controlled were 1.3 times likely to bear LBW babies compared to those whose diabetes was under control (UOR=1.3 95%CI: 0.231-7.315 p=0.766).

The qualitative findings were drawn from ten health care providers and were asked to mention some of the maternal related factors associated with low birth weight.

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 above responses imply that poor feeding that involves not eating balanced diet, foods of low nutrients and inadequate intake are related to bearing low birth weight newborns.

Table 4: Bivariate Analysis between Individual factors and Low Birth Weight

Variable	Birth Weight		Total	χ^2(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.*

4.4.1. Univariate analysis of 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.

Table 5: Univariate analysis of 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

4.4.2. Bivariate Analysis between Nutritional factors and Low Birth Weight

The study found that 90 (54.54%) of the mothers have been taking meals twice a day and 9(10.0%) had LBW babies and 60 (36.36%) of the mothers take meals three times a day.

However, number of meals per day was found not to be associated with LBW (Fisher's exact=3.85, p=0.225). Mothers who do not take breakfast were 4.26 times more likely to have LBW babies compared to those who did (UOR=4.26 95%CI: 2.369-7.670 p<0.001).

Mothers who have meals twice a day were 5.53 times more likely to produce LBW babies (UOR=5.53 95%CI: 2.53-12.068 p<0.001) and those who have it three times were 3.17 times more likely to have LBW (UOR=3.17 95%CI: 1.466-6.856 p=0.003) and for those who have four or more meals were 1.55 times likely to have LBW (UOR=1.55 95%CI: 0.289-8.343 p=0.607).

Regarding Body Mass Index (BMI) which was obtained by dividing weight by meter squared, more than half 184 (64.56%) in 285 of the postpartum mothers had normal BMI (18.5 to 24.9) with 24 (13.0%) who gave birth to low birth weight babies. On the other hand, 42(49.4%) in 85 of the underweight mothers had low birth weight babies.

This study also confirmed that association between BMI and LBW was statistically significant (Fisher's exact=43.57, p=<0.001). The study showed that out of 85 underweight mothers, nearly half of them had LBW babies.

The statistics indicates that they were less likely to have LBW babies (UOR=0.44 95%CI: 0.056-3.519 p=0.442). The fact that the overweight and obese mothers were few, they were found to be less likely to have LBW babies (UOR=0.07 95%CI: 0.009-0.540 p=0.011).

The postpartum mothers were also asked about their frequency in consumption of grains, fruits, vegetables, protein foods and dairy products. Overall, most of the above food types were either mainly never consumed or consumed either 1-2 times per month or 1-3 times per week.

Regarding grain consumption, more than a quarter 93 (32.63%) of the postpartum mothers reported consuming grains three or more times per week. The study found 17(18.3%) of the

mothers delivered LBW babies. However, no significant association was found between grain consumption and LBW (χ^2=2.45 df =3, 0.484).

The study found slightly more than half 148(51.9%) of the mother never consume fruits whether in fresh or dried or in juice and the majority of the LBW babies were also among these group accounting for 44(29.7%).

On the other hand, 77(27.02%) in 285 of the mothers consume fruits 1-2 times/month. Overall, no statistically significant association exists between fruit consumption and LBW. The distribution of vegetable, protein food and dairy consumption were nearly distributed equally.

Mothers who consume green vegetables from 1-2 times per month, 1-3 times per week and 3 or more times were less likely to bear LBW babies compared to those who had never (UOR=0.36 95%CI: 0.137-0.956 p=0.040, UOR=0.40 95%CI: 0.148-1.089 p=0073 and UOR=0.26 95%CI: 0094-0.700 p=0.008 respectively).

The study found that 94 in 285 of the mothers consume protein found 3 or more times/week and 77 consume 1-2 times per month. Similarly, 94 in 285 of the mothers consume dairy products 1-2 times/month while 73 in 285 consume 1-3 times/week. The dairy products consumption frequency was nearly normally distributed.

This could be due to the availability of cattle in the study area hence there is access to dairy products by some of the women or families. On further analysis, the odds of having LBW weight increased with increase in frequency of consumption of the diary products.

Mothers who consume it 1-2 times per month were less likely to have LBW babies (UOR=0.54 95%CI: 0.217-1.356 p=0.190). Looking at mothers who consume 1-3 times per week and 3 or more times per week were 1.18 and 1.23 times more likely to have LBW respectively (UOR=1.18 95%CI: 0.593-2.349 p=0.638 and UOR=1.23 955CI: 0.586-2.593 p=0.581).

Table 6: Bivariate Analysis between Nutritional factors and Low Birth Weight

Variable	Birth Weight		Total	χ^2(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.*

4.5.1. Univariate analysis of 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 workers attitude to be good.

Table 7: Univariate analysis of 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

4.5.1. Bivariate Analysis between health services factors and low birth weight

The study showed that the majority 281 (98.6%) in 285 of the postpartum mothers had spontaneous vaginal delivery and all mothers with LBW came from this group. However, there was no statistically significant relationship between mode of delivery and LBW (p=0.576).

The majority 257 (90.18%) in 285 of the mothers had fetal assessment during their pregnancy periods and 52(20.1%) gave birth to LBW babies. Fetal assessment was found to have significant association with LBW (χ^2=19.53 df =1, p<0.001). Mothers who never had fetal assessment were less likely to have LBW compared to those who had (UOR=0.19 95%CI: 0.083-0.417 p=<0.001).

Regarding education on dietary nutrition, most 259 (91.20%) in 284 of the mothers were educated and 52 (20.1%) had LBW babies. Significant association was found between education

on dietary nutrition and LBW (χ^2=14.43 df =1, p<0.001). Mothers who were not educated on dietary nutrition were less likely to have LBW babies (UOR=0.21 95CI: 0.09-0.502 p<0.001).

Overall, the majority of the postpartum mothers were given iron supplement (p<0.001). Mothers who were not given iron supplement were less likely to have LBW compared to those who were given (UOR=0.27 955CI: 0.107-0.680 p=0.006). In addition, mothers given folic acid (p<0.001) and advised on extra intake of energy and protein foods (p=0.001), educated on maternal health issues (p<0.001) and provided with IPT (fansidar) (p<0.001) and antibiotics (p<0.001) during ANC visits and all the above showed statistically significant association with birth weight status of the babies.

In terms of health care cost, the majority 241 (84.56%) in 285 of the mothers reported that it was never costly but the majority 56 (23.3%) of the LBW were among them. However, healthcare cost had no significant relationship with LBW (Fisher's exact=2.43, p=0.326). Mothers who reported that healthcare cost was costly were 1.21 times more likely to bear LBW babies (UOR=1.21 95%CI: 0.502-2.921 p=0.670).

The postpartum mothers' ANC attendance was also reviewed and it emerged that the majority 273 95.79%) out of 285 of them attended ANC which was a very good ANC coverage. Statistical analysis found significant relationship between ANC attendance and low birth weight status (χ^2=24.99 df=1, p<0.001). Focusing on the frequency of ANC, slightly more than half 150 (54.95%) in 273 of the mothers who attended ANC had less than four (4) ANC visits and constituted the group with higher low birth weights of 44(29.3%). Generally significant relationship was found between frequency of ANC attendance and low birth weight status (χ^2=18.59 df =2, p<0.001). Mothers who attended four ANC were found to be 6.81 times more likely to have LBW babies. In ideal, the more ANC attendance, the reduced LBW prevalence should be. Interestingly, the odds of LBW was reducing with increase in ANC attendance from 4 and above (UOR=1.45 95%CI: 0.614-3.436 p=0.395). This implies that the more number of ANC attendances, the reduction of likelihood of having LBW babies.

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]

Distance from home to health facility recommended to be not more than 5kms. This study found that less than half 121 (42.46%) in 285 of the mother's travel for less than five (5) kilometers to access health facility with 24(19.8%) who delivered LBW babies while 97 and 67 cover 5 and more than 5 kms respectively (χ^2=9.33 df=2, p=0.009). Mothers who travel 5 kilometers to access their health facility were 1bout 1.1 times likely to have LBW babies (UOR=1.09 95%CI: 0.550-2.142 p=0.812). In addition, mothers who took more than 5 kilometers were less likely to have LBW babies

On the other hand, slightly more than half of the mothers reported that the health care workers had good attitude. LBW among these mothers accounted for 34(21.4%) followed by those who said they had very good attitude towards them 17(20.0%) in 85 mothers. The study found that the association between attitude of the health care workers and LBW was significant (χ^2=10.36 df =3, p=0.016).

Mother who reported that the health workers have fair, good and very good attitude were less likely to have LBW babies compared to those who reported poor attitude (UOR=0.17 95%CI: 0.019-1.554 p=0.117, UOR=0.53 955CI: 0.062-4.417 p=0.553 and UOR=0.57 95%CI: 0.066-4.963 p=0.612 respectively).

Table 8: Bivariate Analysis between health services factors and low birth weight

Variable	**Birth Weight Status**		**Total**	**χ^2(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.

4.6. 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.

Socioeconomic 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).

Table 9: Multiple Logistic Regression Analysis

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

CHAPTER FIVE: DISCUSSION OF RESULTS

5.0 Introduction

This chapter discusses the key findings of the study conducted at Bentiu Hospital in Unity State on the prevalence and associated factors influencing low birth weight among postpartum mothers. South Sudan. The dependent variable was LBW prevalence and the key study variables from socioeconomic factors were age (category), occupation and social support, the individual factors were, pregnancy complication and those in health system factors include frequency of ANC attendance intake of folic acid tablets and antibiotics during pregnancy.

Generally**,** this chapter is discussed in contrast and comparison of findings from past studies irrespective of the settings and relevant literature from previous studies were used and further personal analysis into the findings was also made.

5.1. 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 wieght 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 singificant role in the difference in additon 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.

5.2. 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.

5.3. 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.

5.4. 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.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.0. Introduction

This chapter presents the conclusions and recommendations of study on the prevalence and associated factors influencing low birth weight among postpartum mothers in Bentiu State Hospital, South Sudan.

6.1. Conclusions

Prevalence of low birth weight

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.

Socioeconomic factors

i. This study surprisingly found mothers aged 20-24 years have higher likelihood of bearing LBW babies compared to women aged 19 years. This could be due to the fact that most of the mothers were in the above age range.

ii. Older women are more likely to bear low birth weight babies, which could be attributed to the physiological deterioration associated with aging.

iii. Business women were less likely to have LBW babies compared to the peasant women.

iv. Mothers in formal salaried employment were less likely to have LBW babies compared to peasant women hence significantly reduced LBW.

Individual factors

i. The study found that age at first birth, social support status and no pregnancy complication experience significantly associated with Low Birth Weight.

Nutritional factors

i. The odds of bearing LBW reduced with increase in the number of meals among the mothers.

Health service factors

i. Postpartum mothers who did not take folic acid and antibiotics during pregnancy were likely to give birth to LBW babies.

6.2. Recommendations

Socioeconomic factors

i. The government in Unity State in partnership with parents should ensure that girls of school going age be encouraged to attend school until they attained better education level so as to reduce early marriage, unwanted pregnancies which is one of the root cause of low birth weight.

ii. The health care providers should also develop appropriate messages for dissemination at the hospital and at community-based level about the risks of pregnancy outcome among under aged children and older of 35 and above years in regards to low birth weight outcome.

iii. The community leaders should ensure women engage in income generating activities (business) that can translate to increased income that can be used during before, during and after child birth for proper nutrition, access to health care and other requirements. Women in the communities should also be provided equal opportunity like their male counterparts in employment and be encouraged to join formal employment which has the potential to empower them financially.

iv. The male partners to the spouses, family members, relatives should be sensitized about the significance of their support to vulnerable pregnant women in the communities so that they get to understand how much their support could be valuable in reducing prevalence of negative pregnancy and newborn outcomes at birth.

Individual factors

i. The health care providers should conduct health education to women during community based out reaches and at health facility level about pregnancy complications mainly focusing on the likely causes and feasible prevention and mitigation measures.

6.2.3. Health services factors

i. The hospital or health facility health care providers should encourage women to attend all the four recommended ANC visits and any additional visits deemed still significant during the pregnancy period. This information can be disseminated during ANC visits and community-based outreaches, churches, women groups and other social gatherings in order to empower people about the significance of the interventions received during the period.

ii. It is important that health care providers should ensure adequate folic acid tablets are in stock for all expectant women who turn up for ANC. They should be provided and consume them because of the effect on reduction of low birth weight including preterm birth among others. In addition, they should be educated clearly about the reasons for providing them folic acid during pregnancy.

iii. The health care providers should ensure that expectant women who have any bacterial infection during pregnancy receive the prescribed antibiotics in order to prevent low birth weight among women.

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APPENDICES

APPENDIX I: STUDY WORK PLAN

ACTIVITY	J	F	M	A	M	J	J	A	S	O	N	D
Presentation of Concept												
Writing research proposal												
Submission of draft proposal 1												
Update draft proposal 1												
Submission of draft proposal 2												
Update draft proposal 2												
Submit final proposal												
Recruit and train research assistants												
Data collection												
Data entry and cleaning												
Data analysis												
Report writing												
Submission of draft report 1												
Updating draft report 1												
Submission of draft report 2												
Updating draft report 2												
Submission of final report copies for marking												
Dissertation defense												
Update final report												
Print hard copies for submission												

APPENDIX II: STUDY BUDGET

No.	Item	Unit Cost	Quantity	Amount (Ugx)
	Writing proposal/data	500,0000	1	500,000
	Printing	80,000	1	80,000
	Recruitment and training of research assistants	10,000	4	40,000
	Data collection	80,000	3	240,000
	Transport	100,000	1	100,000
	Communications/airtime	30,000	1	30,000
	Data entry and cleaning	100,000	1	100,000
	Data analysis	250,000	1	250,000
	Report writing	350,000	1	350,000
	Printing/binding	45,000	3	135,000
	Total			**1,825,000**

APPENDIX III: INFORMED CONSENT FOR POSTPARTUM MOTHERS

Background: Thank you for taking the time to talk with me today! My name is John Bosco Alumai, a student at Institute of Public Health and Management of Clarke International University. I am required to conduct a research. My study is on "prevalence of low birth weight and associated factors among postpartum mothers in Bentiu State Hospital, South Sudan"

Purpose of the study: The purpose of the study is to determine the prevalence of low birth weight and associated factors so as to come up with strategies that may be used to appropriately prevent and manage low birth weight. Please be informed that we shall also obtain some information from your maternal card.

Voluntary: Your participation in this research is voluntary and you have the liberty to withdraw at any time from it and please feel free to decline to answer any of the questions asked any time too. If you agree to be in this study, we shall ask you questions that may take about 25-35 minutes.

Confidentiality: All the information you give will be kept confidential. Your name will not be linked with the research materials, and will not be identified in the report too. Research records will be kept in a locked file; only the researcher will have access to the records.

Risks and benefits: There are no risks or direct benefits to you, associated with your participation in this study. The information you provide will be used to improve strategies and implementation of preventive and management of low birth weight.

If you have questions: In case you wish to ask or have clarification regarding this study, I can be contacted on +211913036084/+256774165047 or my supervisor on +256774317709

You can ask me any more questions about any part of the research study, if you wish to. Do you have any questions?

Participant: I, _____ have been adequately informed about the purpose, procedure, risks and benefits of this study and have received answers to all the questions I asked. I consent to take part in the study.

Signature: _____Date: _____ Mob. Contact: _____

Participant

Signature _____ Date _____

Name: _____Signature: _____Date: _____

Interviewer

APPENDIX IV: SEMI-STRUCTURED QUESTIONNAIRE

General instruction:

Ask questions accurately and record valid data in the respective sections and write responses in the spaces provided.

A. Socioeconomic factors

no.	Questions	Responses	Tick/Write
	How old are you?	:_____ years	
	What is your marital status?	1. Single	
		2. Married	
		3. Divorced/separated	
		4. Widowed	
	What is your occupation?	1. Peasant farmer	
		2. Business	
		3. Salaried employment	
		4. Not working	
	What is your education level?	1. No formal education	
		2. Primary	
		3. Secondary	
		4. Tertiary	
	What is your religion?	1. Catholic	
		2. Anglican	
		3. Muslim	
		4. Others	
	What is your average monthly income?	1. <18,000 SSP	
		2. 18,000-28,000	
		3. ≥29,000	
	How do you rate the social support to you at home during pregnancy	1. Yes (High)	
		2. No (Low)	
	If no, why?	……	
	What is your place of residence	1. Rural	
		2. Urban	
	What type of family do you have?	1. Nuclear	
		2. Extended family	
	How many people live in your household?	_____Adult _____children	
	LOW BIRTH WEIGHT STATUS		
	What is the weight of the baby at birth	_____kgs	
	What is the sex of the baby	1. Male	
		2. Female	

B. Individual factors

No.	Questions	Responses	Tick
	If no, how old were you at first birth?	_____years	
	If no, what is your pregnancy interval?	1. Less than 24 months	
		2. 24 months	

		3. 36 months and above	
	If no, was your baby small during the last birth?	1. Yes	
		2. No	
	If no, how many live children do you have now?	_____children	
	How many pregnancies have you so far had irrespective of the outcome?	_____pregnancy (ies)	
	May I kindly know whether you wanted this last pregnancy?	1. Wanted	
		2. Unwanted	
	What is the type of the recent pregnancy?	1. Planned and supported	
		2. Unplanned and supported	
		3. Unplanned and unsupported	
	When you were pregnant with this baby, what was the gestation duration/age to delivery?	1. Full term (Insert ____weeks)	
		2. Preterm (Insert_____ weeks)	
		3. Post-term (Insert____ weeks)	
		1.	
		2.	
		3.	
	While pregnant with this baby, did you attend antenatal care (ANC)?	1. Yes	
		2. No	
	If yes, how many times did you attend?	_____times in total	
	In which trimester did you begin your first ANC during pregnancy?	1. First trimester	
		2. Second trimester	
		3. Third trimester	
	Do you have any chronic medical diseases?	1. Yes	
		2. No	
	Have you suffered with any illness in your pregnancy?	1. Yes	
		2. No	
	If yes, which illness	1. Malaria	
		2. Bacteriuria	
		3. Diabetes	
		4. Blood pressure	
	Confirm whether the newborn has any congenital condition	1. Yes	
		2. No	
	Did you get any physical trauma during pregnancy (probe for hard work or accidents)	1. Yes	
		2. No	
	If yes, did the trauma or injury affected your womb/placenta or around abdomen?	1. Yes	
		2. No	
	Have you ever experienced any pregnancy	1. Yes	

	complication that made to seek immediate medical intervention?	2. No	
	If yes, what was the complication?	1. Anemia	
		2. Depression	
		3. Fetal problems	
		4. Gestational diabetes	
		5. High blood pressure	
		6. Placenta previa/Vaginal bleeding	
		7. Preeclampsia	
		8. Others…….	
	May I know whether you smoke cigarrete	1. Yes	
		2. No	
	If yes, did you smoke during pregnancy	1. Yes	
		2. No	
	May I know whether you drink alcohol	1. Yes	
		2. No	
	If yes, did you also drink during pregnancy	1. Yes	
		2. No	

C. Nutritional Factors

NO.	QUESTIONS	RESPONSES	TICK
	May I know whether you usually take breakfast	1. Yes	
		2. No	
	If no, why	1. No money	
		2. No food reserve	
	How many meals do you have in a day?	1. Once	
		2. Twice	
		3. Three times	
		4. Four times	
	What is the mother's height?	_____ metres	
	What is the mothers' weight?	_____ kgs	
	How often do you usually eat the following food groups?		
	Grains (Bread, cereal; all grains)	Never	
		1-2 times/ month	
		1-3 times/week	
		3+ times/week	
	Fruits (fresh, dried, juice)	Never	
		1-2 times/ month	
		1-3 times/week	

		3+ times/week	
	Vegetables (fresh, dried or juice)	Never	
		1-2 times/ month	
		1-3 times/week	
		3+ times/week	
	Proteins (Meat, poultry, beans, eggs, nuts,	Never	
		1-2 times/ month	
		1-3 times/week	
		3+ times/week	
	Diary (Milk-cheese, yoghurt)	Never	
		1-2 times/ month	
		1-3 times/week	
		3+ times/week	

D. Health System related factors

	Health system related factors		**Tick**
	What was your mode of delivery?	1. Spontaneous vaginal delivery	
		2. Instrumental delivery	
		3. Caesarian Section	
	During antenatal care visits, was fetal assessments conducted	1. Yes	
		2. No	
	During your pregnancy, were educated on dietary nutrition?	1. Yes	
		2. No	
	If yes from where	1. Public health facility	
		2. Private health facility	
	If no, why were you not counseled?	1. No transport money	
		2. No body to accompany or sickly	
		3. No dietary nutrition counseling services	
		4. Others specify ……	
	During your pregnancy, were you given; a) Iron supplementation	1. Yes	
	b) Folic Acid	2. No	
		1. Yes	
		2. No	
	Were you advised to take extra energy and protein foods during pregnancy?	1. Yes	
		2. No	
	During your pregnancy period were you education on maternal health issues (Hygiene,	1. Yes	
		2. No	

	nutrition,		
	During your second trimester, were you given fansidar to prevent malaria?	1. Yes	
		2. No	
	If yes, from where was it given?	1. Bentiu State Hospital	
		2. Others	
	Have you been given antibotics to prevent asymptomatic bacteriuria?	1. Yes	
		2. No	
	If yes, from where?	1. Bentiu State Hospital	
		2. Others	
	Do you have diabetes or high blood pressure?	1. Yes	
	If yes, was the condition or disease being controlled	2. No	

	How do you rate cost of health services	1. Never costly	
		2. Costly	
		3. Very costly	
	How far is your home from this health facility	1. < Five (5) kms	
		2. Five (5)	
		3. > Five (5) kms	
		Or insert exact: 4. Others…….	
	How do you rate the attitude of the health workers to expectant women and postpartum mothers	1. Poor	
		2. Fair	
		3. Good	
		4. Very good	

APPENDIX V: INFORMED CONSENT FORM FOR KEY INFORMANTS

(Key healthcare providers in ANC and Maternity Departments)

I _____ have been adequately informed about the purpose, procedure, risks and benefits of this study. I was given opportunity to ask questions and agreed satisfied with responses given to me.

I am aware that I can refuse to participate or withdraw from the study without loss or benefit which I would have otherwise been eligible. Therefore, based on all the information provided, I agree to participate in the study.

Signature: _____

Date: _____

INTERVIEWER'S STATEMENT

I have explained the procedure to be followed in this study to the respondent and She/he also agreed to participate in the study.

Signature: _____

Date: _____

APPENDIX VI: KEY INFORMANTS INTERVIEW GUIDE

PART A: Socioeconomic factors

i. What do you think are some of the socioeconomic factors that may determine low birth weight among postpartum mothers?

PART B: Maternal nutritional related factors

i. What do you think are some of the maternal related factors associated with low birth weight?

PART C: Individual factors

i. What do you think are some of factors related to the mother are associated low birth weight?

PART D: Health Services related factors

i. What interventions do you provide for pregnant women during ANC to prevent low birth weight?

ii. What can you say about health education activities in relation to low birth weight? What information do you include during the sessions?

APPENDIX VII: INTRODUCTION LETTER AND ENDORSEMENT

(CORRESPONDENCE) .

IHSU INTERNATIONAL HEALTH SCIENCES UNIVERSITY
sanitas per scientiam

making a difference to health care

Dean's Office-Institute of Public Health and Management

Kampala, 16th July 2018

HOSPITAL DIRECTOR
BENTIU STATE HOSP.

Dear Sir/Madam,

RE: ASSISTANCE FOR RESEARCH

Greetings from International Health Sciences University.

This is to introduce to you **Alumai John Bosco** Reg. No. **2016-MPH-RL-AUG-015** who is a student of our University. As part of the requirements for the award of a Masters degree in Public Health, the student is required to carry out research.

The topic of research is: **Prevalence and associated risk factors influencing low birth weight among postpartum mothers in Bentiu State Hospital – South Sudan.**

This therefore is to kindly request you to render the student assistance as may be necessary for the research.

I, and indeed the entire University are grateful in advance for all assistance that will be accorded to our student.

Sincerely Yours,

Alege John Bosco
Dean, Institute of Public Health & Management

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