Factors Associated with Birth Weight among Newborns Delivered at Finote Selam Hospital, Amhara National Regional State, Ethiopia

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Abstract

This study aimed to investigate the major factors associated with birth weight in newborns delivered at Finote Selam Hospital, Amhara Region. For this purpose, quantitative research approach with cross-sectional design was used. Data were collected from 165 mothers delivered at Finote Selam Hospital from February 27 to March 21, 2020. To analyze the data, both descriptive and inferential statistical techniques were employed. Multivariable logistic regression analysis was used to identify the associated factors. The findings have shown that mothers who were unable to read and write, had informal education, and attended primary level of education with values of OR= 72.2 %, OR=4.166, and OR=11.424 respectively were more likely to have a low birth-weight neonates. Babies who were born <37 weeks were 1.523 times more likely to be low birth weight. Mothers who did not take iron and folic supplementation during pregnancy were 19.2% more likely to have a low birth weight babies. Mothers who did not experience pregnancy complications showed 0.187 times decreased delivered low birth weight. Mothers who were taking substances, or taking one to two times, and three times during pregnancy showed decreased chance of low delivered birth weight. On the contrary, mothers who were taking substances more than four times and above had a more likelihood to deliver low birth weighted babies. Overall, most of the variables under consideration had a paramount impact on newborns' birth weight. The findings of the study imply that various stakeholders should discharge their responsibilities to alleviate the problem of low birth weight.

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Introduction

According to the World Health Organization (WHO), birth weight is understood as the first weight of the newborn obtained immediately after birth within the first hour of life before significant weight loss occurs after birth. It is classified into three: macrosomia (> 4.5kg), normal birth weight (2.5 -4.5 kg), and low birth weight (< 2.5kg) (WHO, 2008).

Globally, birth weight (BW) is a key predictor of the health survival and development of a newborn baby. It is not only associated with the high mortality risk during childhood, but also highly associated with health, physical, emotional, psychological, and scholastic development and wellbeing in childhood and adulthood (Islam & Elsayed, 2015).

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Research across the globe revealed that the factors associated with birth weight of new-born babies had direct impact on intrauterine growth which includes infant sex, racial/ethnic origin, maternal height, pre-pregnancy weight, paternal weight and height, maternal birth weight, parity, history of prior low-birth-weight infants, gestational weight gain and caloric intake, general morbidity and episodic illness, malaria, cigarette smoking, alcohol consumption, and tobacco chewing (Muthayya, 2009). Consequently, in developing countries, the major determinants of Intra Uterine Growth Restriction (IUGR) are poor gestational nutrition, low pre-pregnancy weight, short maternal size, and malaria. Whereas in developed countries, the most important single reason, by far, is cigarette smoking, followed by poor gestational nutrition and low pre-pregnancy weight. For the gestational duration, only pre-pregnancy weight, prior history of prematurity or spontaneous abortion, and cigarette smoking have well established causal effects, and the majority of prematurity occurs in both developing and developed country settings remain unexplained (Karmer, 1987). Shortage of uterine resources resulting in intrauterine growth restriction hurts cognitive development in childhood. The effect of intrauterine growth restriction is directly related with family socioeconomic status (SES) so that low-SES families reinforce the effect of low birth weight and high-SES families fully compensate for it (Torche & Echevarría, 2011).

A study by a research group on over 1500 pregnant women delivering at a district general hospital in inner London showed that maternal smoking, stress, and poor socioeconomic conditions during pregnancy were linked with low birth weight babies. However, the most important influence on fetal growth was smoking, which was associated with a 5% reduction in birth weight after adjustment for maternal height and parity, gestation, and the baby's sex. The study concluded that any effect of stress and poor environment on fetal growth is small compared with the effect of smoking (Brooke, Anderson, Bland, Peacock & Stewart, 1989).

Researchers have attempted to study maternal factors associated with child birth weight. For instance, Muftah (2016) revealed that maternal nutritional status, young maternal age, bad obstetric history, maternal anemia and rural settlements, antenatal care received, prematurity, and the birth interval were highly associated with newly born child birth weight outcome. Besides, Agarwal & Reddaiah (2005) in their study confirmed that non-use of antenatal care during pregnancy was independently and significantly associated with low birth weight.

Africa is a continent that has high rates of children born with LBW and most recent studies have shown a high rate of child mortality. It is expected that in sub-Saharan Africa, LBW represents 14.3% that is approximately twice the rate of LBW in European countries (Tchamo, Prista & Leandro, 2016). For example, the prevalence of low birth weight in Ghana, Burkinafaso, Senegal, Malawi, and Uganda was 10.2%, 13.4%, 15.7%, 12.1%, and 10%. respectively (He, Bishwajit, Yaya, Cheng, Zou & Zhou, 2018)

In Ethiopia, according to the 2011 Ethiopian demographic and health survey, only less than eight percent of children are normal birth weight. This is not unexpected because quite many births do not take place in a health facility, and children are less likely to be weighed at birth in a non-institutional setting. Maternal socio-demographic (maternal education level, occupation, income, and place of residence), maternal/obstetric (maternal age, antenatal care

visit, maternal weight, and stature, preterm birth, and parity), obstetric and medical disorders during pregnancy (hypertensive disorders of pregnancy, anemia, and malaria) and fetal factors (infant sex and congenital malformations) were the common risk factors for newly born birth weight in the region (Amhara, 2018).

Besides, a study in Laelay Maichew district showed that sex of neonate, less than four antenatal care follow-ups, unwanted and unplanned pregnancy, and maternal dietary intake per 24 hours during pregnancy were associated with low birth weight (Adane & Dachew, 2018).

Similarly, researchers in the area asserted that there are patterns of relationships among maternal demographic, maternal factor, and nutritional factors on child birth weight. For instance, according to Wachamo, Yimer, and Bizuneh (2019), newborn birth weight was associated with maternal weight during pregnancy, paternal education, previous obstetrics complication and place of antenatal follow-up. They suggested that these factors were the major determinants affecting newborns' birth weight.

Furthermore, a study conducted in Gondar showed that 485 (89.8%) mothers had ANC follow up during the course of pregnancy (Zeleke, Zelalem & Mohammed, 2012). Three hundred twenty four (66.8%) had four and above antenatal care visits during their pregnancy. In this study, the frequency of ANC visit was high with a significant impact on child birth weight (Zeleke, et al., 2012).

A prospective follow up study conducted in Bahir Dar City Administration also showed that the prevalence of low birth weight (< 2500 g) was 7.8% (95% CI = 6.0%, 9.7%) with 1.4% versus 10.5% among those who received acceptable and not acceptable quality ANC services respectively. In this study, maternal nutritional advice, iron-folic acid supplementation, maternal educational status, parity and age were predictors of birth weight (Tafere, Afework &Yalew, 2018).

In general, empirical studies, both international and local, revealed that birth weight represents a heavy burden for holistic child development. One of the salient slogans of the World Health Organization, *children's health is tomorrow's wealth,* has been given little attention. In addition, most researches conducted on birth weight outcomes in Ethiopia focused mainly on identifying risk factors of clinical/medical importance and documented the prevalence of child low birth weight within a cross-sectional design. However, to the best knowledge of the researchers, no adequate research has been conducted on the factors that associate with the birth weight of newly born children specifically in Finote Selam Hospital, Amhara Region.

Thus, this study aims to assess the factors associated with birth weight focusing on both normal birth weight as well as low birth weight in Finote Selam Hospital[2]. To achieve this purpose, the following research questions were formulated: (1) to what extent was the birth weight of newly born babies associated with the study variables? (2) to what extent did the combinations of the study variables predict the birth weight of the newly born babies?

[2] It is a government hospital found in West Gojjam Administrative Zone of the Amhara National Regional State. It is 385 kilometers away from Addis Ababa and 176 kilometers from Bahir Dar, the capital city of the Amhara National Regional State.

Methods

Design of the Study

As indicated earlier, this study sought to identify factors associated with birth-weight among newborns focusing on both low birth weight and normal birth weight of newly born babies. To achieve this purpose, the study employed a quantitative research approach with correlational design as it is appropriate to measure the degree of association between two or more variables and to examine to what extent a set of predictor variables predict an outcome variable.

Variables

Birth weight was the *criterion variable* of the study. It can be either low birth weight (1) or normal birth weight (0). The study has also two major *predictor variables*. The first one was demographic-related factors including (a) maternal age, educational level of the mother[3], occupational status of the mother[4], and marital status of the mother[5]. The second variable, on the other hand, includes the following maternal-related factors: (a) pregnancy interval of previous birth, (b) pregnancy ANC follow up, (c) gestation period, (d) substance use of the mother, and (e) nutritional status during pregnancy and iron and folic supplementation.

Sampling

The target population of this study was mothers who delivered their children at Finote Selam Hospital in the study period, i.e., from February 27 to March 21, 2020. By taking into account the complexity of data collection, a comprehensive sampling technique was employed. In this study, random sampling technique was not employed because of the nature of the respondents. Hence, all mothers in the study period from February 27 to March 21, 2020 were considered. According to Stevens' (1996) recommendation, about 15 participants per predictors are needed for a reliable equation. In this study, therefore, 65 mothers who came to the hospital during the study period to deliver their newborns were selected comprehensively.

Data Gathering

In order to get relevant information, both primary and secondary data were used. Of primary data sources, a questionnaire was delivered to cover all the predictor variables for newborn babies' mothers whereas document review was used as a secondary data source for newborn baby's weight recorded. Both questionnaire and document observation (analysis) were used to collect the data. The data collection instruments were modified based on the framework and objectives of the study. Moreover, WHO policy documents were used as important references of the study.

[3] 0= unable to read and write, 1=able to read (informal education, 2= primary school level, 3= secondary school and above.
[4] 0= housewife, 1= farmer, 2= merchant, 3= government worker, 4= other
[5] 0= married, 1= divorced, 2= separated, 3= single, 4= widowed

The tools were adapted and modified from studies conducted in Tanzania, Kenya, and Hosanna (Ethiopia) which passed through peer review for instrument validity (Abdo, Endalamaw & Tesso, 2016; Muchemi, Echoka & Makokha, 2015; Siza, 2008). Since the tools were developed and validated in another culture, they were adapted to the local language passing through various steps. In this regard, the instruments were translated from English to Amharic and back from Amharic to English language with the help of two Ph.D. students in the department of Foreign Language and Linguistics. After this, the questionnaire was tried out on eight mothers of the study population at the same hospital.

Before data collection, informed consent was obtained from the Psychology Department of Bahir Dar University. To gain access to potential participants of the study, i.e., mothers of newly born babies, interpersonal contact techniques were used. In the study, only participants who were volunteer to participate were considered.

The data collection process passed through the following five phases. In the first phase attention was given for the preparation of the instruments. Next to this, in the second phase, the researchers administered the questionnaire. Of course, before the questionnaire was administered, participants were invited to share their experience for the purpose of rapports. The questionnaire, consisting of a series of questions prepared to gather information from respondents, was administered by one of the researchers. The third phase of the data collection process was devoted to the observation of the newly born babies' weight registration document that corresponds with the baby's weight. While doing the tasks of this phase, the researchers were assisted by the hospital's health workers.

During the fourth phase of data collection, the researchers observed additional overall newly born babies' weight record documents. Finally, in the fifth phase, the tasks of document observation and questionnaire administration were completed. Here, all the documents were returned.

Data Analysis

After quantitative data collection, the data were checked for completeness and consistency. Following this, data were coded and entered into SPSS, version 25 software. The data entered were cleaned and edited before subsequent analyses.

The data entered into SPSS were analyzed using descriptive and inferential statistical techniques. Among the descriptive statistical methods, means, standard deviations, frequencies, percentages, Chi-square and bivariate logistic regression were used. The Pearson Chi-square test was also employed to assess the association between the independent variables and the response variable.

From inferential statistics, multivariate logistic regression was used since the outcome variable was binary and some predictor variables were categorical while others were continuous. All statistical tests with significant associations were declared at a p-value of less than 0.05 (95% CI).

Results

Descriptive Statistics

Descriptive statistics is important to describe, summarize and organize data. Hence, the Tables, 1, 2, 3 and 4 below show the descriptive summary of the statistical features of a set of observations.

Table 1

Newly Born Child Birth Weight

Birth Weight	No. of respondents	Percent
Normal birth weight	77	46.7
Low birth weight	88	53.3
Total	165	100

As displayed in Table 1, a total of 165 mothers were included in the study. More than half, i.e., 88 (53.3%) delivered low birth weight babies (less than 2.5 KG). The remaining 77 (46.7%) mothers delivered normal weight babies (greater than or equal to 2.5 KG).

Table 2

Age, Pregnancy Interval and Gestational Age of Mothers

Variable	**N**	**Mean**	**St. Deviation**	**Range**	**Min**	**Max**
Age	163	27.47	4.205	20	17	37
Pregnancy interval	113	61.83	46.586	189	15	204
Gestational age	163	34.63	3.578	14	26	40

As can be seen from Table 2, the age of respondents ranged from 17 to 37 years. Moreover, the table indicates that the average mean and standard deviation of the women during the study time were 27.47 and 4.205 years respectively.

In relation to maternal last pregnancy interval, Table 2 displays that the interval ranges from the minimum interval of 15 months to the maximum interval of 204 months. Likewise, the mean and standard deviation of pregnancy interval, as indicated in the table, were 61.83 and 46.586 respectively. The mean, standard deviation, and range of last gestational age in terms of weeks were 34.63, 3.578, and 14 weeks, respectively.

Frequency Distribution

Table 3

Percentage distribution of newly born babies by independent categorical variables

Category	Description	Normal BW 2.5 – 4.5 KG %(n)	Low BW <2.5 KG % (n)	Total % (n)
Maternal Education	Unable to read	1.2(2)	12.7(21)	13.9(23)
	Able to read	5.5(9)	24.8(41)	30.3(50)
	Primary school level	16.4(27)	6.1(10)	22.4(39)
	Secondary school and above	23.6(39)	9.7(16)	33.3(55)
Maternal occupation	House Wife	13.3(22)	22.4(37)	35.8(59)
	Farmer	7.3(12)	20.6(34)	27.9(46)
	Merchant	11.5(19)	4.2(7)	15.8(26)
	Government Worker	14.5(24)	6.1(10)	20.6(34)
Marital Status	Married	35.2(58)	39.4(65)	74.5(123)
	Divorced	3.6(6)	4.2(7)	7.8(13)
	Separated	3.6(6)	4.8(8)	8.5(14)
	Single	2.4(4)	2.4(4)	4.8(8)
	Windowed	1.8(3)	2.4(4)	4.2(7)
Pregnancy Complication	Yes	17.6(29)	38.2(63)	55.8(92)
	No	29.1(48)	15.2(25)	44.2(73)
Antenatal Care Follow up	No ANC follow up	4.2(7)	17.6(29)	21.8(36)
	1sttrimester ANC	26.7(44)	18.8(31)	45.5(75)
	2ndtrimester ANC	7.3(12)	6.7(11)	13.9(23)
	3rdtrimester ANC	8.5(14)	10.3(17)	18.8(31)
Substance usage	Not at all	32.3(53)	18.3(30)	50.6(83)
	1 to 2 times	7.3(12)	15.2(25)	22.6(37)
	Three times	3.0(5)	8.5(14)	11.6(19)
	Four and above	4.3(7)	11.0(18)	15.2(25)
Nutritional status	Balanced diet	33.9(56)	19.4(32)	53.3(88)
	Over nutrition	1.8(3)	3.6(6)	5.5(9)
	Under nutrition	10.9(18)	30.3(50)	41.2(68)
Iron and folic supplementation	Yes	34.5(57)	26.7(44)	61.2(101)
	No	12.1(20)	26.7(44)	38.8(64)

As indicated in Table 3, out of the total number of mothers, 23 (13.9%) mothers were unable to read and write. Among these mothers, 2 (1.2%) delivered normal birth weight babies whereas 21(12.7%) mothers delivered low birth weight babies. This indicates that the majority of mothers delivered low birth weight babies. In similar manner, out of the total number of mothers, 50 (30.3%) mothers were able to read and write. Among these mothers, 9 (5.5%) delivered

newborns whose birth weight was normal whereas 41(24.8%) delivered low birth weight newborns. These figures indicated that the majority of mothers delivered low birth weight newborns. Similarly, from the total number of mothers 39 (22.4%) mothers were under the category of primary school level. Among these mothers, 27 (16.4%) mothers delivered newborns whose birth weight was normal whereas 10 (6.1%) mothers delivered newborns whose birth weight was low. From these figures, we can say more mothers gave normal birth weight babies than mothers of their counterparts. In the same vein, out of the total number of mothers, 55(33.3%) mothers were at secondary level education. Among these mothers, 39 (23.6%) delivered newborns whose birth weight was normal whereas 16 (9.7%) mothers delivered low birth weight babies. The figures informed us more mothers delivered normal birth weight than mothers of their counterparts. Perhaps, from the above result, we can say that as mothers' education levels increase, the possibility of newborns of low birth weights decrease, however, it is too early to conclude at this stage.

As indicated from the above table, 59(35.8% of mothers were house wives. From these mothers, 22(13.3%) delivered babies whose birth weight was normal whereas 37 (22.4%) mothers delivered babies whose birth weight was low. These figures inform us that more mothers delivered newly born babies whose birth weight was low than mothers who delivered newborns whose birth weight was normal. In the same way, out of the total number of mothers, 46 (27.9%) were farmers. Among these mothers, 12 (7.3%) delivered normal birth weight newborns whereas 34 (20.6%) mothers delivered babies of low birth weight. The figures indicate that less mothers delivered normal birth weight babies than mothers of their counterparts. Furthermore, out of the total number of mothers 26 (15.8%) were merchants. Out of the merchant mothers, 19 (11.5%) delivered newborns whose birth weights were normal whereas 7 (4.2%) mothers gave birth to their child whose birth weights were low. These figures confirmed that more mothers in this category delivered normal newborns than mothers of their counterparts. Likewise, out of the total numbers of mothers, 34 (20.6%) were government employees. Among these, 24 (14.5%) delivered newborns whose birth weight was normal whereas 10 (6.1%) mothers delivered newborns whose birth weight was low. From these figures, we can say more mothers delivered newborns whose birth weight were normal than those of their counterparts.

In relation to marital status, out of the total number of mothers, 123(74.5%) were married. Among these mothers, 58 (35.2 %) delivered NBW babies whereas 65 (39.4 %) mothers delivered newborns whose birth weight was low which indicates more mothers delivered low birth weight babies than mothers of their counterparts. Similarly, out of 13 (7.8%) of mothers who were divorced, about 7 (4.2%) delivered NBW babies whereas 6 (3.6%) mothers delivered LBW babies. This indicates more mothers in this category delivered normal birth weight babies than mothers of their counterparts. In the same way, out of the total number of mothers, 14(8.5%) were separated. From these mothers, 6(3.6%) delivered normal birth weight babies whereas 8(4.8%) mothers delivered low birth weight babies. These figures indicate us fewer mothers deliver normal birth weight babies than mothers of their counterparts. In another category of marital status, out of the total number of mothers, 8(4.8%) were single. Among these mothers, 4(2.4%) delivered normal birth weight babies whereas 4(2.4%) delivered low birth

weight babies. Lastly, out of total number of mothers, 7(4.2%) were widowed. From these mothers, 3(1.8%) delivered normal birth weight babies whereas 4(2.4%) delivered low birth weight babies.

In relation to pregnancy complication, from the total number of mothers, 92(55.8%) faced pregnancy complication. Among these mothers, 29(17.6%) delivered normal birth weight babies whereas 63(38.2%) delivered low birth weight babies. The figures inform that more mothers delivered low birth weight babies than mothers of their counterparts. In the contrary, 73(44.2%) of mothers did not face pregnancy complications. Among these mothers, 48(29.1%) delivered normal birth weight whereas 25(15.2%) delivered low birth weight babies. From these figures, it is possible to say that more mothers delivered newborn whose birth weight was normal than mothers of their counterparts.

In relation to antenatal care follow up, out of the total number of mothers, 36(21.8%) mothers did not take antenatal care follow up. Among these mothers, 7(4.2%) delivered normal birth weight newborns whereas 29(17.6%) delivered low birth weight newborns. This implies that mothers who did not take antenatal care follow up delivered significant number of low birth weight newborns. In another category, out of the total number of mothers, 75(45.5%) of the mothers attended first-round trimester antenatal care follow-up and from those mothers 44 (26.7 %) delivered NBW babies whereas 31 (18.8 %) mothers delivered LBW babies. In the same way, out of the pregnant mothers who had followed second-round trimester, 12 (7.3%) delivered NBW newborns but the other 11 (6.7%) mothers delivered LBW babies. Lastly, 31(18.8%) mothers who were following only the third-round trimester, about 14 (8.5%) mothers delivered NBW babies whereas 17 (10.3%) of mothers delivered LBW babies.

With regard to substance use, 83(50.6%) of mothers did not use substances. Among these mothers, 53 (32.3%) delivered normal birth weight babies whereas 30 (18.3%) delivered low birth weight babies. The figures show that more mothers in this category deliver normal birth weight newborns than mothers of their counter parts. Besides, 37 (22.6%) of mothers used substances 1-2 times. Among these mothers, 12 (7.3%) delivered newborns whose birth weight was normal whereas 25 (15.2%) delivered low birth weight newborns. From the other category of substance use, 19 (11.6%) mothers used substances three times. Among these mothers, 5 (3%) delivered normal birth weight babies whereas 14(8.5%) delivered low birth weight babies. These figures indicate that almost three folds of mothers gave birth to their babies having low birth weight. As indicated in the table above, 25 (15.2%) of mothers used substances four and above times. Among these mothers, 7 (4.3%) gave birth to their babies having normal birth weight whereas 18 (11.0%) gave birth to their babies having low birth weight.

With regard to nutritional status, 88(53.3%) of mothers used balanced diet, out of which 56 (33.9%) delivered normal birth weight babies whereas 32 (19.4%) delivered low birth weight babies. The figures indicate that more mothers gave normal birth weight than mothers of their counterparts. Out of the total number of mothers, 9 (5.5%) of mothers were classified under over nutrition category. Among these mothers, 3 (1.8%) delivered normal birth weight babies whereas 6 (3.6%) delivered low birth weight babies. The figures indicate that more mothers delivered low birth weight babies than mothers who gave normal birth weight babies. In the last category,

68(41.2%) of mothers were under nutritional status. Out of these mothers, 18(10.9%) delivered normal birth weight babies whereas 50(30.3%) delivered newborns whose birth weight was low. The figures show that mothers under this category delivered more low birth weight babies than normal birth weight babies.

Out of 165 mothers, around 101(61.2%) took iron and folic supplementation during their pregnancy. Among these mothers, 57(34.5%) delivered normal birth weight babies whereas 44(26.7%) delivered low birth weight babies. Out of 64 (38.8%) of the mothers who did not take iron and folic supplementation, only 20(12.1%) of the mothers delivered normal birth weight babies whereas 44 (26.7%) of mothers gave birth to their child whose birth weight was low.

Chi-squares Test of Associations

A Kx2 Chi-square analysis was conducted to assess the association between birth weight and series of predictor variables as indicated below. The bivariate statistical analysis addresses the marginal effect of a predictor variable on the response without taking into account other predictors. To determine the factors which are significantly correlated with the criterion variable, a preliminary assessment was used using the chi-square test.

Table 4

Chi-square Test of Association Between Newly Born Birth Weight and Predictor Variables

Variables	Pearson-Chi-squares Value	D.F	Sig.(P-Value)
Maternal Education	53.107	3	<0.001
Maternal Occupation	25.016	3	<0.001
Marital Status	3.914	4	0.418*
Pregnancy Complication	19.164	1	<0.001
Antenatal Care Follow up	15.367	3	0.002
Substance Use	19.507	3	<0.001
Nutritional Status	21.969	2	<0.001
Iron and Folic Supplementations	9.984	1	0.002

As shown in Table 4, the predictor variables were strongly associated with the criterion variable. Thus, maternal education level (χ^2 (3,165) =53.107, p<.05) was significantly associated with newborns' birth weight. This indicates that newborn's birth weight varies across the levels of mother's education. As shown from the table above, marital status (χ^2 (4,165) = 3.814, p> .418) was not significantly associated with birth weight of newborns which implies that there was no real evidence that shows the variation of birth weight across marital status categories. On the other hand, pregnancy complication (χ^2 (1,165) = 19.164, p<.05) was significantly correlated with birth weight of newborns. This implies that birth weight varies across the levels of pregnancy complication. Similarly, there was statistically significant association between Antenatal Care Follow up and birth weight of newborns (χ^2 (3,165) = 15.367, p<.05). This indicates birth weight of newborns varies across the categories of Antenatal Care Follow up. In similar manner, as indicated from the table, substance use was significantly associated with birth

weight of newborns (χ^2 (3,165) = 19.507, p<.05) which implies that existence of variability of birth weight across the categories of substance use. The result from the above tables shows that nutritional status and birth weight of newborns were significantly associated (χ^2 (2,165) = 21.969, p<.05). Perhaps, this indicates that variation in the nutritional status of mothers results in variation in birth weight of newborns. Lastly, iron and folic supplementation was significantly associated with birth weight of newborns (χ^2 (1,165) =9.984, p<.05) which shows birth weight of newborns varies as mother's iron and folic supplementation varies.

Logistic Regression

Bivariate logistic analysis

The first step in the model development process is to select explanatory variables that have the potential to be included in the bivariate analysis model. A bivariate analysis was conducted to examine the relationship of each of the selected predictor variables with outcome variable. It was found that there was a significant association between predictor variables and newly born baby's birth weight. However, a bivariate association between two variables does not necessarily imply a significant causal relationship between them because in real life more than one predictor variables operate to influence the response variable.

Therefore, it is important to carry out a statistical analysis that would incorporate more than one predictor variable at a time. Bivariate logistic regression analyses were performed between maternal age, educational level, occupational status, marital status, pregnancy complication, gestational period, inter pregnancy interval, nutritional status, substance use, iron folic supplementation and ANC follow up on childbirth weight. Even though, three of the eleven variables did not show a significant association with newly born childbirth birth weight at a 95% level of significance. In this regard, the age of mothers, pregnancy intervals, and marital status were not statistically significant at a 0.05 level of significance.

According to Agresti, (2003), Bivariate test having a p-value ≤0.25 is a candidate for multivariable model. So, 0.25 level can be used as a screening criterion for variable selection on binary logistic regression. Based on this, the bivariate logistic regression p< 0.25 analysis of this study revealed that maternal age, educational status, occupational status, marital status, gestational age, ANC visit, pregnancy complication during pregnancy, pregnancy interval, frequency of substance use, iron and folic supplementation and nutritional status were statistically significant with birth weight in the bivariate model. However, maternal age and pregnancy interval did not show significant association with newly born childbirth weight at a75% level of significance. In this regard, the age of mothers and pregnancy intervals (age, p=0.547 & pregnancy interval, p =0.858) were not significant at a 0.25 level of significance and were excluded first from further multivariate analysis.

Multivariate analysis

The main problem with the bivariate approach is that it ignores the possibility that a collection of variables, each of which could be weakly associated with the outcome, can become an important predictor of the outcome when taken together (Hosmer & Lemeshow, 1989).

Hence, multivariate logistic regression approach that takes into account the drawback mentioned by the bivariant technique is considered in the following analysis. Using this method, the model that best described the outcome variable (birth weight) is fitted using the explanatory variables. The forward stepwise technique was used to select the best model.

Table 5

Results of Final Multivariate Binary Logistic Regression Model

Variables	Sub-groups	B	β	Wald	df	Sig. (P-value)	Exp (β) (OR)	95% C.I. for Exp(β)	
								Lower	Upper
				28.061	3	.000			
Education	Unable to read	3.576	1.096	10.638	1	.001*	35.722	4.166	306.268
	Able to read	2.436	.628	15.036	1	.001*	11.424	3.335	39.130
	Primary school level	-.441	.688	.410	1	.522	.644	.167	2.479
	Secondary school level & above (Ref)								
Pregnancy complication	No	-1.676	.515	10.579	1	.001*	.187	.068	.514
	Yes (Ref)								
Gesta. age		-.421	.104	16.196	1	.001*	.523	1.241	1.869
				15.819	3	.001*			
	Not at all	-3.477	1.121	9.616	1	.002*	.031	.003	.278
Substance usage	1 to 2 times	-1.312	1.060	1.532	1	.216	.269	.034	2.150
	Three times	-1.375	1.180	1.358	1	.244	.253	.025	2.554
	Four and above (Ref)								
Iron & folic supplementation.	No	1.161	.568	4.175	1	.041*	3.192	1.048	9.719
	Yes (Ref)								
Constant		-2.899	3.225	15.996	1	.000	.000		

Note. * Significant ($p< 0.05$). Ref. indicates the reference category

The significance of the Wald statistics (under the column with heading Sig.) indicates the importance of the predictor variables in the model. A high value of the Wald statistics shows that the corresponding predictor variable is significant.

As shown in Table 5, from the multivariate logistic regression analysis, maternal educational level was significant predictor of the likelihood of birth weight of newborns, That is, mothers who were unable to read and write (Wald = 10.6, p<.00) were significantly associated with likelihood of birth weight. Thus, mothers who were unable to read and write were 35.722 times more likely gave low birth weight babies than those mothers whose educational level was secondary and above (unable to read and write =0; secondary and above (ref.category) = 3; low birth weight =1, normal birth weight =0). Similarly, mothers who were able to read and write (Wald = 15.036, p<.001) significantly predicted the likelihood of newborn's birth weight. That means, the odds ratio 11.424 shows that mothers who were able to read and write gave birth 11.424 times more likely low birth weight babies than mothers whose educational level was

secondary and above. The results imply that as educational level of mothers decrease, the likelihood of low birth weight babies was delivered. In contrast, the findings indicate that there was no real evidence that showed birth weight differences between mothers whose educational levels were primary school and secondary and above.

From the table above, pregnancy complication (Wald = 10.579, p<.001) significantly predicted the likelihood of birth weight of newborns. The odds ratio .187 indicates that mothers who did not face pregnancy complications were .187 times less likely to give low birth weight babies than mothers who faced pregnancy complication (Yes = 1(ref. category), No =0, low birth weight =1, normal birth weight = 0). This implies that mothers who did not face pregnancy complications delivered normal birth weight babies as compared to mothers of their counterparts.

As displayed on the table above, gestational age (Wald = 16.196, p<.001) significantly predicted the likelihood of newborn's birth weight. The odds ratio .523 confirmed that a unit increase in gestational age decreased .523 times greater likelihood of low birth weight babies to be born. This indicates that, as the gestational age increased, the likelihood of newborn's birth weight was be normal.

From the above table, substance use significantly predicted the odds of newborn's birth weight. That is, mothers who did not use substances at all (Wald = 9.616, p<.031) significantly predicted the odds of newborn's birth weight. As a result, mothers who did not use substances at all delivered .031 times more likely normal birth weight babies than mothers who used substances four and more times. However, as indicated from the table above, the odds of birth weight did not vary across the levels of the other categories of substance use mothers in comparison to the reference category (Not at all = 0, 1-2 times = 1, three times =2 and four and above times (ref.category)= 3; low birth weight =1, normal birth weight =0).

Furthermore, iron and folic supplementation (Wald = 4.175, p<.041) significantly predicted the odds of birth weight of newborns. The odds ratio indicates that mothers who took iron and folic supplementation were 3.192 times more likely delivered normal birth weight babies than mothers who did not take iron and folic supplementation (Yes =1(ref.category), No =0; low birth weight =1, normal birth weight =0). However, from nine variables, other four independent or predictor variables were not statistically significant and hence not included in the Multivariate analysis tested at a p-value of 0.05.

Table 6

Model Summary for the Final Model

-2 Log likelihood	Cox and Snell R Square	Nagelkerke R Square
107.316	.514	.686

As displayed in Table 6, the analysis revealed that statistically significant predictor variables such as maternal educational level, pregnancy complication, gestational age, pregnancy interval, substance use, and iron folic supplementation characteristics contributed 51.4% variance shared to newly born child birth weight (normal or low). Totally, the variance in birth

weight of newborns that was accounted for by predictor variables was 68.6%. Pseudo R squares are additional measures of goodness of fit for ordinal logistic regression. Table 6 shows that the values of the two pseudo R square measures namely, Cox and Snell and Nagelkerke are .514 and .686 respectively for the final model which are good enough.

Discussion

Child birth weight has been affected by different contextual factors. The predominant factors associated with child birth weight are maternal factors. Thus, an attempt was made to identify the factors associated with birth weight as a binary outcome variable (low and normal birth weight).

The finding of the present study showed that mother's educational status was an important predictor of birth weight. For instance, as compared to the reference category (secondary and above educational level), the odds of having low birth weight babies increased by a factor of 35.722 for mothers who are unable to read and write (no education). In another category of educational status, the finding confirmed that mothers who are able to read and write are more likely to deliver low birth weight babies than mothers whose educational status was secondary and above. These findings imply that less educated mothers were more likely to give low birth weight babies. These findings are in line with a study conducted in Ghana which showed that maternal educational level was independent predictor of birth weight (Mohammed, Bonsing, Yakubu & Wondong, 2019).

However, studies in the past reported findings that contradict the findings of the present study. For instance, medium level of education showed no significant prediction when compared to low maternal education (Silvestrin, Silva, Hirakata, Goldani, Silveira, & Goldani, 2013). On the other hand, some studies showed results similar results to the current study. For instance, the study conducted by McCrary & Royer (2006) revealed that childbirth weight and wellbeing positively correlated with mother's education. It is indubitable that educated mothers have awareness on how to manage themselves during prenatal stage by taking different precaution methods. Inconsistencies are evident as long as various contextual factors are in place. Thus, the researchers of this study advise to conduct further studies so as to clarify these irregularities.

With regard to gestation age, the present study shows that it has an important role in determining the infant's birth weight. According to this finding, gestation age significantly predicted the odds of newborns birth weight. As a result, babies who were born less than 37 weeks were more likely to have low birth weight as compared to those born at their full term or greater than or equal to 37 weeks. This finding is consistent to the findings of a previous study that was conducted in Ardabil, Iran (Mirzarahimi, Hazrati, Ahmadi & Alijahan, 2013). In this study, birth was reported to be a risk factor of low birth weight. Besides, a study conducted in Kuala Lumpur, Malaysia (Sutan, Mohtar, Mahat & Tamil, 2014), supports the findings of the present study. According to the finding of this study, premature delivery was among the predictors of low birth weight. The study conducted in the university of Gondar hospital (Adane, Ararsa, Bitew & Zeleke, 2014) further strengthened the findings of the present study. This study

explored those preterm births were about six times more likely to be of low birth weight when compared to full term ones. Likewise, the study conducted in Tigray region reported that premature delivery (gestational period less than 37weeks) was one of the important predictors of low birth weight (Gebremedhin, Ambaw, Admassu & Berhane, 2015; Mengesha,Wuneh, Weldearegawi & Selvakumar, 2017). All these studies make it clear that babies born premature, i.e., before completing their term due to any gynecological, medical, or other causes, are not completing their normal physical development in the womb and are at higher risk to have low weight at birth.

For the variable iron and folic supplementation, the present study investigated that mothers who did not take iron and folic supplementation are more likely to born low birth weight child than those taking iron and folic supplementation. Different literatures support this finding. For instance, the World Health Organization (2012) guideline recommends that daily oral iron and folic acid supplementation as part of the antenatal care to reduce the risk of low birth weight. In addition to this, the study conducted by Passerini, Casey, Biggs, Cong and Montresor (2012) showed that the provision of women with regular weekly iron-folic acid supplemented before pregnancy associated with a reduced prevalence of low birth weight. Sushma, Shila, and Sushil (2018) further indicated that intake of folic acid by pregnant women was strongly related with normal birth weight of children. In sum, both the present and previous studies showed that iron and folic supplement during pregnancy decreases the chance of delivering low birth weight babies.

This study further examined that the odds of babies having low birth weight decreased by a factor of 0.187 for mothers who did not experience pregnancy complications as compared to those mothers who experienced pregnancy complications. This finding is in line with the study that was conducted in Northern Ethiopia (Hailu & Kebede, 2018). This study showed that pregnancy complications were predictors of low birth weight whereas cesarean and instrumental delivery had a positive effect to prevent low birth weight.

In relation to substance use, taking the reference category four or more times, the odds of the mother having low birth weight babies was decreased by a factor of 0.031 for mothers not taking substances at all compared to mothers taking substances four or more times. This shows that substance use adversely predicted the odds of birth weight of newborns. Previous studies conducted on the issue at hand are in line with the findings of the present study. For instance, the study conducted by Bailey and Diaz-Barbosa (2018) revealed that maternal substance use during pregnancy was becoming an increasing social problem with adverse prenatal and neonatal outcomes. Licit and illicit drug use during pregnancy was reported to have equal harmful effects on the newborns. On top of this, the study conducted by Shankaran, Lester, Das, Bauer, Bada, Lagasse and Higgins (2007) corroborated the findings of the current study. These researchers suggested that ongoing use of alcohol and tobacco had been affecting childhood behavior. Intra Uterine Growth Restriction (IUGR) status at birth impacts the risk of hypertension in childhood. It is also clear that substance use during pregnancy has physical and mental health implications beyond childhood.

Conclusions and Implications

Based on the findings obtained from this study, the following major conclusions were drawn. Generally, mothers having better educational status were less likely to deliver low birth weight babies. Considering gestation period, high gestation period is negatively associated with low birth weight of children. The present study also indicated that mothers who were not taking iron and folic supplementation were more likely to deliver low birth weight babies as compared to mothers who were taking iron and folic supplementation. Similarly, mothers who had no pregnancy complications were less likely to have low birth weight babies as compared to mothers who had pregnancy complications.

The above findings have far-reaching implications for various stakeholders with regard to the problem of low birth weight of newborns. Scholars said that the child is the man as the morning is the day. This implies early developments (from conception to birth) are important for later development of the child. Researches documented that birth weight specifically low birth weight has a significant effect on later life outcomes such as educational attainment and learning. Hence, early intervention programs or special care for LBW children in school could be an effective means of improving educational outcomes and the behavior of these children.

On top of the above implications, childcare centers should undertake prevention and intervention strategies to reduce low birth weight of newborns. They can also create awareness among pregnant mothers how to take care their neonates by avoiding different hazardous things such as substance use (licit or illicit substance use). Besides, Early Childhood Care and Education professionals should prepare maternal guidance and counseling programs that elaborate all maternal conditions connected with childbirth weight. On top of these, health professionals need to teach pregnant mothers on the importance of taking iron and folic supplementation. They should also convince mothers to avoid the use of drugs during pregnancy time unless they are ordered to do so concerned health professionals. Besides, they need to advise pregnant mothers to attend ANC follow up without interruption until they give birth to their babies.

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