Determinants of low birth weight in public health facilities, of Kambata Tembaro Zone, South Ethiopia

Determinante male telesne težine na rođenju u javnim zdravstvenim ustanovama zone Kembata Tembaro, Južna Etiopija

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ABSTRACT

Objective. The study is aimed to assess the determinants of low birth weight among term neonates born in the health facilities of Kambata Tembaro Zone, Ethiopia.

Methods. An Institution-based case control study was conducted. Term neonates born with birth weight less than 2500.00 g (LBW) were grouped into cases, and those term neonates with weight greater or equal to 2500.00 g were grouped as controls. A total of 282 participants (57 cases and 225 controls) were included with controls to cases ratio of 4:1. Binary logistic regression was done to get candidate variables. An adjusted odd ratio (aOR) was estimated from multivariable analysis with corresponding confidence interval to assess the strength of the association and statistical significance between the independent and the outcome variable.

Results. A total of 282 term neonates (57 cases and 225 controls) comprised the study participants. The mean birth weight of the neonates was 2041.23 g (standard deviation-SD 339.00) for cases and 376.00 g (438.572) for controls. Among mothers of neonates 38 (66.7%) cases' and 146 (64.9%) controls' were age > 24 years old. Household food insecurity (aOR=6.74; 95% confidence interval-CI 2.78-16.36), gender of neonates (aOR=2.74, 1.24-6.05), iron supplementation (aOR=9.71, 3.51-26.88), additional food during pregnancy (aOR=5.49, 2.49-12.11) and anemia (aOR=3.51, 1.56-7.85) were significantly associated with LBW at term.

Conclusion. Neonatal, maternal and dietary factors are mutually associated with low birth weight among term neonates included in our study.

Key words: infant, newborn; low birth weight; risk factors.

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APSTRACT

Cilj. Ova studija ima za cilj da proceni determinante male telesne težine terminske novorođenčadi (MTT) rođenih u ustanovama javnog zdravstva u Kambata Tembaro regiji, Etiopija.

Metode. Institucionalno je sprovedena studija slučaj kontrola. Terminska novorođenčad rođena sa težinom manjom od 2500,00 g grupisana su u „slučajeve“, a oni sa težinom većom ili jednakom 2500,00 g grupisani su kao „kontrolni“. Ukupno 282 učesnika (57 slučajeva i 225 kontrolnih) uključeno je u kontrole i slučajeve u odnosu 4:1. Sprovedena je binarna logistička regresija da bi se dobile značajne varijable. Prilagođeni količnik šanse (aOR) je izračunat na osnovu multivariabilne analize sa odgovarajućim granicama poverenja a radi procene veličine udruženosti i statističke značajnosti između nezavisne i ishodišne varijable.

Rezultati. Ukupno 282 dece (57 slučajeva i 225 kontrolnih) uključeno je u studiju. Srednja težina novorođenčadi bila je 2041.23 g (standardna devijacija-S.D 339.00) za „slučajeve“ i 376.00 g (438.57) za „kontrolne“. Što se tiče majki novorođenčadi 38 (66.7%) u grupi „slučajeva“ i 146 (64.9%) u „kontrolnih“ je bilo starosti >24 godine. Nedostatak hrane u domaćinstvu (aOR=6.74, 95% granice poverenja-CI 2.78-16.36), pol novorođenčadi (aOR=2.74, 1.24-6.05), suplementacija gvožđa (aOR=9.71, 3.51-26.88), dopunska hrana tokom trudnoće (aOR=5.49, 2.49,12.11) i anemija (aOR=3.51, 1.56-7.85) su značajno povezani sa MTT na rođenju u terminu.

Zaključak. Neonatalni, majčinski i nutritivni faktori zajednički su povezani sa malom telesnom težinom terminske odojčadi koja su uključena u našu studiju.

Ključne reči: odojče, novorođenčce; mala telesna težina na rođenju; faktori rizika.

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INTRODUCTION

Low birth weight (LBW) is defined by the World Health Organization (WHO) as weight at birth of less than 2500.00 grams. Infants weighing less than 2500.00 g had approximately 20 times higher risk of fatal outcome than babies with normal body weight. Moreover, low birth weight contributes to numerous poor health outcomes. Mother's own fetal growth and maternal dietary habits affected birth weight of her child.¹ There is a strong consensus that birth weight plays an important role in the health of child from birth to older ages. Low birth weight is very prevalent, particularly in developing countries and represents a significant risk factor for adverse health outcomes including common childhood diseases.¹⁻⁴ The prevalence of low birth weight in Ethiopia is estimated on 14%, which is one of the highest rates among world countries.⁵

The low birth weight represents a disadvantage for the child.⁶ It is a great risk for mortality and morbidity and influences the health outcomes in later, adult life. About a half of all prenatal and one third of all infant fatal outcomes are directly or indirectly associated with LBW; mortality of children with LBW is 40 times higher than the babies with normal weight.⁷ Preterm and small for gestations births accounted for 52% of newborn deaths.⁸ Low birth weight (LBW) represents significant risk for chronic disease in adulthood such as cardiovascular diseases, diabetes mellitus type II and metabolic syndrome^{7,8}. World Health Organization (WHO) shows that factors contributing to LBW in developing countries in order of importance include: malaria and female sex of the fetus, illness, especially infections, social factors such as lower status of women, malnutrition, lack of antenatal care (ANC) etc.⁹

Ethiopia has achieved millennium development goal, three to four years earlier to 2015 deadlines.¹⁰ It was also reported that the current trends of infant mortality has declined to 59% in 2011 from 97% in 2002 but neonatal mortality, which accounts 42% of under-five mortality, declined marginally compared to other child health indicators.¹¹ The national newborn and child survival strategy has targeted to decrease neonatal mortality from 28% to 11% by 2020.¹² Thus, to address the challenges associated with neonatal mortality reduction, the contribution of adverse birth outcomes such as LBW and preterm births to neonatal morbidity and mortality should not be ignored.

However, the trends of LBW were declining in Ethiopia from 14.6% in 2005 to 11 % in 2011.¹³ If this trend continues in this way Ethiopia will not achieve the global nutrition target of LBW reduction by 30% in 2025. A 30 % (3.9 % annual) reduction of LBW is one of the global targets for 2025 endorsed by World Health Assembly in 2012.¹⁴ This

shows that attention is paid to birth weight improvement as a means of reducing child mortality. In most countries like Ethiopia, it was estimated that an infant dies from a disease related to LBW every ten seconds.¹⁵ Thus, this study was conducted to identify the determining factors of low birth weight on term neonates in public health facilities, Kambata Tembaro Zone, South Ethiopia. The finding of this study will be used for further researchers and policy makers to know the determinants of low birth weight and to intervene on specific problem.

SUBJECTS AND METHODS

Study area, design, and period

Kembata Tembaro Zone has seven administrative Districts and one Town Administration with a total of 118 rural and 16 urban kebeles. It is located 352 km from Addis Ababa and 125 km from the regional capital. Based on the 2007 census conducted by the Central Statistical Agency of Ethiopia (CSA), Kembata Tembaro Zone has a total population of 683,167 people, of which 337,852 are men and 345,315 are women; within an area of 1523.60 square kilometers. Kembata Tembaro has a population density of 502.13 people/km². There are two hospitals and 29 health centers owned by the government in the zone in 2016. A facility based unmatched case-control study was conducted from February 1st, 2016 to April 30th, 2016. Ethical approval was obtained from Ethical Review Committee of Jimma University, College of Health Science.

Source and study population

The study populations were all newborns who were delivered in the health facility during the study period. Exclusion criterion was a neonate, which mother was mentally and physically not capable of being interviewed. Cases were all term neonates born with birth weight < 2500 g at the health facilities in Kambata Tembaro Zone during the study period and controls were all term neonates born with birth weight ≥ 2500 g at the health facilities in Kambata Tembaro Zone during the study period.

Sample size determination

The sample size was computed using StatCalc application of Epi Info version 2.3. statistical software with the following assumptions: proportion of preeclampsia among mothers of controls exposed 9.1%, 80 % power of the study, control to case ratio of 4:1 to detect an odds ratio of 3.32 with a 5 % of alpha error level.¹⁶ The sample size required for the study was 282 (57 cases and 225 control neonates).

Sampling technique

There are 31 public health facilities which provide antenatal care and delivery service (ANC) in Kambata Tembaro Zone. All health facilities were included to get maximum number of cases in specified period. Then, cases were selected consecutively and four controls were assigned for each case. In case, where there were more than four controls for one case at the same time of case ascertainment; four of them were selected consecutively. This procedure continued until the desired sample size was obtained (Figure 1).

related factors (number of iron with folic acid received, time of the first supplementation, time of last supplementation, health education, dietary counseling, and number of ANC followed) and nutritional factors (food security, additional food) were considered the independent variables.

Data quality control

The questionnaire was prepared in English and then translated from English to Amharic and re-translated back to English. The interviewers were recruited from the study

Figure 1. Recruitment summaries of study populations.

Data collection instruments and procedure

Structured questionnaires, clients' chart and standard beam balance were used. The neonates' weights were measured by using standard beam balance in the delivery room immediately after birth (preferably within one hour) by trained data collectors. Clients' charts were reviewed by using data extraction format to retrieve medical information and mother's test results that could not be captured by the interview. Afterwards, face to face interview was used to collect data on socioeconomic, behavioral, obstetric, food security and health service related factors. The nine standard household food insecurity measurement tools were used to assess the household food security status of the mother.¹⁷

Variables of the study

Low birth weight was considered as dependent variable in this study. Socio-demographic variables (mother's age, marital status, educational level, occupation, religion and place of residence), pregnancy and health related factors (parity, history of still birth, history of abortion, number of ANC visit, maternal morbidity, and anemia), ANC-

area of health workers who speak local language (Kambata-issa), and have previous experience of data collection. Sixty six midwives and nurses were recruited as data collectors. The eight health officers as supervisor were participated in the data collection. The data collectors and supervisors were trained for two days and standardized particularly in the proper filling of questionnaire. Data quality was controlled through conducting a pre-test on 5 % of the samples in Hossana Hospital before the actual survey and important modifications were made on the basis of the findings. The data collection was supervised by the principal investigator. Every questionnaire was supervised and reviewed for completeness and logical consistency. The completeness of the questionnaire was also checked before data entry.

Data processing and analysis

The data was entered into Epi Info version 3.1 and then (after data validation) exported to SPSS windows version 20 for analysis. Descriptive analysis was carried out and chi-square test statistics were done to check assumption. Binary logistic regression analysis was carried out to examine the relationship between low birth weight status and explana-

tory variables. Only variables that had $p < 0.25$ in the univariable analysis were candidate variable for multivariable logistic regression model to control for the confounding; the model fitness were checked using Hosmer-Lemeshow test. The degree of association between independent and dependent variables were assessed using odds ratio with 95% confidence interval and $p < 0.05$ were considered as statistically significant.

Operational definitions

Household food security is a condition when there is rarely or no anxiety and uncertainty about the food supply, insufficient food quality and intake and its physical consequences. Mild food insecurity - worries about not having enough food occur sometimes or often, and/or is unable to eat preferred foods, and/or eats a more monotonous diet than desired and/or some foods are considered undesirable, but only rarely. Moderate food insecurity - household sacrifices quality more frequently, by having a monotonous diet or undesirable foods sometimes or often, and/or has started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes. Severe food insecurity - households has graduated to cutting back on meal size or number of meals often, and/or experiences any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating),

even as infrequently as rarely. Household food insecurity - having anxiety and uncertainty about the household's food supply or worried sometimes or often or households experience problems of insufficient quality of food or insufficient food intake or its physical consequences.¹⁷ Additional food - having at least one additional meal than regular due to pregnancy.

RESULTS

A total of 282 term neonates (57 cases and 225 controls) were included in the study. The mean birth weight of the neonates was 2041.23 g (standard deviation-SD 339.00) for cases and 376.00 g (438.57) for controls. Among mothers of neonates, 38 (66.7%) cases' and 146 (64.9%) controls' were age > 24 years old. The majority, 52 (91.2%) of cases' and 184 (81.8%) controls' mothers of were protestant religion followers and 40 (70.2%) cases' and 164 (72.9 %) controls' were living in rural areas. Majority 44 (77.2%) of mothers of cases' and 180 (80%) controls' were housewives while 16 (28.1%) of mothers of cases' and 39 (17.3%) of controls' had not attended formal education. Univariable analysis of socio demographic factors showed that only educational status of the mother was significantly associated with term low birth weight (Table 1).

Table 1. Maternal socio-demographic characteristics of cases and controls.

Variable	Category	Number (percent)	Birth weight		OR (95% CI)	p
			Cases	Controls		
Age of mothers	15-24 years	98 (34.8)	19 (33.3%)	79 (35.1%)	0.92 (0.50-1.71)	0.80
	> 24 years	184 (65.2)	38 (66.7%)	146 (64.9%)	1	
Residence	rural	204 (72.3)	40 (70.2%)	164 (72.9%)	1	0.68
	urban	78 (27.7)	17 (29.8%)	61 (27.1%)	1.14 (0.6-1.1)	
Educational status	no formal education	55 (19.4)	16 (28.1%)	39 (17.3%)	1.86 (0.95-3.6)	0.07
	formal education	227 (80.5)	41 (71.9%)	186 (82.7%)	1	
Occupational status	housewife	224 (79.4)	44 (77.2%)	180 (80%)	1.18 (0.59-2.38)	0.64
	no house wife	58 (20.6)	13 (22.8%)	45 (20%)	1	

OR-odds ratio, CI-confidence interval, p-probability

Obstetric characteristics

Among mothers of neonates 19 (48.7%) cases' and 55 (40.7%) of controls' had parity ≥ 4 births. Among mothers of neonates who had history of previous pregnancy, 10 (17.5%) cases' and 16 (7.2%) controls' had history of still birth, 6 (10.5%) cases' and 14 (6.2%) controls' mothers reported history of abortion. The 30 (52.6%) cases' and 94 (41.8%) controls' mothers gave the current birth before the birth interval of 3 years. Among mothers of neonates 14 (26.4%) cases' and 25 (11.1%) controls' were unplanned pregnancy, from mothers of neonates 35 (62.5%) cases' and 103 (46.4%) controls' attended less than four antenatal cares

during their pregnancy. However, 9 (16.1%) cases' and only 22 (9.8%) controls' started their ANC visiting during the first trimester. From mothers of neonate 38 (66.7%) cases' and 204 (90.7%) controls reported that they were given iron during their ANC follow up. In terms of dietary advice from the mother of neonates 44 (77.2%) of cases' and 203 (90.2%) of controls' responded that they had got dietary advice during ANC visiting. On univariable analysis of obstetric profile of mothers only previous still birth history of the mother, type of pregnancy, number of ANC follow up, time of the first ANC visit, nutritional counseling and iron with folic acid supplementation were significantly associated with term low birth weight (Table 2).

Table 2. Obstetric profiles of mothers among cases and controls

Variable	Category	Number (percent)	Birth weight		OR (95% CI)	p
			Cases	Controls		
Parity	< 4 births	102 (58)	20 (51.3%)	82 (59.9%)	1	0.34
	≥4 births	74 (42)	19 (48.7%)	55 (40.1%)	1.42 (0.69-2.89)	
Previous still birth	yes	26 (9.3)	10 (17.5%)	16 (7.2%)	2.75 (1.1-7.45)*	0.02
	no	254 (90.7)	47 (82.5%)	207 (92.8%)	1	
History of abortion	yes	20 (7.1)	6 (10.5%)	14 (6.2%)	1.77 (0.65-4.84)	0.26
	no	262 (92.9)	5 (89.5%)	211 (93.8%)	1	
Birth spacing in a year	≥3years	55 (30.7)	10 (25%)	45 (32.4%)	0.69 (0.31-1.56)	0.37
	<3years	124 (69.3)	30 (75%)	94 (67.6%)	1	
Pregnancy type	planned	242 (85.5)	43 (75.4%)	200 (88.9%)	1	0.01
	unplanned	40 (14.2)	14 (24.6%)	25 (11.1%)	2.6 (1.25-5.42)*	
Number of ANC	<4	138 (49.6)	35 (62.5%)	103 (46.4%)	1.9 (1.05-3.51)*	0.03
	≥4	140 (50.4)	21 (37.5%)	119 (53.6%)	1	
Time of first ANC	1st trimester	31 (11.2)	9 (16.1%)	22 (9.9%)	1	0.12
	2nd trimester	193 (69.4)	33 (58.9%)	160 (72.1%)	0.50 (0.2-1.2)	
	3rd trimester	54 (19.4)	14 (25%)	40 (18%)	0.85 (0.32-2.3)	
Nutritional counseling	yes	247 (87.6)	44 (77.2%)	203 (90.2%)	1	0.010
	no	35 (12.4)	13 (22.8%)	22 (9.8%)	2.73 (1.27-5.82)*	
Iron plus folate	yes	242 (85.8)	38 (66.7%)	204 (90.7%)	1	<0.001
	no	40 (14.2)	19 (33.3%)	21 (9.3%)	4.86 (2.39-9.89)*	

OR-odds ratio, CI-confidence interval, p-probability, *statistically significant level

Co-morbidities during pregnancy

In our study 8 (14%) cases' and 12 (5.3%) controls' mothers had reported history of hypertension during the current pregnancy. A half of 29 (50.9%) cases' and 38 (16.9%) controls' mothers had history of anemia during the pregnancy and 6 (10.5%) of cases' and 24 (10.7%) of controls' mothers had history of an urinary tract infection and 6 (10.5%)

of mothers with low birth weight babies and 17 (7.6%) of mothers with normal birth babies reported a malaria attack during the current pregnancy. Among co morbidity factors only hypertension (HTN) and anemia were significantly associated with term low birth weight in univariable analysis (Table 3).

Table 3. Co-morbidities during pregnancy among cases and controls.

Variable	Category	Number (percent)	Birth weight status		OR (95% CI)	p
			Cases	Controls		
HTN	yes	20 (7.1)	8 (14%)	12 (5.3%)	2.89 (1.12-7.47)	0.28
	no	262 (92.9)	49 (86%)	213 (94.7%)	1	
Anemia	yes	67 (23.8)	29 (50.9%)	38 (16.9%)	5.09 (2.7-9.5)*	<0.01
	no	215 (76.2)	28 (49.1%)	187 (83.1%)	1	
UTI	yes	30 (10.6)	6 (10.5%)	24 (10.7%)	0.98 (0.38-2.5)	0.97
	no	252 (89.4)	51 (89.5%)	201 (89.3%)	1	
Malaria	yes	23 (8.2)	6 (10.5%)	17 (7.6%)	1.43 (0.54-3.8)	0.46
	no	259 (91.8)	51 (89.5%)	208 (92.4%)	1	

HTN-hypertension, UTI-urinary tract infection, OR-odds ratio, CI-confidence interval, p-probability, *statistically significant level

Nutrition-related factors and neonatal genetic characteristics

In our study, 48 (84.2%) cases' and 86 (38.2%) controls' mothers reported some form of household food insecurity in the last four weeks preceding the study. The 14 (24.6%) cases' and 164 (72.9%) controls' have taken additional food

during pregnancy. On univariable analysis of nutrition related factors, both house hold food insecurity and additional food during pregnancy were significantly associated with term low birth weight (Table 4). Among neonates 38 (66.7%) of cases and 104 (46.2%) of controls were females. On univariable analysis the sex of a neonate was significantly associated with term low birth weight (Table 4).

Table 4. Nutrition-related factors among women and neonatal genetic characteristics with cases and controls.

Variable	Category	Number (percent)	Birth weight status		OR (95% CI)	p
			Cases	Controls		
Food insecurity	yes	134 (47.5)	48 (84.2%)	86 (38.2%)	8.6 (4.02-18.45)*	<0.001
	no	148 (52.5)	9 (15.8%)	139 (61.8%)	1	
Additional food	yes	178 (63.1)	14 (24.6%)	164 (72.9%)	1	<0.001
	no	104 (36.9)	43 (75.4%)	61 (27.1%)	18.26 (4.22-16.15)*	
Neonatal gender	male	137 (49.6)	19 (33.3%)	121 (53.8%)	1	0.007
	female	139 (50.4)	38 (66.7%)	104 (46.2%)	2.32 (1.26,4.28)*	

OR-odds ratio, CI-confidence interval, p-probability, *statistically significant level

After entering each explanatory variables into univariable analysis, educational status of the mother, still birth history of the mother, sex of neonates, household food insecurity, numbers of ANC visits, time of first ANC visit, additional food, HTN, anemia and iron folate supplementation during pregnancy become statically significant for term low birth weight at $p < 0.25$.

Basic characteristics of the study participants associated with low birth weight

After entering all candidate variables into multivariable analysis, only household food insecurity, sex of neonates, iron supplementation and additional food during pregnancy were significantly associated with LBW at term. When

comparing food secured households with food insecure households, neonates from food insecure households had more than six times higher risk of LBW at term than neonates from food secured households. Also those neonates whose mothers didn't have additional food were more than 5 times more likely at risk for term LBW than those neonates' mothers who had additional food during the pregnancy. Regarding iron folate supplementation during pregnancy, neonates' mothers who didn't receive iron folate were more than eight times at higher risk for term LBW than neonates' mothers who had received iron folate. The mothers who have anemia were more than three times more likely to give low birth weight than non-anemic mothers and the gender of new born being female is two times more likely to cause LBW than being male (Table 5).

Table 5. Both univariable and multivariable results of factors associated with birth weight status

Variable	Category	Birth weight		OR (95% CI)	aOR (95% CI)
		Low	Normal		
School attended	yes	41 (71.9%)	186 (82.7%)	1	1.47 (0.55,3.92)
	no	16 (28.1%)	39 (17.3%)	1.86 (0.95-3.65)	1
Previous still births	yes	10 (17.5%)	16 (7.2%)	2.75 (1.17-6.45)	1.44 (0.44-4.85)
	no	47 (82.5%)	207 (92.8%)	1	1
Type of pregnancy	planned	43 (75.4%)	200 (88.9%)	1	1
	unplanned	14 (24.6%)	25 (11.1%)	2.6 (1.25-5.42)	1.45 (0.55-3.85)
Number of ANC	<4	35 (62.5%)	103 (46.4%)	1.93 (1.05-3.51)*	1.26 (0.56-2.87)
	≥4	21 (37.5%)	119 (53.6%)	1	1
Nutritional counseling	yes	44 (77.2%)	203 (90.2%)	1	1
	no	13 (22.8%)	22 (9.8%)	2.73 (1.28-5.82)	1.10 (0.38-3.15)
Iron folate received	yes	38 (66.7%)	204 (90.7%)	1	1
	no	19 (33.3%)	21 (9.3%)	4.86(2.39-9.89)*	9.71 (3.51-26.88)*
HTN	yes	8 (14%)	12 (5.3%)	2.89(1.12-7.47)	1.76 (0.53-5.77)
	no	49 (86%)	213 (94.7%)	1	1
Anemia	yes	29 (50.9%)	38 (16.9%)	5.09 (2.70-9.50)*	3.51 (1.56-7.85)*
	No	28 (49.1%)	187 (83.1%)	1	1
Food insecurity	yes	48 (84.2%)	86 (38.2%)	8.62 (4.02-18.45)*	6.74 (2.78-16.36)*
	no	9 (15.8%)	139 (61.8%)	1	1
Additional food	yes	14(24.6%)	164 (72.9%)	1	1
	no	43 (75.4%)	61 (27.1%)	8.26 (4.22-16.15)*	5.49 (2.49-12.11)*
Infant gender	male	19 (33.3%)	121 (53.8%)	1	1
	female	38 (66.7%)	104 (46.2%)	2.32 (1.26-4.28)*	2.74 (1.24-6.05)*

aOR-adjusted odds ratio, *statistically significant

DISCUSSION

This study is mainly aimed to assess the determinants of a low birth weight at term. Based on the main objective of this study, an iron intake, additional diet during pregnancy, food insecurity, anemia and gender of neonates were found significantly associated with low birth weight at term.

The significant association between houses holds food insecurity of the mother and term low birthweight has been found, both by univariable and multivariable analysis. The odd of term LBW was 6.74 times higher among mothers from food insecure households as compared to secured households. This finding is in line with a case control study finding in Tehran.¹⁸ Possible explanation for the significant association between food insecurity and low birth weight may be the fact that food insecurity reduces the quality and quantity of food available to mothers, reducing weight gain and impair the nutritional status of the mother which subsequently reduces weight at birth. Food insecure mothers may often restrict their food and scarify their own nutrition in order to protect their children from hunger which in turn impairs the nutritional status of the mother and consequently reduces weight at birth. Other possible explanation is that women from food in secured households may be at risk of depression and stress which are potential determinants of term LBW as documented in some studies.¹⁹

The more distal factors such as urban - rural difference, maternal occupational and educational status; religion and marital status of the mothers, were not found statistically associated with term low birth weight. The finding of this study is also in line with different studies conducted in Ethiopia.²⁰⁻²² In contrary to this, a study finding in rural hospital from Gambia showed the pattern of low birth weight varies with geographical difference and term low birth weight was significantly associated with rural residence.²³ This difference may be due to the sample size, geographical location or applied study methods.

Many factors contributed to anemia of the mother during pregnancy which necessitated taking of iron supplements and intake of such preparation associated with the decreased risk of LBW. Our finding is consistent with the results of some other studies on iron supplementation and pregnancy outcome. A double blinded randomized community trial in Nepal revealed that iron folic acid supplementation increases mean birth weight by 39 g and reduces the percentage of low birth weight babies by 16%. However, no significant association was reported among preterm babies.²³ A large population based study in India also revealed that iron folic acid supplementation was significantly associated with 23% reduction in the odds of LBW.²⁴ Similar,

supporting result comes from the study conducted in Nepal.²⁵ In most public clinics iron is provided in combination with folic acid. Studies found that iron, but not folic acid supplementation, reduces the risk of low birth weight among pregnant women.²⁶⁻²⁸

In our study medical factors (hypertension, malaria and urinary tract infections) were not significantly associated with term LBW. This is not in line with other similar studies in which maternal exposure to hypertension, urinary tract infection and malaria attack during pregnancy were reported as risk factor for low birth.²⁹⁻³¹ This difference may be due to a fewer number of cases and controls exposed in our research. Our study sample may be insufficient to detect the existing difference between cases and controls which in turn results in insignificant association between medical factors with term LBW

On the other side, the mothers with anemia during pregnancy were more than three times more likely to give LBW than non-anemic mothers. Anemia is caused by a decrease of hemoglobin level, which may lower the amount of blood production in mother's body and in that way limit the amount of the nutrients received by neonates. The reduction of nutrients may cause impairs birth weight. This finding is in line with other study which showed that iron deficiency anemia during pregnancy is an important cause of restricted fetal growth leading to low birth weight.³²

Obstetric factors such as birth interval and parity were not significantly associated with LBW in our research, which is, to a certain degree, different from other study conducted in Tanzania.³³ As 38.3% respondents had their first birth, we think that information related to the birth interval and previous history of low birth weight was inaccurate.

Our study also found that mothers of neonates who were not taking additional diet during the pregnancy were at a risk of low birth weight. Optimal nutrition and weight management before and during pregnancy are necessary for healthy child not only at birth but also later in life. Studies conducted in Northern Ghana and other areas in Ethiopia also supported our findings, but some other researchers did not.^{21,32,33} This discrepancy might be due to differences in the study population, the time gap between the study periods, geographical location, in the study and other methodological issues.

This study shows us that LBW is associated with genetic factors such as the sex of a new born. In this study the sex of a newborn being female is more than two times more likely to cause LBW than being male. This may be due to the genetic characteristics of nutritional intake of female which

differs from males and is similar with the results of the studies conducted in Axum Laelay Maichew Districts, North Ethiopia and Jimma Hospital.^{14,32}

The strength of this case-control study design was its capability of evaluating the determinant factors of low birth weight to other exposure variables. The limitation of the study was the following: risk for recall bias, social desirability bias and interviewer bias because of reliance data reported by participants, inability to establish causality (due to case control design) and the absence of data about anthropometric and mental status of the mother which could influence study outcome.

In conclusion, our study suggested that low birth weight at term could be likely improved with iron intake during pregnancy and proper dietary advices as well as appropriate measures to secure household food. Additional research such as large scale (community based with large sample size), strong designed study (prospective cohort or experimental study) including nutritional status and depression status of the mother needs to be conducted.

ABBREVIATIONS

ANC: antenatal care; aOR: adjusted odds ratio; UTI: urinary tract infection; CI: confidence interval; OR: odds ratio; EDHS: Ethiopian Demographic and Health Survey; EMDHS: Ethiopian Mini Demographic and Health Survey.

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