Determinants of Low Birth Weight among Infants Born at Gabiley General Hospital, Gabiley District, Western Somaliland: Unmatched Case-Control Study

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Abstract

Background: Low birth weight (LBW) remains a major public health concern worldwide with a disproportionately high burden in low and middle-income countries. However, no published research has been done to identify the factors contributing to low birth weight in the Gabiley district in Western Somaliland. Therefore, this study assessed the determinants for low birth weight in infants born at Gabiley General Hospital.

Methods: A facility-based unmatched case-control study was employed from July 1 to August 31, 2022, at Gabiley General Hospital Somaliland. A total of 291 mothers-newborn pairs were included in the study of which 97 were cases and 194 were controls. Data were collected using a structured and pretested interviewer-administered questionnaire. Data were analyzed by SPSS software. Logistic regression was conducted to identify determinant and statistical significance declared at a $p< 0.05$.

Results: A total of 291 mothers-newborn pairs (97 cases and 194 controls) were included in the study making the response rate 97%. Gestational age of <37 weeks (AOR=2.18; 95 % CI: 1.11, 4.29), previous history of low birth weight (AOR=2.17; 95 % CI: 1.12,4.21), a 1st-trimester hemoglobin level of <11g/dl (AOR=1.93; 95% CI: 1.06,3.50), meal frequency of two times and three times per day (AOR=4.70; 95% CI: 1.38,15.97), (AOR=4.47; 95% CI: 1.50,13.34) and mid-upper arm circumference <23cm (AOR=4.04; 95% CI: 2.19,7.45) were the factors significantly associated with low birth weight.

Conclusions: Factors such as gestational age, previous history of low birth weight, anemia in the first trimester, meal frequency during pregnancy, and maternal mid-upper arm circumference were identified to be associated with low birth weight. Therefore, it is recommended that healthcare providers prioritize screening for hemoglobin levels in the first trimester, encourage using iron and folic acid supplements, and offer nutritional guidance and support.

***Keywords*:** Low Birth weight, Gabiley, Western Somaliland

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Introduction

Low birth weight (LBW) is the weight of an infant below 2,500 grams (United Nations Children's Emergency Fund, 2003). It is a major public health concern globally with a disproportionate burden on low and middle-income countries (WHO, 2014). In 2020, an estimated 14.7% of all babies born globally, suffered from LBW. Nearly three-quarters of LBW births in 2020 occurred in southern Asia (44.5%) and sub-Saharan Africa (27.1%) (Okwaraji *et al*., 2024).

Low birth weight babies are at a greater risk of mortality within the first month of life and may experience negative health consequences such as impaired growth cognitive delays, language difficulties, delayed motor skills, social development issues, learning disabilities, and lower intelligence quotient (Scharf RJ, Stroustrup A, 2016; Edmond *et al*., 2017; Ballot *et al*., 2012). A systematic review of LBW in Africa showed an increased risk of death, growth retardation, and delayed neurodevelopment among meager birth weight and shallow birth weight children (Tchamo *et al*., 2016). Furthermore, newborns with LBW were at higher risk of stillbirth, low activity, pulse, grimace, appearance, respiration (Apgar) score within the first minute after birth, admission to the neonatal intensive care unit (NICU), and early neonatal death in Zambia. Additionally, low birth weight was associated with a risk of hypertension later in life (Lule *et al.,* 2018).

Prenatal corticosteroids, ventilation, and exogenous surfactants are among the high-cost neonatal interventions in hospitalized low birth weight (LBW) babies. In addition, providing care for LBW babies, such as

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Neonatal intensive care unit (NICU) treatment, specialized feedings, and medical interventions, can have a significant impact on both the economic and psychological well-being of families (WHO, 2020). These costs continue to rise after hospital discharge, adding to the burden on families, society, and the global community to maintain and develop LBW babies (Sharma & Mishra, 2013).

Different studies identified the absence of maternal iron supplementation, nutritional counseling, consumption of additional meals during pregnancy (Ahmed *et al.,* 2018), maternal anemia and maternal undernutrition (Girma *et a*l., 2019), low maternal education, food insecurity status, and inadequacy of dietary diversity and anti-natal care visit during the current pregnancy (Gizaw & Gebremedhin, 2018), maternal age and gestational age, hypertensive disorder (Adane & Dachew, 2018), previous obstetric complications, maternal gravidity and weight during pregnancy (Wachamo *et al*., 2019), previous history of low birth weight (Talie *et al.,* 2019) were associated with low birth weight babies.

Efforts to reduce complications related to LBW in developing countries gave greater attention to understanding and addressing the risk factors (*Johnson et al*., 2017). However, to the best of the investigators' knowledge, no published research has been conducted to clarify the determinants of low birth weight in this study setting. Therefore, this study aimed to assess determinants of LBW among babies born at Gabiley General Hospital, Gabiley district, in western Somaliland.

Materials and Methods

Study Setting, Design, and Period

A facility-based unmatched case-control study was conducted in Gabiley General Hospital, Gabiley district from July 1 to August 31, 2022. The district is located 58 kilometers to the west of the capital city of Hargeisa, Somaliland. Based on the report from the Ministry of National Planning and Development in 2016 the total population of Gabiley was 40,000 (Ministry of National Planning and Development, 2016). The district has only one public hospital namely Gabiley General Hospital. The hospital renders a range of medical, maternal, and child health services including delivery services, and various inpatient and outpatient healthcare services.

Study Population, Inclusion and Exclusion Criteria

The study population for the study consisted of singleton term infants with a birth weight of less than 2500 grams as the cases group, while the control group included term newborns with a birth weight ranging from 2500 to less than 4000 grams. Newborns from multiple births or with visible deformities were excluded from the study.

Sample Size, and Sampling Technique.

The sample size was determined using a proportional difference approach for a case-control study using the Epi-Info statistical software package (Version-7) taking into account maternal anemia as the main exposure variable and considering a 95% confidence level, 80% power of the study and control to case ratio of 2:1 for estimating low birth weight. As such, we considered that the percentage of controls exposed (having anemic mothers) among the controls was 11.6% (FAO & FHI, 2010). Assuming a 15% difference (increase) in cases that is assumed in advance, the proportion of cases with exposure became 26.6% producing the least extreme Odds Ratio of 2.76 to be detected. Accordingly, after adding a 15% non-response rate to each, 100 cases and 200 controls were estimated making a total sample size of 300 subjects to be included in the study. A consecutive sampling technique was employed to reach the study participants. The first low birth weight (birth weight < 2500 grams) case was considered as the starting participants then the next two normal birth weights (birth weight ≥ 2500-4000 grams) were considered as controls. For each LBW, the next two deliveries with birth weight ≥ 2500-4000 grams were considered as controls and the procedure was continued in that way until a calculated sample size was achieved.

Data Collection Techniques

Data were collected by the following method;

Face-to-face interview: The data were collected by interviewing mother after giving birth by a trained nurse using a pretested structured questionnaire which was adapted from previous literatures (Adam *et al.,* 2019; Adane & Dachew, 2018; Girma *et al*., 2019; Hailu & Kebede, 2018; Talie *et al.,* 2019; Wachamo *et al.,* 2019), The questioner contains different parts

which is socio demographic characteristics, maternal health service & obstetrics, Maternal Behavior and lifestyle and Nutritional factors.

Anthropometric measurement: The weights of the newborns were measured within 1 hour after birth using a balanced digital Seca scale by rounding to the nearest 100 g. The scale was always used to check and zero before weighing each newborn. The mid-upper arm circumference (MUAC) of the mother was measured at the mid-point between the tip of the acromion process of the scapula and the olecranon process of the ulna after delivery using a flexible non-stretchable standard tape measure. The measurements were taken two times from the left arm while it was hanging and relaxed and then the average was calculated and recorded to the nearest 0.1 cm.

Reviewing medical records: The medical records of the mothers were reviewed to extract information like last-normal menstrual period, ultrasound dating of pregnancy, previous obstetric complication, and antenatal care during the current pregnancy, and maternal weight and hemoglobin measurement during the first trimester.

Definitions of Terms/Operational Definition

Multiple births: refer to when more than one fetus is carried to term in a current pregnancy (mbasha, 2017).

Gestational age: is a measure of the age of a pregnancy which is taken from the first day of the woman's last menstrual period (Demelash *et al.,* 2015).

Smoking: smoking at least one piece per day in this current pregnancy.

Current Khat chewing: Chewing khat during the current pregnancy was considered a current khat chewer (Misgana *et al.,* 2022).

Coffee drinking: daily drinking coffee in this current pregnancy (Hunde *et al*., 2023).

Family size: is defined as nuclear when the mother, father, and their children live together and extended family is defined as when the grandmother/ grand- father, aunt/uncle, or cousins live with the nuclear family (Georgas *et al.,* 2001).

Data Quality Control

The questionnaire was prepared in English and translated into Somali language and back-translated to English by a language expert to keep the consistency of the questions and increase understanding with respondents. The questionnaire was pretested on 5% of the sample size (5 cases and 10 controls) in Umulkalkaal General Hospital out of the study area before the actual data collection was implemented. The necessary amendments and corrections were made based on the pretest findings. Training was given to data collectors and supervisors. During the data collection, data collectors were supervised at the site. The collected data was checked for completeness and consistency daily by the principal investigator and supervisor.

Data Processing and Analysis

Data were cleaned using EpiData version 3.1 (EpiData Association, Odense, Denmark) and exported to the Statistical Package for Social Sciences (SPSS) version 25 software (SPSS Inc. Chicago, IL, USA) for analysis. Descriptive statistics, including frequency distribution and summary measures like mean and standard deviation, are computed for both cases and controls. Hosmer and Lemeshow goodness-of-fit was used to test model fitness. Bivariate and multivariate logistic regression analyses were utilized to identify determinant factors associated with LBW. Variables with p-values less than 0.25in the bivariate analysis were considered as candidates for the multivariable analysis. Variables with a P-value of less than 0.05 at a 95% confidence interval (CI) in multivariate analysis were considered statistically significant factors associated with LBW.

Ethical Consideration

Ethical clearance was obtained from the Institutional Review Board (DDU-IRB-SGS/22/0104 with reference number 81/2014) of DireDawa University. A letter of cooperation was obtained from the Gabiley Regional Health Bureau. The objective of the study, rights, and benefits of the study were explained to the head of the hospital and the selected mother. Then, informed, voluntary, written, and signed consent was taken from both of them. For participants who were under 18, assent was sought from their guardians. To ensure confidentiality, their names and other personal identifiers were registered in the format.

Results

Socio-demographic characteristics

A total of 291 mothers with their newborns (97 cases and 194 controls) were included in the study making the response rate 97%. The mean ± SD of birth weight

was 2156 ± 127 g for cases and 3208 ± 352 g for controls. Ten (3.4%) of cases and 34 (11.7%) of controls had college and above in formal education, while 36 (12.4%) of husbands among cases and 84 (28.9%) of controls had reached college and above in formal education. Moreover, 77 (26.5%) of mothers among cases and 180 (61.9%) among controls were living in urban settings (Table 1).

Table 1: Socio-Demographic Characteristics among Mothers of Cases and Controls in Gabiley General Hospital, Gabiley District, western Somaliland, 2022 (n= 291).

Variables	Category	Cases (%) N=97	Controls (%) N=194	Total (%) N= 291
Maternal Age (years)	≤20	18 (6.2)	20 (6.9)	38 (13.1)
	21-35	60 (20.6)	137 (47.1)	197 (67.7)
	>35	19 (6.5)	37 (12.7)	56 (19.2)
Marital Status	Married	93 (32)	182 (62.5)	275 (94.5)
	Others*	4 (1.4)	12 (4.1)	16 (5.5)
Maternal Education	No formal education	29 (10)	34 (11.7)	63 (21.6)
	Primary education	29 (10)	49 (16.8)	78 (26.8)
	Secondary education	29 (10)	77 (26.5)	106(36.4)
	College and above	10 (3.4)	34 (11.7)	44 (15.1)
Husband's Education	No formal education	20 (6.9)	12 (4.1)	32 (11.0)
	Primary education (1-8)	12 (4.1)	25 (8.6)	37 (12.7)
	Secondary education(9-12)	29 (10.0)	73 (25.1)	102 (35.1)
	College and above	36 (12.3)	84 (28.9)	120 (40.2)
Maternal Occupation	Housewife	45 (15.4)	103 (35.4)	148 (50.8)
	Merchant	20 (6.8)	31 (10.7)	51 (17.5)
	Government employee	11 (3.8)	21 (7.2)	32 (11.0)
	Private company employee	6 (2.1)	12 (4.1)	18 (6.2)
	Others**	15 (5.2)	27 (9.3)	42 (14.5)
Husband's Occupation	Daily labor	30 (10.3)	40 (13.7)	70 (24.1)
	Merchant	21 (7.2)	60 (20.6)	81 (27.8)
	Government employee	25 (8.6)	49 (16.8)	74 (25.4)
	Private company employee	11 (3.8)	30 (10.3)	41 (14.1)
	Others***	10 (3.4)	15 (5.2)	25 (8.6)
Monthly Family income ($)	≤150	2 (0.7)	-	2(0.7)
	151-300	30 (10.3)	50 (17.2)	80 (27.5)
	>300	65 (22.3)	144 (49.5)	209 (71.8)
Residence	Urban	77 (26.5)	180 (61.9)	257 (88.3)
	Rural	20 (6.9)	14 (4.8)	34 (11.7)
Family size	Nuclear family	71 (24.4)	134 (46.0)	205 (70.4)
	Extended family	26 (8.9)	60 (20.6)	86 (29.6)
Sex of the newborn	Boys	40(13.8)	70 (24.0)	110 (37.8)
	Girls	57 (19.6)	124 (42.6)	181 (62.2)

Others; single, separated or divorced, others**; Student, Non-governmental organization, others***; Bajaj Driver, Student*

Maternal Obstetric Factors

A total of 75 (25.8%) cases and 180 (61.9%) control had a gestational age at delivery of greater than 37 weeks, respectively. In the case group, 24.1% (70) had ANC follow-up, while in the control group, 61.2% (178) had ANC follow-up. Among these, 18.9% (55) of cases and 46.7% (136) of controls had ANC follow-up during the first trimester. Forty-four (15.1%) of mothers among cases and 54 (18.6%) controls had a history of previous low birth weight. A considerable number of mothers in cases 71 (24.4%) and 180 (61.9%) controls had taken iron supplementation in current pregnancy, and those taken TT vaccine were 47 (16.2%) in cases and 166 (57.0%) in controls. Mothers with a history of physical trauma during current pregnancy were 24 (8.2) in cases and 18 (6.2) in controls (Table 2).

Table 2: Maternal Obstetric Characteristics among Mothers of Cases and Controls in Gabiley General Hospital, Gabiley District, western Somaliland, 2022 (N=291)

Variables	Category	Cases (%) N=97	Controls (%) N=194	Total (%) N= 291
Gravidity	Primigravid	20 (6.9)	28 (9.6)	48 (16.5)
	Multigravida	77 (26.5)	166 (57.0)	243 (83.5)
Parity	Primipara	20 (6.9)	28 (9.6)	48 (16.5)
	Multipara	77 (26.5)	166 (57.0)	243 (83.5)
Previous low birth weight	Yes	37 (15.2)	44 (18.1)	81 (33.3)
(n=243)	No	53 (21.8)	109 (44.9)	162 (66.7)
Previous obstetric complication	Yes	34 (14.0)	53 (21.8)	87 (35.8)
(n=243)	No	47 (19.3)	109 (44.9)	156 (64.2)
History of Cesarean section	Yes	22 (9.1)	49 (20.1)	71 (29.2)
(n=243)	No	59 (24.3)	113 (46.5)	172 (70.8)
Gestational age at delivery	Preterm (<37)	22 (7.6)	14 (4.8)	36 (12.4)
(weeks)	Term (≥37)	75 (25.8)	180 (6.1.9)	255 (87.6)
ANC visit	Yes	70 (24.1)	178 (61.2)	248 (85.2)
	No	27 (9.3)	16 (5.5)	44 (14.8)
Time of first ANC visit	In the first 3	55 (22.2)	136 (54.8)	191 (77.0)
(n=248) months	4-6	8 (3.2)	14 (5.7)	22 (8.9)
	7-9	7 (2.8)	28 (11.3)	35 (14.1)
1st-trimester Hemoglobin (g/dl)	<11	30 (15.7)	109 (57.1)	139 (72.8)
(n=191)	≥11	33 (17.3)	19 (9.9)	52 (27.2)
Birth Interval (n=243) years	<2	17 (7.0)	29 (11.9)	46 (18.9)
	≥ 2	60 (24.7)	137 (56.4)	197 (81.1)
Iron supplementation	Yes	71 (24.4)	180 (61.9)	251 (86.3)
	No	26 (8.9)	14 (4.8)	40 (13.7)
TT Vaccine	Yes	64 (22.0)	147 (50.5)	211 (72.5)
	No	33 (11.3)	47 (16.2)	80 (27.5)
Number of TT doses taken	< doses	7 (3.3)	33 (15.5)	40 (18.8)
(n=213)	≥ doses	40 (18.8)	133 (62.4)	173 (81.2)
Gestational DM	Yes	6 (2.1)	12 (4.1)	18 (6.2)
	No	91 (31.3)	182 (62.5)	273 (93.8)
Pregnancy Induced Hypertension	Yes	10 (3.4)	37 (12.7)	47 (16.2)
	No	87 (29.9)	157 (54.0)	244 (83.8)
Hyperemesis gravidarum	Yes	78 (26.8)	137 (47.1)	215 (73.9)
	No	19 (6.5)	57 (19.6)	76 (26.1)
Physical trauma during the current pregnancy	Yes	24 (8.2)	18 (6.2)	42 (14.4)
	No	73 (25.1)	176 (60.5)	249 (85.6)

ANC; Antenatal Care, DM; Diabetes mellitus, TT: Tetanus Toxin

Maternal Behavior and Medical Condition

Mothers who had a history of smoking cigarettes during pregnancy were 4(1.4%) and 8(2.7%) among cases and controls, respectively. Mothers who had a habit of drinking coffee daily during current pregnancy were 18(6.2%) in cases and 49(16.8%) in controls. Maternal chronic diseases among cases were 6(2.1%) for Diabetes mellitus (DM) and 8 (2.7%) for hypertension while controls had 12 (4.1%) for DM and 21(7.2%) for hypertension and both of the groups had no medical conditions like STD, TB, and malaria during pregnancy (Table 3).

Maternal Nutritional Status-Related Factors

A proportion of 61(21.0%) of mothers among cases and 118(40.5%) in controls had used to take a meal three times daily during pregnancy. While having one additional meal consumption among mothers was 22 (7.6%) in cases and 63 (21.6%) in controls. Undernutrition in mothers as defined by MUAC < 23 cm was 53 (18.2%) and 55 (18.9%) among cases and controls, respectively (Table 4).

Table 3; Maternal Behavior and Lifestyle among Mothers of Cases and Controls in Gabiley General Hospital, Gabiley District, western Somaliland, 2022(N=291).

Variables	Categories	Cases (%) N=97	Controls (%) N=194	Total (%) N= 291
Smoking cigarettes during pregnancy	Yes	4 (1.4)	8 (2.7)	12 (4.1)
	No	93 (32.0)	186 (63.9)	279 (95.9)
Drinking Coffee daily	Yes	18 (6.2)	49 (16.8)	67 (23.0)
	No	79 (27.1)	145 (49.8)	224 (77.0)
Medical conditions	DM	6 (2.1)	12 (4.1)	18 (6.2)
	Hypertension	8 (2.7)	21 (7.2)	29 (10.0)
	None	83 (28.5)	161 (55.3)	244 (83.8)

DM; Diabetes mellituss

Table 4; Maternal Nutritional Factors among Mothers of Cases and Controls in Gabiley General Hospital, Gabiley District, western Somaliland, 2022 (N=291).

Variables	Category	Cases (%) N=97	Controls (%) N=194	Total (%) N= 291
Frequency of meal/day	Two times	12 (4.1)	10 (3.4)	22 (7.6)
	Three times	61 (21.0)	118 (40.5)	179 (61.5)
	≥four times	24 (8.2)	66 (22.7)	90 (30.9)
Additional meal Consumption	Yes	22 (7.6)	63 (21.6)	85 (29.2)
	No	75 (25.8)	131 (45.0)	206 (70.8)
Nutritional counseling	Yes	12 (4.1)	41 (14.1)	53 (18.2)
	No	85 (29.2)	153 (52.6)	238 (81.8)
MUAC (cm)	<23	53 (18.2)	55 (18.9)	108 (37.1)
	≥23	44 (15.1)	139 (47.8)	183 (62.9)
Height (cm)	<150	14 (4.8)	32 (11.0)	46 (15.8)
	≥150	83 (28.5)	162 (55.7)	245 (84.2)
1st trimester Maternal Weight (kg) (n=191)	<50	5 (2.6)	7 (3.7)	12 (6.3)
	≥50	59 (30.9)	120 (62.8)	179 (93.7)
1st trimester BMI (n=191)	<18.5	6 (3.1)	9 (4.7)	15 (7.8)
	18.5-24.9	23 (12.1)	55 (28.8)	78 (40.9)
	>25	27 (14.1)	71 (37.2)	98 (51.3)

BMI; Body Mass Index

Determinants of low birth weight

In Bivariate analysis, maternal education, husband's education, residence, gestational age at delivery, ANC visit, time of first ANC visit, previous history of low birth weight, iron supplementation, 1st-trimester hemoglobin level, physical trauma during the current pregnancy, frequency of meal/day and maternal MUAC were candidate for multivariable analysis. In multivariate analysis gestational age at delivery, previous history of low birth weight, 1st trimester haemoglobin level, frequency of meal/day and maternal MUAC were factors associated with LBW. The odds of giving LBW were two times higher in mothers who delivered at a gestational of <37 weeks (AOR = 2.18, 95 % CI; 1.11, 4.29). The odds of giving LBW were two times higher among mothers who had a previous history of low birth weight (AOR=2.17, 95 % CI; 1.12, 4.21) as compared to mothers who had no history of LBW babies. Having lower levels of hemoglobin <11g/dl in the first trimester increases the chance of LBW by 93% (AOR = 1.93, 95 % CI; 1.06, 3.50) as compared to mothers whose 1st-trimester hemoglobin was equal or greater than 11g/dl. Mothers who consumed two to three meals a day had a fourfold higher chance of having low birth weight (LBW) infants compared to those who ate four or more meals a day during pregnancy (AOR = 4.70, 95% CI; 1.38, 15.97) and 4.47 times (AOR= 4.47, 95% CI; 1.50, 13.34) respectively. Mothers whose MUAC was <23cm were 4.04 times more likely (AOR = 4.04, 95 % CI; 2.19,7.45) to deliver an LBW baby as compared to mothers whose MUAC was ≥23 cm (Table 5).

Table 5: Determinants of LBW among newborns delivered in Gabiley General Hospital of Gabiley District, western Somaliland, 2022 (n=291)

Variables	Category	Low Birth weight		COR (95% *CI*)	P-value	AOR (95% *CI*)
		Cases No (%)	Controls No (%)			
Gestational age at delivery (weeks)	Preterm (<37)	22 (61.1)	14 (38.9)	3.77(1.83 – 7.76)	<0.001	2.18 (1.11– 4.29)*
	Term (≥37)	75 (29.4)	180 (70.6)	1		1
Previous history of LBW(n=243)	Yes	37 (45.7)	44 (54.3)	1.73 (1.00– 2.99)	<0.001	2.17 (1.12 - 4.21)*
	No	53 (32.7)	109 (67.3)	1		1
1st-trimester HGB level (n=191)	<11 g/dl	33 (63.5)	19 (36.5)	6.31(3.15 - 12.63)	<0.001	1.93 (1.06–3.50)*
	≥11 g/dl	30 (21.6)	109 (78.4)	1		1
Frequency of meal/day	Two times	12 (54.5)	10 (45.5)	3.30 (1.26 - 8.62)	0.01	4.70 (1.38-15.97)*
	Three times	61 (15.1)	118 (84.9)	1.29 (0.81 - 2.45)	0.11	4.47 (1.50-13.34)*
	≥four times	24 (26.7)	66 (73.3)	1		1
Maternal MUAC (cm)	<23	53 (18.2)	55 (18.9)	3.04 (1.83 - 5.06)	<0.001	4.04 (2.19–7.45)*
	≥23	44 (15.1)	139 (47.8)	1		1
Maternal education	No formal education	29 (46.0)	34 (54.0	2.90 (1.23 - 6.87)	0.01	0.97 (0.19 - 4.81)
	Primary education	29 (37.2)	49 (62.8)	2.01 (0.87 - 4.67)	0.05	0.49 (0.15 - 1.58)
	Secondary education	29 (27.4)	77 (72.6)	1.28 (0.56 - 2.92)	0.27	1.13 (0.43 - 2.96)
	College and above	10 (22.7)	34 (77.3	1		1
Husband's Education	No formal education	20 (62.5)	12 (37.5)	3.89 (1.72 - 8.79)	<0.001	0.72 (0.10 - 5.43)
	Primary education	12 (32.4)	25 (67.6)	1.12 (0.51 - 2.47)	0.39	1.17 (0.28 - 4.93)
	Secondary education	29 (28.4)	73 (71.6)	0.93 (0.52 - 1.66)	0.39	1.49 (0.615 - 3.61)
	College and above	36 (30.0)	84 (70.0)	1		1
Residence	Urban	77 (30.0)	180 (70.0)	1		1
	Rural	20 (58.8)	14 (41.2)	0.29 (0.14 - 0.62)	<0.001	1.14 (0.27 - 4.56)
ANC visit	No	27 (62.8)	16 37.2)	4.29 (2.18 - 8.45)	<0.001	2.47 (0.420 - 14.48)
	Yes	70 (28.2)	178 (71.8)	1		1
Time of first ANC visit (n=248)	In the first 3 months	55 (28.8)	136 (71.2)	1		1
	4-6 month	8 (36.4)	14 (63.6)	2.95 (1.02 - 8.58)	0.047	1.16 (0.38 - 3.51)
	7-9 month	7 (20.0)	28 (80.0)	6.75 (2.09 - 8.35)	<0.001	3.81 (0.99 - 14.61)
Iron supplementation	No	26 (65.0)	14 (35.0)	4.71 (2.33- 9.53)	<0.001	0.54 (0.14 - 2.14)
	Yes	71 (28.3)	180 (71.7)	1		1
Physical trauma during the current pregnancy	Yes	24 (57.1)	18 (42.9)	3.21 (1.65- 6.28)	<0.001	0.55 (0.21 - 1.40)
	No	73 (29.3)	176 (70.7)	1		1

ANC; Antenatal care, HGB; Hemoglobin; MUAC; Mid Upper Arm Circumference

Discussion

This study aimed to identify the determinates of LBW in western Somaliland and it found that gestational age at delivery, previous history of low birth weight, 1st-trimester hemoglobin level, frequency of meal per day, and maternal MUAC were significant determinates for low birth weight In this study, gestational age at delivery of <37 weeks was significantly associated with the delivery of LBW. This finding is supported by previous studies conducted in Belgium (Mbasha, 2017), Iran (Shokri *et al*., 2020), Ghana (Adam *et al*., 2019), Sudan (Saeed *et al*., 2014), Tanzania (Mvunta *et al*., 2019) Northwest Ethiopia (Talie *et al.,* 2019) and North West Ethiopia (Adane & Dachew, 2018). This could be because low birth weight is most often caused by being born too early, which means before 37 weeks of pregnancy. The reason is that a premature baby has less time in the mother's womb to grow and gain weight since a baby's growth during the last weeks of pregnancy is significantly high (Casirati *et al*., 2022).

In the current study, a 1st-trimester hemoglobin level of <11g/dl was significantly associated with having an LBW neonate. This result is similar to previous studies conducted in Brazil (Figueiredo *et al*., 2019) Turkey (Dane *et al*., 2013) India (Gnanasekaran *et al*., 2019) Iran (Sekhavat *et al.,* 2011) Ghana (Adam *et al*., 2019), Northeast Ethiopia (Ahmed *et al*., 2018) and West Ethiopia (Girma *et al.,* 2019). Maternal anemia has detrimental effects on the developing fetus, which are caused by impaired oxygen transport to the growing

fetus inside the uterus and interference with normal intrauterine growth (Georgieff, 2020).

In the present study, having a previous history of low birth weight was significantly associated with giving LBW neonates. This finding is in line with studies conducted in the United States of America (Su *et al*., 2018), Iran (Shokri *et al*., 2020), Zambia (Smid *et al*., 2015), Tanzania (Mvunta *et al.,* 2019), Kenya (Muchemi *et al.*, 2015) and Northwest Ethiopia (Talie *et al*., 2019). This can be due to the majority of risk factors for LBW being likely to persist into future pregnancies and inter-generational research suggests that there may be genetic and environmental factors that contribute to improper development of the placenta and thereby to fetal growth restriction and placental insufficiency could continue their influence from one generation to another leading to a low birth weight (Senanayake *et al.,* 2013).

In the current study, mothers who consumed two to three meals a day had a higher chance of having low birth weight (LBW) infants than those who had more than four meals during pregnancy. This study is in line with studies conducted in Japan (Viengsakhone *et al*., 2010), Northwest Ethiopia (Talie *et al.,* 2019), and Northeast Ethiopia (Ahmed *et al*., 2018). The fact is that the demand for macronutrients (proteins, carbohydrates, and lipids) increases during pregnancy, but if mothers don't match the demand by having additional meals it leads to calorie deficiency and protein deficiency which significantly affects the growing baby in the womb, and finally giving a lower birth weight baby (Mousa *et al.,* 2019).

In this study, undernutrition among mothers as measured by maternal MUAC of less than 23 cm significantly increased having LBW neonates. This result is similar to other previous studies conducted in North West Ethiopia (Adane & Dachew, 2018), Northeast Ethiopia (Ahmed *et al.,* 2018), public health West Ethiopia (Girma *et al*., 2019) and Kersa Demographic Surveillance and Health Research Center field site in eastern, Ethiopia (Assefa *et al.,* 2012). The possible explanation is that the consequences of undernourishment of pregnant women not only affect women's health status but also harm the growing baby in the womb and lead to a lower birth-weight baby (Borkar *et al.,* 2022).

Strengths and Limitations of the Study

This study had a few limitations. Mothers' hemoglobin levels were obtained from their first-trimester antenatal records and used to assess anemia as a risk factor for LBW. Since mothers attend ANC clinics at different gestational ages. It would have been more accurate to follow the trends of their hemoglobin levels from the beginning of their antenatal period to delivery in assessing the association of anemia to LBW. However, the study has revealed some important determinant factors that may contribute to the occurrence of low birth weight in the Gabiley district.

Conclusion

This study found that factors like gestational age, 1st-trimester hemoglobin level, previous history of low birth weight, frequency of meals during pregnancy, and maternal MUAC were associated with low birth weight. Therefore, Healthcare providers should prioritize screening and monitoring of hemoglobin levels in the first trimester, recommend iron and folic acid supplements, and offer nutritional counseling and support to pregnant women, with a special focus on those with a history of delivering low birth weight babies. Future research should place importance on tracking hemoglobin trends and weight gain throughout pregnancy to determine the significance of preventing low birth weight babies.

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Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

HM, NA, and AS designed the study, participated in data collection, analysis, interpretation, and write-up, and drafted the manuscript. All authors read and approved the final manuscript.

List of Abbreviations

ANC; Antenatal Care; BMI; Body Mass Index, Hgb; Hemoglobin LBW; Low birth Weight, MUAC; Mid-upper arm circumference, TT; Tetanus Toxin, WHO; World Health Organization.

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