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Prevalence and Determinants of Low Birth Weight Among Infants Born in Kapsabet Referral Hospital, Nandi County, Kenya

ORIGINAL RESEARCH

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Abstract: Low Birth Weight (LBW) is defined by the World Health Organization as weight at birth less than 2,500g. LBW continues to be a significant public health problem globally and is associated with a range of both short and long term consequences. The purpose of this study was to investigate the prevalence and determine probable factors associated with LBW at the Kapsabet Referral Hospital in Nandi County, Kenya.This study adopted a hospital based cross-sectional study design. A total of one hundred and seventy-eight (178) mothers were selected using the simple random sampling method. A researcher administered semi-structured questionnaire was the main tool for data collection. Data was analyzed using the Epi Info version 3.3.2. A probability value of <0.05 was considered significant. Prevalence of LBW was found to be 16.6%. About two thirds (59.5%) of the mothers were between 20-29 years. The mean birth weight of the infants was 2728±351 grams. Fifty two percent (52.1%) were female infants while forty seven percent (47.9%) were male. The following factors were significantly associated with LBW: sex of infant (OR=2.34, 95% C.I.=2.45-13.50), age of the mother at child birth (OR=3.41, 95% C.I. =1.53-13.43), education level of the mother (OR=2.95, 95% C.I. = 1.43-12.45), LBW delivery in a previous birth (OR=2.75, 95% C.I. =2.45-12.23), premature births (OR=1.78, 95% C.I. =1.89-13.67) and the nutrition status of the mother at child birth (OR= 3.37, 95% C.I. = 2.56-12.97). Independent predictors of LBW were gestational age, mode of delivery, pregnancy complications and iron & folic acid supplementation during pregnancy. Prevalence of LBW in this hospital was higher than the national prevalence and therefore urgent mitigation measures are necessary to tackle this problem.

Keywords: Low birth weight, prevalence, determinants, infant

Introduction

The birth weight of an infant is one of the most important determinants of the newborn's survival, healthy growth and development and is associated with a lower risk of neonatal mortality [1]. An estimated 20 million infants worldwide, representing 15.5% of all births, are born with LBW. Of these 95.6% live in developing countries. The prevalence of LBW in developing countries (16.5%) is more than double that of developed regions (7%) [2,3]. Half of all LBW babies are born in South-Central Asia where the prevalence is 27%. Sub-Saharan Africa is reported to have a prevalence of 15% [4].

Prevalence of LBW and its associated factors has been documented; [5] reported a prevalence of 10.5% in the Tigray region of Ethiopia, [6] in Utter Pradesh, India found a 40% prevalence whereas [7,8] reported a 13.6% and 9.1% respectively in Tanzania. In Kenya, WHO and UNICEF estimate the prevalence of LBW to be 11% [9]. A study done at the Narok District Hospital revealed a LBW prevalence of 16.4% [10]. [11] in a study of two urban informal settlements in Nairobi reported a LBW prevalence of 6.7% while [12] reported a prevalence of 12.3% in Olkalou District Hospital, Kenya. In developing countries, LBW is as a result of inadequate pre-pregnancy weight gain, short stature, malaria, trauma during pregnancy, malnutrition and lack of antenatal care [13]. In China, [14] found that LBW was related to maternal age of less than 20 years, low maternal education, previous history of adverse pregnancies and pregnancy complications. Exposure to environmental pollutants including organophosphate pesticides have also been significantly associated with low birth weight deliveries [15]. [1] reported infant's sex, woman's education, mother's residence, household wealth, maternal mid-upper

arm circumference (MUAC), season at birth, birth order and pregnancy interval as determinants of low birth weight. [16] identified preterm birth, physical trauma during pregnancy and history of any pregnancy complications as predictors of low birth weight. In a study in Ethiopia, maternal height <155cm, complications during pregnancy, low maternal education, gastetional hypertension and incomplete antenatal visits were reported as the predictors of low birth weight [17]. A study in Ghana reported preterm delivery, mothers with secondary education, living alone during pregnancy, not taking daily required iron supplementation and mothers with 1st trimester hemoglobin below 11 g/dl as predictors of low birth weight [18].
The current trends of infant and under five mortality rates in Kenya are declining. Under-five mortality in Kenya decreased by 36% from 115 deaths per 1000 in 2003 to 74 deaths per 1000 in the 2008-09 [9]. Infant mortality decreased by 32% from 77 deaths per 1000 in the 2003 to 52 deaths per 1000 in the 2008-09 [9]. Although this decline in mortality is an indicator of progress in achieving the third sustainable development goal, addressing the challenges associated with neonatal deaths in Kenya has the greatest potential of contributing to this progress [12]. Indeed, newborn and child survival remains at the core of the global development agenda outlined in the Sustainable Development Goals (SDGs) particularly SDG 3 which aims at ensuring healthy lives and promote well-being for every age group throughout the life cycle [19]. Therefore, it is critical to address factors that contribute to LBW and their subsequent consequences.

Epidemiological studies show that LBW infants are at a higher risk of neonatal mortality compared to babies of normal weight [20]. According to the WHO about 3.3 million babies die within their first month of life every year and the proportion of neonatal deaths has increased in all regions of the world, currently estimated at 41%. Ninety percent (90%) of these deaths occur in low and middle income countries and a third of all neonatal deaths occur in Sub-Saharan Africa [13]. LBW leads to lifelong consequences such as stunted growth, poor cognitive development, visual handicaps, compromised physical health, impaired language and academic achievement and increased risk of non-communicable diseases such as diabetes and cardiovascular diseases [21]. LBW is one of the leading causes of all under five child mortality worldwide [13]. In addition, economic studies in low-income settings have demonstrated that reducing the burden of LBW could have important cost savings both to the health system and to households.

Although several studies have been done on the prevalence and determinants of LBW locally and worldwide, there is scanty literature in the proposed study area. Having proper knowledge of risk factors of LBW is important in identifying high risk mothers and infants and enables prompt attention for early detection and management of complications. This will alleviate incidences of LBW and related consequences. Therefore, this study investigated the prevalence and determinants of LBW among deliveries at the Kapsabet Referral Hospital in Nandi County, Kenya.

Methods

Study design
This was a hospital based cross-sectional study carried at the Kapsabet Referral Hospital, Nandi County Kenya, among women presenting for delivery at the hospital. This design was chosen for the study because it allowed measurement of prevalence for all factors under investigation. It also enabled researchers to study multiple outcomes and exposures.

Study setting
The study was undertaken in the postnatal and New Born Unit (NBU) ward at the hospital between June and July 2019. This hospital is located in Nandi County, Emgwen Constituency, a predominantly rich agricultural area, approximately 30km from Eldoret town. It is a level 5 referral facility serving neighboring health institutions with catchment population of about 65,714 [22]. The study involved 178 mothers drawn from the hospital catchment area and those presenting for delivery at the hospital.

Sample size determination

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The sample size was calculated using a proportion (p) of 16.4% from the prevalence of LBW in a previous study conducted in Narok District Hospital in 2011 [10]. Cochran formula was used to calculate the sample size [12].

$n_o = Z^2 pq/e^2 = 843$

where n_o= desired sample size; z= the standard normal deviate of 1.96, which corresponds to the 95% confidence level; p= (0.164), the proportion in the target population estimated to have LBW; 1-p= 0.836; e= degree of accuracy desired to get a 95% is 2.5%. The average number of deliveries per month was estimated to be 114 (established in the facility). Finite correction was done using the following formula:

$$n=\frac{no}{\{1+\frac{no-1}{N}\}}$$

where n =sample size and N is the population size.

Therefore, $n= \frac{843}{\{1+\frac{843-1}{200}\}}$

$= 161$

A 10% contingency sample was added to cater for non-response giving a total sample size of 161+17 = 178. The sample size for the study was therefore 178.

Sampling procedure

Random numbers generated from Open Epi [23] were used to randomly draw a sample of 178 mothers from a sampling frame of 200. Consecutive positions were allocated to the women as they came for delivery from position 1 to 200. The allocated positions were arranged in an ascending order by use of Microsoft Excel. Respondents who did not consent or did not meet the inclusion criteria, were replaced by the respondent in the consecutive position, and the next random position considered until a sample size of 178 was obtained.

Inclusion and exclusion criteria

All live mothers aged ≥ 18 years who gave birth to live neonates during the study period were randomly selected and included in the study. The study exempted mothers with multiple births and still births. Other exclusion criteria included maternal death following delivery, serious illness of the mother and mothers immediately referred after delivery.

Data collection procedure

Researcher administered semi-structured questionnaires were used for data collection. The questionnaires were written in English language but administered in the local language, *Kalenjin* or *Kiswahili* or English as per the preference of the respondents. Hospital records with infant's weight at birth and mothers' ANC clinic cards were also used to collect data. Pre-testing of the questionnaires was done at the Uasin Gishu District Hospital postnatal ward among 20 selected mothers of new born babies.

Data analysis

Data was analyzed using the Epi Info statistical software version 3.3 (2002). Descriptive analyses were done to show the prevalence of LBW and the socio-demographic characteristics of women respondents while bivariate analyses were performed to determine the factors influencing LBW. Logistic regression analysis was used to identify independent predictors of LBW. Odds ratio (OR) and a two-tailed test of significance was used with a 95% confidence interval (CI). A p value of ≤0.05 was found adequate.

Ethical clearance

A letter of introduction to the Kapsabet Referral Hospital was provided by the Department of Family and Consumer Sciences, University of Eldoret. Permission to carry out this study was granted by both the Nandi County Health Service Department and the Medical Superintendent of the hospital. Written consent was sought from the respondents before commencing the study. Interviews and all examinations were done in a private room adjacent to the ward and no names were included in the questionnaires for confidentiality.

Results

Socio-demographic characteristics of respondents

The results indicated that there was a 16.6% (n=27) prevalence of low birth weight babies in the study sample. Two thirds (59.5%) of the mothers, were between 20-29 years. Forty-eight percent (48.5%) had attained secondary education, thirty-nine percent (39.3%) completed primary education, nine percent (9.8%) had tertiary education while two percent (2.5%) had no formal education. More than two thirds (65.6%) were married whereas about one third (34.3%) were unmarried. Their partners' level of education was as follows: fifty-two percent (52.8%) had secondary education, twenty percent (20.9%) had primary education and twenty-five percent (25.2%) had tertiary education while 1.2% had no formal education.

About half (52.1%) of the mothers were self-employed, about a third (37.4%) were unemployed while only 10.4% were employed. In contrast, 53.4% of their male partners were employed, 27.6% were self-employed and 19.0% were unemployed. Most of the mothers were of Christian faith (91%) while 6.7% were Muslims (Table 1).

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Table 1: Socio-demographic characteristics of mothers in Kapsabet Referral hospital

Socio-demographic variable	Frequency (n)	Percentage (%)
Age of mother at child birth		
<20 years	31	19.0
20-29 years	97	59.5
30-39 years	29	17.8
>39 years	6	3.7
Level of education of mother		
No formal education	4	2.5
Primary education	64	39.3
Secondary education	79	48.5
Tertiary education	16	9.8
Level of education of partner		
No formal education	2	1.2
Primary education	34	20.9
Secondary education	86	52.8
Tertiary education	41	25.2
Religion		
Protestant	112	68.7
Catholic	37	22.7
Muslim	11	6.7
Unknown	3	1.8
Mothers employment status		
Employed	17	10.4
Self-employed	85	52.1
Unemployed	61	37.4
Paternal employment status		
Employed	87	53.4
Self-employed	45	27.6
Unemployed	31	19.0
Marital status		
Single	34	20.9
Separated/divorced	12	7.4
Married	107	65.6
Widowed	10	6.1

Reproductive characteristics of respondents

Over half (58.9%) of the mothers had more or equal to gravida 2, with mean gravidity being 2.8±1.6. Seventy-nine percent (79.1%) of the mothers had a birth interval greater than 2 years, with a mean birth interval being 2.6±2.1 years. Two thirds (63.2%) of the mothers had had more than two living children, with a mean parity of 2.1±1.5. Fifteen mothers (9.2%) had had a LBW baby in their previous pregnancies, with mean weight of previous babies being 2732±331 grams. Eight mothers (4.9%) reported previous abortion, while 4.3% reported history of neonatal death. Majority 83.4% reported to have attended 3 or more antenatal clinic visits, with average antenatal clinic visits being 3±1.1. One hundred and thirty-four mothers (82.2%) practiced family planning.

The main mode of delivery was spontaneous vaginal delivery (84.0%), followed by cesarean section 12.9% while 3.1% was through assisted breech. One hundred and eighteen mothers (71.8%) were 37-42 weeks' gestation at the delivery time, 5.5% were more than 42 weeks gestation and 20.9% were less than 37 weeks gestation. There were 47.9% male neonates and 52.1% female neonates, with an average birth weight of 2728±351 grams (Table 2).

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Table 2: Reproductive characteristics of mothers and infants in Kapsabet referral hospital

Reproductive variable	Frequency (n)	Percentage (%)
Sex of newborn		
Female	85	52.1
Male	78	47.9
Mother's gravidity		
Primigravida	67	41.1
Multigravida	96	58.9
Mother's parity		
Primipara	60	36.8
Multipara	103	63.2
Pregnancy interval of previous birth		
<2 years	34	20.9
2-4 years	111	68.1
>4years	18	11.0
LBW in previous birth		
Yes	15	9.2
History of previous abortion		
Yes	8	4.9
History of previous neonatal death		
Yes	7	4.3
Family planning		
Yes	134	82.2
Timing of 1st ANC visits		
1st trimester ≤12 weeks	121	74.2
2nd trimester 12-24 weeks	35	21.5
3rd trimester ≥24 weeks	7	4.3
Number of ANC visits		
2 or less	27	16.6
3 or more	136	83.4
Gestation age at birth		
Fullterm	117	71.8
Preterm	34	20.9
Postterm	9	5.5
Unknown	3	1.8
Mode of delivery		
SVD	137	84.0
Cesarean delivery	21	12.9
Assisted breech	5	3.1
Birth weight		
<2500g	27	16.6
≥2500g	136	83.4

ANC = Antenatal clinic; SVD = spontaneous vaginal delivery

Health and nutritional characteristics of the mothers

Mean height and weight measurements of the mothers were 167±0.6cm, and 64.8±6kg, respectively. Thirty-one percent (19.0%) of the mothers were underweight with a BMI of < 18.5. Mean hemoglobin level was 11.6±1.8g/dl. One hundred and thirty-six (83.4%) of the mothers received iron and folic acid supplements. Ninety-seven (59.5%) of the mothers reported to have avoided certain foods during pregnancy. One hundred and twenty-six (77.3%) of the mothers experienced nausea and vomiting, heart burn (59.5%, n=97) and poor appetite (86.5%, n=141) during pregnancy. Several women experienced more than one of these symptoms during pregnancy (Table 3).

Fifty mothers (30.7%) had been exposed to agricultural chemicals during pregnancy. Seventeen of the mothers (10.4%) obtained their domestic water from a borehole/well, 42.3% from stream/river and 47.3% obtained water from tap water. Only 8% reported having taken alcohol during pregnancy while none reported to have smoked during pregnancy. Only 4.3% of the mothers had been treated of sexually transmitted illness and 17.8% treated of malaria during pregnancy. None had been diagnosed with tuberculosis.

Table 3: Health and nutritional characteristics of mothers in Kapsabet Referral hospital

Health/nutritional variable	Frequency (n)	Percentage (%)
Mother's place of residence		
Rural	76	46.6
Urban	87	53.4
Source of household water		
Borehole/well	17	10.4
River/stream	69	42.3
Tap water	77	47.3
Exposure to agricultural chemicals		
Yes	50	30.7
Taken alcohol during pregnancy		
Yes	13	8.0
Smoking during pregnancy		
Yes	0	0
Symptoms during pregnancy		
Nausea and vomiting	126	77.3
Heart burn	97	59.5
Loss of appetite	141	86.5
Avoided certain foods during pregnancy		
Yes	97	59.5
Iron and folic acid supplementation during pregnancy		
Yes	136	83.4
Gestational diabetes		
Yes	23	14.1
Mother's history of chronic diseases		
Yes	22	13.5
Treated of disease/infection during pregnancy		
Sexually Transmitted Infections (STIs)	7	4.3
Malaria	29	17.8
Tuberculosis	0	0
Pregnancy complications		
Yes	45	27.6
Hemoglobin level		
Normal (≥10 g/dl)	143	87.7
Mild (8.8-9.9 g/dl)	20	12.3
Body Mass Index (BMI)		
<18.5	31	19.0
≥18.5	132	81.0
Mid-Upper Arm Circumference (MUAC)		
<23 cm	19	11.7
≥23 cm	144	88.3

Bivariate analysis of factors associated with LBW

The following factors were significantly associated with LBW: sex of infant (OR=2.34, 95% C.I.= 2.45-13.50, p-value=0.03, age of the mother at child birth (OR=3.41, 95% C.I. =1.53-13.43, p-value= 0.01), education level of the mother (OR=2.95, 95% C.I. = 1.43-12.45, p-value=0.03), LBW delivery in a previous birth (OR=2.75, 95% C.I. =2.45-12.23, p-value=0.02), premature births (OR=1.78, 95% C.I. =1.89-13.67, p-value=0.04), and

nutrition status of the mother at child birth (OR= 3.37, 95% C.I. = 2.56-12.97, p-value=0.01). Mothers who had a previous LBW baby were found to be almost 3 times more likely to give birth to a LBW infant than one who had given birth to a normal weight baby. Mothers having premature births were almost twice likely to give birth to a LBW than one who had no premature birth. Malnourished mothers were almost 4 times likely to give birth to a LBW babies compared to well-nourished mothers (Table 4).

Table 4: Bivariate analysis of various variables with low birth weight

Variable	OR (95% C.I)	*p*-value
Age of mother at birth	3.41 (1.53-13.43)	0.01
Sex of infant	2.34 (2.45-13.50)	0.03
Previous LBW delivery	2.75 (2.45-12.23)	0.02
Mother's education level	2.95 (1.43-12.45)	0.03
Premature birth	1.78 (1.89-13.67)	0.04
Mother's nutritional status	3.37 (2.56-12.97)	0.01

OR=Odds Ratio, C. I= Confidence interval, *p*-value = ≤0.05

Confounding and effect modification

Stratified analysis showed that a mother's residence and sex of the infant were leading to confounding effects. Effect modifier identified was maternal age.

Independent factors associated with LBW

From the logistic regression analysis, gestational age, mode of delivery, complications during pregnancy and iron and folic supplementation during pregnancy, were found to be independent predictors of low birth weight among the study sample (Table 5).

Table 5: Logistic regression of independent factors associated with LBW

Variable	OR (95% C.I)	*p*-value
Gestational age		
Term	1.00	
Preterm	5.01(2.92-9.61)	0.00*
Post term	1.70(0.51-5.26)	0.58
Unknown	1.56(0.74-3.33)	0.34
Mode of delivery		
SVD	1.00	
Assisted breech	0.47(0.23-0.97)	0.04*
Cesarean delivery	0.38(0.19-0.89)	0.02*
Pregnancy complications		
No	1.00	
Yes	2.61(1.63-5.87)	0.00*
Iron and folic acid supplementation		
No	1.00	
Yes	1.56(0.97-1.56)	0.01*

*Statistically significant, *p*-value ≤0.05

Discussion

Results from this study showed that the prevalence of LBW at the Kapsabet Referral Hospital was 16.6%. This was higher than the national prevalence of 11% [9]. Similarly, this prevalence is higher compared to that reported in the Rift Valley region 16.4% prevalence, Nyanza Provincial General Hospital 15.0% [10], and in Olkalou District Hospital, Kenya 12.3% [12]. Likewise, the prevalence of LBW reported in the present study was higher than 13.6% prevalence reported in Kilimanjaro Christian Medical Center (KCMC) Moshi Tanzania [7] and a 9.1% prevalence reported in Korogwe District Tanzania [8,24]. However, on the contrary, [25] reported 22.5% prevalence in Jimma zone South West Ethiopia whereas [26] reported 17.1% prevalence in Gondar University

Hospital North West Ethiopia which was both higher than that of the present study. The high prevalence in Kapsabet Hospital could be attributed to the fact that it is a referral hospital in Nandi County.

Most of the mothers were between the ages 19-29 years. This was consistent with several findings elsewhere [7,8,12,25-28] . The bivariate analyses showed that the age of the mother at birth was significantly associated with LBW. Children born of mothers 15 to 23 years of age are more likely to be LBW than children of older mothers. Mothers who are less than 25 years of age are prone to have physical and emotional maturity issues which may contribute to elevated incidences of small size births or LBW infants. Their lack of knowledge on how to take care of themselves during pregnancy works against child birth weight [29]. This observation was confirmed by [30].
Majority of the mothers in the present study attained secondary school education. [12] and [26] also found similar findings in Kenya and Ethiopia respectively. [25] and [26] reported contrasting findings with most of the mothers in both studies having completed primary education. Findings from this study showed a strong association between the mother's education level and LBW. [7] confirmed that mothers without formal education were 4 times more likely to give birth to LBW babies compared to those with formal education, whereas the father's level of education significantly influenced the occurrence of low birth weight. These findings have been confirmed by [31] and [32].

Most of the mothers in the present study were married and either employed or self-employed. This finding was consistent with that by [25-27]. [7] reported that unmarried mothers were more likely to give birth to low birth weight babies compared to their married counterparts. Although there is no research evidence to support this, it is likely that married women receive both financial and emotional support provided by their partners and this may help in improved child rearing practices. In this study the partners were also either employed or self-employed.

A significant association between LBW and low birth weight delivery and premature infants in previous births was reported in the present study. Fifteen mothers (9.1%) had LBW infants, 20.9% had pre-term births less than 37 weeks and the average birth weight of the infants was 2732±331gms. These findings are consistent with other studies [3,6,25,26,33,34]. A study in Gondar University Hospital, Ethiopia by [28] reported that preterm infants are six (6) times more likely to be LBW than full term infants. This could be attributed to the fact that infants born prematurely do not complete normal physical development in the womb and are at high risk of LBW [16]. Premature birth is the primary cause of LBW and it describes babies born before 37 completed weeks of gestation. The earlier a baby is born, the more likely it will weigh less. This is because the baby has less time in the mother's uterus to grow and gain weight [20]. Therefore, timely and early identification and management of any, medical conditions posing a risk for premature delivery is very important.

Results from the present study showed that the mode of delivery influenced LBW with 84% having normal deliveries whereas 12.9% had cesarean section deliveries. [11] reported that deliveries by cesarean section may lead to LBW since some births take place before term owing to miscalculated gestational age or planned early deliveries. In addition, medical complications associated with LBW such as eclampsia may increase the demand for cesarean delivery; hence, the baby is born before reaching term. This study finding concurs with [35] who reported that infants born via cesarean were 1.4 times more likely to have a LBW than those born via vaginal delivery.

This study found that complications during pregnancy were strongly associated with LBW with 27.6% of the mothers suffering complications such as gestational diabetes, pre-eclampsia, miscarriages and high blood pressure. Spotting or bleeding during pregnancy was reported to influence LBW [14,33,36]. Pregnancy complications are indicators of disorders during pregnancy that can have negative impacts on the birth weight of the infant [16]. This underscores the need for regular antenatal checks and follow-ups to identify and manage such disorders.

In the present study, thirteen percent (13.5%) of the mothers suffered from a chronic disease commonly gestational diabetes and malaria. Several studies have reported an association between chronic diseases, such as hypertension, pre-eclampsia and eclampsia, bleeding, placenta praevia, abruption placenta, premature rupture of membranes, anemia, Tuberculosis, Malaria, and LBW [3,7]. However, [16] reported that chronic diabetes mellitus was less likely to lead to LBW and argued that it could be medically explained or could be mere incidental.

The frequency of ante-natal visits has been found to greatly contribute to a positive infant outcome. In the present study, more than 83% of the mothers attended ANC at least 3 times and more, and majority of them attending during the first trimester. Few ANC visits is associated with LBW because of inadequate ANC services such as nutrition counselling, low micronutrient intake, and reduced chances of identifying risks such as pregnancy-related morbidity and other risks that might lead to preterm births [37]. Further, mothers whose prenatal visits are less than four are prone to have LBW or less than average size babies. Increased prenatal visits ensure mothers receive adequate diet literacy which helps improve child birth weight [29]. Therefore, improving ANC coverage and uptake of services is essential for improving infant outcome [20]. However, the uptake of ANC services in rural Kenya is still poor with only 52% of pregnant mothers completing the WHO recommended four ANC visits [38,39].

The nutrition status of the mothers in this study had a significant association with LBW. Although the nutrition indicators showed that more than three quarters of the mothers had a BMI of ≥18.5 and MUAC > 23cm revealing fairly good nutrition status 19% had a BMI of < 18.5 while 11.7% had MUAC of < 23cm indicative of poor nutrition status. Similar findings were reported by [29] where height and weight were significant predictors of LBW. Consistent findings were reported by [31] and [40] who concluded that mother's weight and height is a reflection of the food taken which has a direct influence on child's birth weight. Baby's size at birth is predominantly influenced by maternal nutrition [27].

Iron and folic acid intake in the present study was an independent predictor of LBW with more than three quarters (83.4%) of the mothers taking these supplements while only 16.6% did not. [41] recommended a daily oral iron and folic acid supplementation with 30 to 60 mg of elemental iron and 400 µg (0.4 mg) folic acid for pregnant women to prevent maternal anaemia, low birth weight, and preterm birth. Mothers in the present study had a mean Hb of 11.6±1.8g/dl which is slightly below the recommended 12g/dl for women [5]. Deficiencies of both iron and folic acid has health consequences such as reduced cognitive performance, lower work performance and endurance, impaired iodine and vitamin A metabolism to increased risk of maternal and child mortality [42]. Therefore, concerted efforts towards iron and folic acid uptake are critical.

The present study revealed a significant association between the sex of the infant and LBW, whereby there were more (52.1%) female neonates than male (47.9%). [1] concurs that infant's sex was a determinant of LBW. On the contrary though, preterm births have been shown to be more common in boys, with around 55% of all preterm births worldwide occurring in males [42]. This calls for further research to ascertain the differences.

Limitations of the study

This was a hospital based study and therefore limits generalizations to the whole country however; generalizations may be made to similar settings. Also, being a cross-sectional study, the researchers could not give seasonal variations affecting LBW. Gestational age was calculated using the Last Normal Menstrual Period (LNMP) which was obtained from the mother child booklet, the delivery register or by asking the mother. Those who could not recall were regarded as non-response. Despite these limitations, this study has made important contribution on the prevalence of LBW in Kapsabet Referral Hospital and has identified the important risk factors that may contribute to the occurrence of high prevalence of LBW in the hospital.

Conclusion

From the results of this study the following conclusions can be made:

1. The prevalence of low birth weight in Kapsabet Referral Hospital was 16.6%. This prevalence is a substantial risk to neonatal death among newborns in this hospital and therefore a population based study should be done to ascertain if the prevalence is an epidemiological risk to the population.
2. This study identified the following as risk factors for LBW; age and education level of the mother, low birth weight and premature deliveries in previous births, nutrition status of the mother, pregnancy complications, mode of delivery, iron and folic acid supplementation.

Recommendations:

The following recommendations may be made:

1. Regular training of health personnel on ante-natal care to ensure early detection of risks of LBW so that prompt and appropriate management is done.
2. The government to step up the quality of ante-natal care services and promote maximum use of these services. Focus should be put towards increased nutrition counselling, iron and folic acid uptake so as to improve modifiable risk factors such as the nutrition status of mothers.
3. Sensitization and raising awareness on the need to attend ANC services for prompt and early identification of pregnancy complications.
4. Increasing opportunities for girls' education is of utmost importance
5. We also recommend a population based study to ascertain the prevalence of LBW and associated risk factors in Nandi County.
6. Policy makers should develop systems to recruit hard-to-reach pregnant women into antenatal care services. This can be done through outreach personnel and establishment of referral relationships with other service systems, such as the Special Supplemental Food Program for Women, Infants and Children (WIC).

Conflict of interest

The authors declare no conflict of interest

Authors' contributions

All authors read and agreed on the final manuscript before submission for publishing. Nancy Jepng'etich: development of proposal, data collection, analysis and manuscript writing. Kevin Omondi Aduol; supervision and manuscript writing. Gertrude Were: supervision, correction of general research work and manuscript review before submission for publishing.

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References

1. Sebayang, S. K., Dibley, M. J., Kelly, P. J., Shankar, A. V, & Shankar, A. H. (2012). Determinants of low birthweight , small-for-gestational-age and preterm birth in Lombok , Indonesia : analyses of the birthweight cohort of the SUMMIT trial, *Tropical Medicine & International Health*. *17*(8), 938–950. https://doi.org/10.1111/j.1365-3156.2012.03039.x
2. Bugssa, G., Dimtsu, B., & Alemayehu, M. (2014). Socio Demographic and Maternal Determinants of Low Birth Weight at Mekelle Hospital , Northern Ethiopia : A Cross Sectional Study. *American Journal of Advanced Drug Delivery*. vol. 2, no. 5, pp. 609-618.
3. Gebremedhin, M., Ambaw, F., Admassu, E., & Berhane, H. (2015). Maternal associated factors of low birth weight : a hospital based cross-sectional mixed study in Tigray , Northern Ethiopia. *BMC Pregnancy and Childbirth*, vol.15, no.1, article 222. https://doi.org/10.1186/s12884-015-0658-1
4. WHO. (2004). World Health Report Life in the 21st century A vision for all Report of the Director-General.
5. Mengesha, H. G., Wuneh, A. D., Weldearegawi, B., & Selvakumar, D. L. (2017). Low birth weight and macrosomia in Tigray , Northern Ethiopia : who are the mothers at risk ?, *BMC Pediatrics*, vol.17, no.1, article144. 1–9. https://doi.org/10.1186/s12887-017-0901-1
6. Agarwal, K., Agarwal, A., Agrawal, V. K., Agrawal, P., & Chaudhary, V. (2011). Prevalence and determinants

of "low birth weight " among institutional deliveries, *Annals of Nigerian Medicine*, vol. *5*(2), 48–52. https://doi.org/10.4103/0331-3131.92950
7. Siza, J. E. (2008). Risk factors associated with low birth weight of neonates among pregnant women attending a referral hospital in northern Tanzania. T*anzania Journal of Health Research.10*(1), 1–8.
8. Mmbando, B. P., Sembuche, S., Kamugisha, M. L., & Theander, T. (2008). Risk factors for low birth-weight in areas with varying malaria transmission in Korogwe , Tanzania : implications for malaria control, *Tanzania Journal of Health Research.*. *10*(3), 137–143.
9. Wasunna A, Mohammed K (2002) Low birth weight babies: socio demographic and obstetric characteristics of adolescent mothers at Kenyatta National Hospital, Nairobi. East Afr Med J.79: 543-546.

10. Mutugi, M. P. (2012). Prevalence of low birth weight deliveries and associated factors in Narok district hospital, Kenya. University of Nairobi; 2012. Available from: http://erepository.uonbi.ac.ke:8080/xmlui/handle/123456789/7 354
11. Nyamasege C. K, Kimani-Murage E. W, Wanjohi M, Kaindi D. W. M, Ma E, Fukushige M, Wagatsuma Y. (2018) Determinants of low birth weight in the context of maternal nutrition education in urban informal settlements, Kenya. Journal of Developmental Origins of Health and Disease page 1 of 9. doi: 10.1017/S2040174418000715
12. Muchemi O.M, E. Echoka, & A. Makokha. (2015). Factors associated with low birth weight among neonates born at Olkalou District Hospital, Central Region, Kenya. *PanAfrican Medical Journal*, *8688*, 1–11. https://doi.org/10.11604/pamj.2015.20.108.4831
13. World Health Organization (2014). Global targets 2025. To improve maternal, infant and young child nutrition (www.who.int/nutrition/topics/nutrition globaltargets2025/en/, accessed 17 October 2015).

14. Chen, Y., Li, G., Ruan, Y., Zou, L., Wang, X., & Zhang, W. (2013). An epidemiological survey on low birth weight infants in China and analysis of outcomes of full-term low birth weight infants. *BMC Pregnancy and Childbirth*,vol.13, article 242.
15. Perera, F. P., Rauh, V., Tsai, W., Kinney, P., Camann, D., Barr, D., … Whyatt, R. M. (2003). Children ' s Health Articles Effects of Transplacental Exposure to Environmental Pollutants on Birth Outcomes in a Multiethnic Population, *111*(2), 201–205. https://doi.org/10.1289/ehp.5742
16. Hailu, L. D., & Kebede, D. L. (2018). Determinants of Low Birth Weight among Deliveries at a Referral Hospital in Northern Ethiopia, *Hindawi BioMed Research International* vol. 2018, Article ID 8169615, 8 pages https://doi.org/10.1155/2018/8169615*2018*.
17. Mulu, G. B., Gebremichael, B., Desta, K. W., Kebede, M. A., Aynalem, Y. A., & Getahun, M. B. (2020). Determinants of Low Birth Weight Among Newborns Delivered in Public Hospitals in Addis Ababa , Ethiopia : Case-Control Study. *Pediatric Health, Medicine and Therapeutics*, *11*, 119–126.
18. Adam, Z., Ameme, D. K., Nortey, P., Afari, E. A., & Kenu, E. (2019). Determinants of low birth weight in neonates born in three hospitals in Brong Ahafo region , Ghana , 2016- an unmatched case-control study. *BMC Pregnancy and Childbirth*, *19*(174), 1–9.
19. United Nations Report, Sustainable Development Report 2019. New York, NY. 2019

20. United Nations Children's Fund and World Health Organization. Low Birth Weight: Country, regional and global estimates. NEW YORK: UNICEF; 2004. Google Scholar.

21. Rogers, L.K., & Velten, M. (2011). Maternal Inflammation, Growth Retardation, and Preterm Birth: Insights into Adult Cardiovascular Disease. Life Sciences. Volume 89: 417-421
22. KNBS, & ICF International. (2015). *Kenya Demographic and Health Survey 2014*. https://dhsprogram.com/pubs/pdf/FR308/FR308.pdf
23.Sullivan, K. M., & Dean, A. (2009). Open Source Epidemiologic Statistics for Public Health, Version 2.3.1. Available from: www.OpenEpi.com.Back, W, (2010). Low Birth Weight. March of Dimes, Professionals and Researchers. Available at; http://www.marchofdimes.com/professionals/14332-1153.asp Accessed on February 2016.

24. Wilcox, A. J., & Skcerven, R. (1992). Birth Weight and Perinatal Mortality : The Effect of Gestational Age, *82*(3).
25. Tema, T. (2006). Prevalence and determinants of low birth weight in Jimma zone , Southwest Ethiopia. *EastAfricanMedicalJournal*, *83*(7), 366–371.
26. Berihun M. Z., Meseret Z., & N. M. (2012). Incidence and correlates of low birth weight at a referral hospital in Northwest Ethiopia, *Pan African Medical Journal*, *8688*, 1–8.
27. Magadi, M., Madise, N., & Diamond, I. A. N. (2001). Factors associated with unfavourable birth outcomes in Kenya. *Journal of Biosocial Science*. ;36(2):153–76., 199–225.
28. Adane, A. A., Ayele, T. A., Ararsa, L. G., & Bitew, B. D. (2014). Adverse birth outcomes among deliveries at Gondar University Hospital , Northwest Ethiopia, BMC *Pregnancy and Child Birth* vol. 14, no. 1, article 90 1–8.
29. Gathimba, N. W., Wanjoya, A., Kiplagat, G. K., Mbugua, L., Kibiwott, K. Modeling Maternal Risk Factors Affecting Low Birth Weight Among Infants in Kenya. *American Journal of Theoretical and Applied Statistics*. Vol. 6, No. 1, 2017, pp. 22-31. doi: 10.11648/j.ajtas.20170601.13

30. Roth, J., & Hendrickson, J. (1998). The risk of teen mothers having low birth weight babies: Implications of recent medical research. Journal of School Health, 68 (7), 271.
31. Ngwira A, Stanley C. C. Determinants of Low Birth Weight in Malawi: Bayesian Geo-Additive Modelling. PLoS One. 2015; 10, e0130057.

32. Beguy D., Elung'ata P., Mberu B, et al. Health & Demographic Surveillance System Profile: The Nairobi Urban Health and Demographic Surveillance System (NUHDSS). Int J Epidemiol. 2015; 44, 462–471.

33. Mirzarahimi, M., Hazrati, S., Ahmadi, P., & Alijahan, R. (2013). Prevalence and risk factors for low birth weight in Ardabil, Iran." *Iranian Journal of Neonatology*, vol. 4, no. 1, pp. 18–23.
34. Sutan, R., Mohtar, M., Mahat, A. N., & Tamil, A. M. (2014). Determinant of Low Birth Weight Infants : A Matched Case Control Study. *Open Journal of Preventive Medicine*, (March), 91–99.
35. Coutinho P. R, Cecatti J. G, Surita F. G, Costa M. L, Morais S. S. Perinatal outcomes associated with low birth weight in a historical cohort. Reprod Health. 2011; 8, 18–18.
36. Demelash, H., Motbainor, A., Nigatu, D., Gashaw, K., & Melese, A. (2015). Risk factors for low birth weight in Bale zone hospitals , South-East Ethiopia : a case – control study, 1–10. *BMC Pregnancy and Childbirth*, vol.15, no.1, article 264. https://doi.org/10.1186/s12884-015-0677-y
37. Elshibly E. M, Schmalisch G. The effect of maternal anthropometric characteristics and social factors on gestational age and birth weight in Sudanese newborn infants. BMC Public Health. 2008; 8, 244.

38. Gitonga, E. (2017). *Determinants of Focused Antenatal Care Uptake among Women in Tharaka Nithi County, Kenya* [Research Article]. Advances in Public Health; Hindawi. https://doi.org/10.1155/2017/3685401
39. Mwangi, W., Gachuno, O., Desai, M., Obor, D., Were, V., Odhiambo, F., Nyaguara, A., & Laserson, K. F. (2018). Uptake of skilled attendance along the continuum of care in rural Western Kenya: Selected analysis from Global Health initiative survey-2012. *BMC Pregnancy and Childbirth*, *18*(1), 1–13. https://doi.org/10.1186/s12884-018-1803-4
40. Kader M, Tripathi N (2013) Determinants of low birth weight in rural Bangladesh, Int J Reprod Contracept Obstet Gynecol. 2 (2): 130–134.
41. Ronoh, A. K., Were, G. M., & Mbithi, M. M. (2017). Biofortified Crops Can Alleviate Micronutrient Deficiencies: Review of Evidence from Randomized Feeding Trials. *Vitamins & Minerals*, *06*(02). https://doi.org/10.4172/2376-1318.1000154

42. WHO Guideline: Daily iron and folic acid supplementation in pregnant women. Geneva: World Health Organization; 2012
(http://www.who.int/nutrition/publications/micronutrients/guidelines/daily_ifa_supp_pregnant_women/en/)

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