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Risk Factors for Low Birth Weight among Neonates Delivered in Public Health Facilities in Adama Town, Oromia Regional State, Ethiopia

Nigusse Obse Nebi[1*], Tolossa Eticha Chaka[2], Tilaye Workineh Abebe[3], Ephrem Mannekulih M[3]

Abstract

Background: Low birth weight is the major predictor of prenatal mortality and morbidity worldwide. It has been defined by the World Health Organization as weight at birth of less than 2,500 grams irrespective of their gestational age. Rate of low birth weight is still high in developing countries like Ethiopia particularly Oromia regional state where adequate primary health care services for maternal and child health are not universally available to all the populations. It is therefore imperative to identify risk factors for low birth weight in various communities in order to come up with feasible intervention strategies to minimize the problem.

Methods: Facility based case-control study design was conducted from June-1/2017 to April-30/2018 on 318 mothers with singleton and full term neonates (108 case to 210 control). Semi structured interviewer administered and pretested questionnaire was used by trained data collectors working in delivery ward. The data were entered and analyzed by using statistical software. Descriptive and bivariate analysis was done.

Result: The mean maternal age of all study participants was 26.7 years with [SD of 4.8] with mean age for mothers of cases was 25.5 years and for controls was 27.4 years. In bivariate analysis residency being rural (AOR= 1.95 with 95% CI (1.0-3.48), parity ≥2 (AOR= 3.45 (1.89-6.32), number of antenatal care attendance <4 visits (AOR= 0.40(0.218-0.73)), birth interval <24 moths (AOR= 2.68 (1.45-4.94), history of hypertension (AOR= 0.39(0.18-0.87) and maternal MUAC <21cm (AOR=0.38 (0.159-0.91) were found to be statistically significant.

Conclusions: Variables that were found to have a statically significant relationship with low birth weight were residency being rural, occupation, parity ≥2 & birth interval ≤24months, number of antenatal care attendance <4 visits, history of hypertension and maternal MUAC <21cm were found to be statistically significant.

Keywords: Low birth weight; Maternal risk factor

Abbreviations: ANC: Antenatal care; BMI: Body Mass Index; EDHS: Ethiopian Demographic and Health Survey; HTN: Hypertension; IUGR: Intra Uterine Growth Retardation; LBW: Low Birth Weight; MUAC: Mid Upper Arm Circumference; UNICEF; United Nations Children Fund

Background

Low birth weight (LBW) has been defined by the World Health Organization(WHO) as weight at birth of less than 2,500 grams irrespective of their age [1]. A baby's low weight at birth is either the result of preterm

Affiliation:

[1]Department of Biomedical sciences, Adama Hospital Medical College, Ethiopia

[2]Department of pediatric, Adama Hospital Medical College, Ethiopia

[3]Department of public Health, Adama Hospital Medical College, Ethiopia

***Corresponding author:**

Nigusse Obse Nebi, Department of Biomedical sciences, Adama Hospital Medical College, Ethiopia.

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birth or due to restricted fetal growth [2]. Pregnancy is a critical period of physiological change for both the mother and the fetus. Fetal growth is largely dictated by the availability of nutrients in maternal circulation and the ability of these nutrients to be transported into fetal circulation via the placenta [3]. These factors may relate to the infant, the mother, or the physical environment and play an important role in determining the birth weight and the future health of the infant [4,5]. The majority of LBW in developing countries is due to intra uterine growth retardation (IUGR) [6]. Causes of IUGR are most of the time focus on the foetus, the placenta and the mother or combinations of all three. Factors that prevent normal circulation across the placenta cause poor nutrient and oxygen supply to the foetus, restricting growth [7]. These factors may include maternal under nutrition, anaemia, and acute or chronic infections (such as malaria, sexually transmitted diseases and urinary tract infections) [8]. Obstetric history of the mother like primiparity and multiple gestation and foetal genetic or chromosomal anomalies also associated with IUGR [9]. Mother's habit like Cigarette smoking, alcohol and drug use may also restrict foetal growth [10-12]. In developed countries the epidemiology of low birthweight has been extensively studied, in less developed countries reliable data on low birthweight remain limited because of high proportion home delivery. But some studies showed that the levels of low birth weight in developing countries remain unacceptably high. According to the report of a joint study from United Nations International Children's Emergency Fund (UNICEF) and the WHO, which investigated global, regional and country-specific LBW; the level of low birth weight in developing countries is (16.5 %) more than double the level in developed regions (7%). Low birthweight levels in Africa is estimated 14 and in sub-Saharan Africa are around 13 per cent to 15 per cent, with little variation across the region as a whole [13]. In Ethiopia, the incidence of low birth weight babies has increased from 8 percent in 2000 to 14 percent in 2005 [14]. Based on the 2011 Ethiopian demography and health survey, after 5 years the prevalence decreased by 3 % and in 2011 the proportion of low birth weight in Oromia region was 28 % [15]. Identifying maternal factors that are modifiable among this group of women is an important contribution to the of child health.

Methods

Study setting & design

A facility-based case-control study design was conducted from June-1/2017 to April-30/2018 to assess risk factors of low birth weight among Neonates born in selected public health facilities in Adama town. The study population were pregnant women who gave birth in sampled public health facilities in Adama town.

Cases

- All full term newborns with weight less than 2500 grams in one of the selected public health facilities of Adama town.

Controls

- Two full term normal weight babies born next to newborns of LBW

Sample size was determined by using statistical software (Epi-Info7) after considering Parity, maternal age of ≤ 20, previous history of LBW and maternal education from previous studies [16]. Accordingly, 103 cases and 206 controls a total sample size of 309 were included. After adding 10% non-response rate the final sample size was 114 cases and 227 a total 341 will participate in the study.

Data Collection

Data were collected through face-to-face interview and medical record reviews of newborns; after informed verbal consent was take from each mother. Weight of the newborns was taken by the assigned midwife as data collector in the delivery room of the health facilities within the first one hour following delivery. Pre-pregnancy weight of the mother was taken from the antenatal follow up record and height of the mother was measured by using height meter fixed to weight measuring scale. The Measurement of Upper Arm Circumference (MUAC) of the mother was taken from the mother's left arm while the mother is sitting or standing position by MUAC measuring tapes.

Data Analysis

Data were coded and double entered into computer using Epi-Info Version 7 and was exported to SPSS version 21 statistical software for analysis. Descriptive analysis was used to explore the characteristics of women participated in the study. Before analysis the fulfillments of assumption for logistic regression was checked. Bivariate binary logistic regression analysis was applied to assess the crude relationship between independent variables and outcome variable (LBW). At this level the candidate variables for multivariate analysis was selected at P-value < 0.25 significance level. Multivariate binary logistic regression was applied to estimate the adjusted effects of independent variables on outcome variable (LBW) by using backward stepwise method. Odds ratio (OR) was used to estimate the magnitude of association between independent and outcome variable and 95% CI was used to assess the statistical significance of association between independent variables and LBW.

Result

Socio-demographic characteristics

About 318 babies (108 were low birth weight babies and

210 were babies with a normal weight) were included in the study with 93% response rate. The mean maternal age of all study participants was 26.7 years with standard [SD of ±4.8 years]. Among cases 96 (88.9 %) and among controls 185 (88.1%) of mothers were in the age group of 19-34 years. The ratio of sex among the cases the male to female ratio was 1.25:1 and among controls the male to female ratio were 1.6:1. (Table 1).

Table 1: Socio demographic characteristics of mothers of the study participants in Adama town Public Health Facilities, Oromia Regional state, Ethiopia, 2017.

Maternal characteristics	Cases	Controls
	Number (%)	Number (%)
Age of the mother		
≤18	2 (4.6)	2 (1)
19-34	96 (88.9)	185 (88.1)
>=35	6 (5.6)	23 (11)
Sex of neonates		
Male	60 (55.6)	129 (61.4)
Female	48 (44.4)	81(38.6)
Residency		
Urban	79 (73.1)	177 (84.3)
Rural	29 (26.9)	32 (15.2)
Educational level of mother		
No formal education	28 (25.9)	37 (17.6)
Grade 1-6	24 (22.2)	50 (23.8)
Grade 7-12	32 (29.2)	92 (43.8)
High school complete and above	24 (22.2)	27 (12.9)
Religion of mother		
Orthodox	55 (50.9)	106 (50.5)
Muslim	32 (29.6)	74 (35.2)
Catholic	3 (2.8)	7 (3.3)
Protestant	16 (14.8)	20 (9.5)
Occupation		
Income own	66 (61.1)	168 (80)
No income own	42 (38.9)	42 (20)
Marital status		
Married and living together	102(94.4)	205(97.6)
Married but not living together	6(5.6)	5(2.4)
Monthly family income		
Low	44 (40.7)	60 (28.6)
Middle	20 (18.5)	63 (30)
High	38 (35.2)	56 (26.7)

Factors Associated with Low Birth Weight among Neonates Born in Public Health facilities in Adama Town

Bivariate analysis was done by enter method for socio-demographic factors, reproductive history, maternal life style and anthropometric measurements of the mother with dependent variable. Variables which were significant in bivariate analysis were put in to multiple logistic regression by backward stepwise method and the final factor significantly influencing occurrence of LBW were residency, occupation, parity, birth interval, ANC visit history of Hypertension, maternal MUAC and weight gain during pregnancy remain to be statistically significantly associated with the low birth weight of neonates (Table 2).

Mother with residency being rural were almost twice risk of having low bith weight than urban (AOR=1.95 with 95% CI [1.0-3.48]). Occupation of the mother was assessed by categorizing in to income owned and not income owned in cash; mothers with no income owned had 2.5 times more higher risk of having LBW neonate than comparable groups AOR=2.47 with CI (1.47-4.16). Regarding obstetric history of the mothers, those who have two or more live births were three time higher risk of having low birth weight neonate than primi parus (AOR=3.45 with CI [1.89-6.32]). Compared to mothers with birth interval of >24 months, mothers with birth interval < 24 month had three times higher more likely to have LBW. On the other hand previous history of abortion, gestational age of first antenatal care (ANC) & history of anemia during pregnancy were not found to have association with LBW delivery in this study (Table 3).

In this study maternal lifestyle or habits like coffee intake, alcohol intake & khat chewing didn't show significant association with the dependent variable. Logistic regression analysis of maternal anthropometric measurement like MUAC and weight gain during pregnancy showed significant association with occurrence LBW. Depending on UNICEF cut off point for detecting malnutrition in adults; maternal MUAC was classified in to two categories. Mothers who had MUAC ≤ 21cm have 30% more likely to have LBW than their comparable groups (AOR=0.3 with 95% CI (0.159-0.91)) (Table-4).

Discussion

In the present study the relationships between LBW, residency, occupation, parity & birth interval, number of antenatal care attendance, history of hypertension and maternal anthropometry were found to be statistically significant. In this study, residency being rural has twice higher risk of giving LBW than mothers in urban dwellers. This finding is consistent with other studies in the country [17, 18]. The association of parity of women with low-birth-

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Table 2 : Logistic Regression Analysis of Factors Affecting Low Birth Weight Neonates in Adama Town Public Health Facilities, East Shoa Zone, Oromia Regional State 2017.

Maternal characteristics	Cases	Controls	COR	AOR
	Number (%)	Number (%)		
Sex of neonates				
Male	60 (56)	129 (61.5)	1.274(0.796-2.03)	
Female	48 (44)	81 (38.9)	1	
Age of the mother				
≤18	5 (4.7)	2 (1)	0.208(0.040-1.09)	2.49(0.40-15.5)
19-34	96(89.7)	185(88.)	1	1
>=35	6 (5.6)	23 (11)	1.98(0.784-5.05)	3.63(0.47-7.79)
Residency				
Urban	79 (73.1)	177 (84.3)	1	1
Rural	29 (26.9)	32(15.2)	2.0(1.15-3.58)	1.95(1.0-3.48)
Educational level of mother				
No formal education	28 (25.9)	37 (17.6)	0.479 (0.627-2.70)	1.97(0.627-3.70)
Grade 1-6	24 (22.2)	50 (23.8)	0.312 (0.355 -1.39)	1.06(0.59-1.89)
Grade 7-12	32 (29.2)	92 (43.8)	0.035 (0.272-0.95)	1.39 (0.79-2.4)
High school complete and above	24 (22.2)	27(12.9)	1	1
Religion of mother				
Orthodox	55 (50.9)	106 (50.5)	1.10(0.309-3.92)	
Muslim	32 (29.6)	74(35.2)	1.321 (0.36-4.83)	
Catholic	16 (14.8)	20 (9.5)	.714 (0.17-2.87)	
Others	4 (2.9)	7 (3.3)	1	
Occupation				
Income own	66 (61.1)	168 (80)	1	1
No income own	42 (38.9)	42 (20)	2.54(1.52-4.25)	2.47(1.47-4.16)
Marital status				
Married and living together	102(94.4)	205(97.6)	1	
Married but not living together	6(5.6)	5(2.4)	0.41(0.124-1.39)	
Monthly family income				
Low	44(40.7)	60(28.6)	0.92(0.525-1.63)	
Middle	20(18.5)	63 (30)	2.13(1.116-4.09)	
High	38(35.2)	56(26.7)	1	

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Table 3: Association of maternal characteristics with LBW in Adama Town Public Health Facilities, Oromia Regional state, Ethiopia, 2017.

Maternal characteristics	Cases	Controls	COR	AOR
	Number (%)	Number (%)		
Parity of the mothers				
1	71 (65.7%)	79 (37.6%)	1	1
>=2	33 (30.6%)	125 (59.5%)	3.40(2.065-5.612)	3.45(1.89-6.32)
History of abortion				
No	84 (77.8%)	239 (79.1%)	1	
Yes	20 (18.5%)	63 (20.9%)	0.578(0.151-2.218)	
Birth interval				
<24months	51 (47.2%)	48 (22.9%)	3.09(1.831-5.244)	2.68(1.45-4.94)
≥24months	56 (51.9%)	162 (77.1%)	1	1
Mode of delivery of current neonate				
Vaginal delivery	93 (86.1%)	185 (88.1%)	0.91 (0.441-1.89)	
Caesarean section	15 (13.9%)	24 (11.4%)	1	
Gestational age of 1st ANC attendance				
<3months	10 (9.3%)	12 (5.7%)	1	
3-6 month	68 (63%)	176 (83.8%)	2.15(0.890-5.224)	
>6month	17 (15.7%)	16 (7.6%)	0.78 (0.266-2.31)	
ANC visits				
<4 visits	59 (54.6%)	87 (41.4%)	2.64(1.542-4.524)	0.40(0.218-0.73)
>=4 visits	37 (34.3%)	118 (56.2%)	1	1
History of anemia				
Yes	14 (13%)	21 (10%)	1.929 (0.870-4.277)	
No	36 (33.3%)	107 (51%)	1	
History of hypertension				
Yes	23 (21.3%)	22 (10.5%)	2.32(1.192-4.540)	0.39(0.18-0.87)
No	82 (75.9%)	186 (88.6%)	1	1
History of DM				
Yes	12 (11.9%)	16 (7.6%)	1.64(0.721-3.763)	
No	74 (73.3%)	181 (86.2%)	1	
History of illness				
Yes	28 (8.1%)	15 (7.1%)	0.552-3.027	
No	80 (91.9%)	195 (92.9%)	1	
1= reference				

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Table 4: Association of Maternal Lifestyle and Anthropometric Measurement with LBW in Adama Town Public Health Facilities, Oromia Regional State, Ethiopia, 2017

Maternal lifestyle	Cases	Controls	COR	AOR
	Number (%)	Number (%)		
Coffee intake of the mothers during pregnancy				
Not take coffee	21 (19.4)	58 (27.6)	1.73(0.941-3.19)	
Once per day	31 (28.7%)	60 (28.6%)	1.25(0.721-2.19)	
Twice and more	52 48.1%	80 (38.1%)	1	
History of alcohol intake				
Yes	6 (5.6%)	13 (6.2%)	0.87(0.324-2.37)	
No	101 (93.5%)	192 (91.4%)	1	
History of khat chewing				
Yes	7 (6.5%)	5 (2.4%)	2.81(0.871-9.08)	
No	100 (92.6%)	201 (95.7%)	1	
Maternal MUAC				
<21	48 (44.4%)	6 (21.9%)	3.07(1.839-5.12)	0.38(0.159-0.91)
>=21	52 (48.1%)	153 (72.9%)	1	1
Weight gain during pregnancy				
<6.8kg	25 (23.1%)	24 (11.4%)	3.72(1.749-7.94)	0.22(0.096-0.50)
≥6.8kg	19 (17.6%)	68 (32.4%)	1	1
1=reference				

weight outcome was assessed using number of live birth children one as a reference category. In comparison to this reference category mothers who give birth ≥2 were more likely to deliver LBW and this observed difference was statically significant (AOR = 3.45 with 95% CI [1.89-6.32]). The significant association found between parity and LBW in this study was in line with findings from elsewhere in the world [19-21]. It is well known that the ANC is essential for protection of adverse outcome of pregnancy that may lead LBW and preterm delivery. Mothers with ANC visit <4 time were 2.6 times higher risk of having LBW neonates than their comparable groups in this study. Statistically significant relation of LBW with ANC in this study is consistent with the findings reported by different studies in Mekele, Metu and Jimma [22-24]. Adequate number of visits and early initiation of ANC enables access to diagnostic and therapeutic methods for several pathologies that have serious outcome on newborn and maternal health. Even though bivariate analysis of gestational age of first ANC and LBW didn't show statistically significant association; mothers with late initiation of ANC (in the second trimester) have twice higher risk of delivering LBW than mothers with early initiation of ANC (just in the first trimester) in our study. Hypertension in a pregnant woman is a multisystem disease and a threat to the well- being of both mother and child. Intrauterine deaths, intrauterine growth restriction, prematurity and perinatal asphyxia are common complications in the baby [25]. In this study hypertension during pregnancy has significant association with occurrence of low birth weight in bivariate analysis. The association of mothers with HTN during pregnancy on LBW varies among the studies [26, 27]. Depending on UNICEF cut off point for detecting malnutrition in adults; maternal MUAC was classified in to two categories (<21cm & ≥21cm). Mothers who had MUAC ≤ 21cm have three times more likely to have LBW than their comparable groups (AOR=0.38 with 95% CI [0.159-0.91]). The significant association of maternal MUAC with LBW in our study was consistent with other studies in the country and elsewhere in the world [28-30]. Even though, data on weight of the mother is not adequate (only 40% of the cases and 43% of the controls pre-pregnancy weight is known) mothers with weight gain ≤6.8kg were almost four times higher risk of having LBW neonates than mothers with weight gain during pregnancy ≥ 6.8kg (OR=3.728 with 95% CI of [1.749-7.944]).The effect of weight gain during pregnancy depends on maternal pre-pregnancy weight and weight gain during pregnancy seems to decrease risk of LBW in this and other studies [31]. The independent effect of birth interval on the risk of having low birth weight babies was assessed using ≥ 24 months as a reference category and there was statically significant association of mother with birth interval of ≤ 24 months. Increased risk of LBW to some extent with decreasing birth interval in this study was

consistent with results from other studies in different parts of the world (16, 20, 32-34). Inter pregnancy interival is the time for the mother to recover from nutritional depletion as a result of fetal demand during previous pregnancy and lactation after birth. Short inter pregnancy interival may worsen the mother's nutritional status and adequate time is needed to recover and prepare for the next pregnancy.

Conclusions

This study was designed to investigate the maternal risk factors that contributed to the risk of having low birth weight in Adama Town Public Health Facilities. Variables that were found to have a statically significant relationship with low birth weight were residency being rural, occupation, parity ≥2 & birth interval ≤24months, number of antenatal care attendance <4 visits, history of hypertension and maternal MUAC <21cm were found to be statistically significant. Brief and detailed counselling on ANC attendance should be emphasized for early initiation of ANC visits in order to tackle obstetric related maternal risk factors for LBW and develop an effective prevention strategy to reduce low birth weight.

Further studies are also needed to identify why some pregnant women do not attend ANC on early gestational age which might be the base for early detection and intervention of risk factors for LBW .

Declarations

Ethics approval and consent to participate

Final proposal of the research work was reviewed and formal letter of permission was obtained from Adama Hospital Medical College Institutional Ethical Review Committee and letters of co-operation were written from the AHMC to respective health facilities. Before commencing to any interview of the questionnaire; verbal consent was taken from the mother by asking her wellingness to participate in the study after the information on the informed concent form was clearified.

Consent for publication

Not applicable

Availability of data and material

Not available

Competing interests

The authors declared that they have no competing interests

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Authors' contributions

NO conceive and designed the study and manuscript writing. EM, TW and TE have contributed their effort on data analysis and report writing . All the authors read the manuscript before they have given the final approval for publication.

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