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Newborn birth weight and its associated risk factors in Somalia using Somalia health and demographic survey

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ABSTRACT

Background: Low birth weight is the result of fetal growth and it is a strong sign of infant morbidity and mortality. In sub-Saharan Africa, the number of low birth weight live births is estimated to have increased from 4.4 million in 2000 to 5 million in 2015. Low birth weight is a strong indicator of multifaceted public health problems, including unfavorable socio-demographic conditions, chronic illness, and poor health care during pregnancy. The aim of this study was to assess the prevalence and risk factors of newborn birth weight in Somalia.
Methods: The data used for this study were obtained from the 2020 Somalia Health and Demographic Survey. A sample of 7462 newborn with their birth weight within five years preceding the survey was included. The newborns' birth weight; which is first categorized in to three: low birth weight (<2.5 kg), normal birth weight (2.5–4 kg) and high birth weight (>4 kg), was considered as a response variable. The analysis was carried out using ordinal logistic regression and adjusted odds ratio with 95 % confidence interval and *p*-value <0.05 was used to declare statistical significance.
Results: From the total of 7462 newborns include in the study, 1196 (16.03 %), 5304(71.08 %) and 962 (12.89 %) were born with low birth weight, normal birth weight and high birth weight, respectively. Maternal age (AOR = 1.48; 95 %CI: 1.12–1.956), having Antenatal care (ANC) visit (AOR = 1.24; 95 %CI: 1.09–1.41), gestational age ≥37 weeks (AOR = 2.02; 95 % CI: 1.34–3.03), rich wealth index family (AOR = 1.46; 95 %CI: 1.29–1.65) and mother with secondary/higher educational level (AOR = 1.51; 95 %CI: 1.19–1.92) as well as place of residence were significantly associated with higher birth weight.
Conclusion: The results of this study showed that birth weight is significantly associated with mother age, ANC visit, mother educational level, wealth index, residence, and gestational age at birth. Significantly large proportions of newborn babies are born with low-birth weight and this might be duet to many factors. Since low birth weight is a strong indicator of multifaceted public health problem, the governmental and non- governmental organizations working on maternal health should focus on alleviating this public health burden by giving special attention for antenatal care utilization coverage and improve other maternal health.

1. Introduction

Low birth weight is the result of fetal growth and a strong predictor of infant morbidity and mortality. New-born birth weight which is the first weight record, preferably taken within an hour of birth and it is classified in three main categories.[1] For a simple epidemiological interpretation, World Health Organization (WHO) categorized newborn birth weights as Low Birth Weight (LBW) (less than 2.5 kg), Normal Birth Weight (NBW) (2.5–4 kg), and High Birth Weight (HBW) (more than 4 kg) at birth regardless of the gestational age.[2,3] Further classification of low birth weight includes; low birth weight (below 2500 g), very low birth weight (below 1500 g), and extremely low birth weight

Abbreviations: ANC, Antenatal care; AOR, Adjusted odds ratio; CI, Confidence interval; COR, Crude odds ratio; SHDS, Somalia health and demography survey; LBW, Low birth weight; NBW, Normal birth weight; HBW, High birth weight; WHO, World Health Organization, UNFPA, United national population fund.

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(below 1000 g) and it has remained a significant health problem in many parts of the world.[4] Low birth weight is a strong indicator of multifaceted public health problems, including unfavorable socio-demographic conditions, long-term maternal malnutrition, chronic illness, and poor health care during pregnancy.[5-8] Low birth weight contributes to poor health outcomes for a baby. It has higher risk of newborn's chances of survival, growth retardation, infection, hypoglycemia, hypothermia, developmental delay and death during infancy and childhood.[9-11] However, high birth weight has also been linked to obstetric complications in both mothers and babies, including death, delayed labor, increased need for cesarean delivery, postpartum hemorrhage, fresh stillbirth, being overweight, having an Apgar score of less than 7 after 5 min, birth injuries, and cancer development.[12,13]

Globally, infants born with LBW are around 20 million every year, of which 95 % live in developing countries. Moreover, Africa with high burden of LBW is only preceded by Asia.[4,14] In sub-Saharan Africa, the number of LBW live births is estimated to have increased from 4.4 million in 2000 to 5 million in 2015 and this is an important marker of maternal and fetal health, predicting mortality, stunting and onset of chronic conditions.[15,16] These rates are high, despite many deliveries occur at home or in small health clinics and go unreported in official records, potentially leading to underestimation of the true prevalence. Therefore, WHO incorporated as a third target to achieve a 30 % reduction in LBW incidence by 2025.[4] Infants with low birth weight have a higher risk of developing chronic diseases such as hypertension, obesity and diabetes in adult life compared to infants with normal birth weight.[17]

There is considerable variation in prevalence across the regions and highly prevalent in low- and middle-income countries, with 95.6 % of overall low birth weight occurring in developing countries.[18] The prevalence of HBW was higher in developed countries having high socioeconomic standing, ranging from 5 % to 20 % and lower in low- and middle-income nations, ranging from 0.6 % in India to 15.2 % in Algeria.[19,20] Studies conducted in the Democratic Republic of Congo, Angola, Kenya, Niger, and Uganda, showed that the prevalence of HBW was 2.7 %, 3.1 %, 3.9 %, 8 %, and 9.1 %, respectively.[20]

The regional estimate of low birth weight includes 28 % in South Asia, 13 % in sub-Saharan Africa with high variation among countries. Given the prolonged conflict in Somalia, this research provides a quantitative analysis of the factors related to new born birth weight. In developing regions like Somalia, more than half of new-born were not weighted at birth which may result in an underestimation of low birth weight.[4,21,22]

Long-term complications associated with LBW include hypertension, diabetes mellitus, proteinuria, and renal disease in late age, eye problems like strabismus and myopia, deafness, neurologic complications like cerebral palsy, seizure and psychological disturbance.[23] In Africa, low birth weight is approximately 22 %, and in sub-Saharan Africa, it is around 13–15 % with a small variation across the region.[24] Babies born with LBW were approximately 20 times more likely to die during infancy compared to normal weight.[14] A study conducted in East Africa, birth with preterm and low birth weight were found to account for 52 % of newborn deaths.[25]

The factors responsible for birth weight are yet to be completely understood, even though many studies have been conducted to ascertain the underlying factors. Socio-demographic characteristics including residence, family income, mother's age, and other characteristics of mothers like illness, inadequate nutrition, birth interval, and parity should be evaluated in relation to birth weight, particularly in Somalia, a nation plagued by protracted conflict, in order to improve policy recommendations.[26-28]

Research conducted in different countries on determinants of birth weight showed various socio- demographic, socioeconomic, maternal health service-related and community- related factors to be predictors of LBW.[27,29] Even though the birth weight was affected by factors operating at both individual and community levels, none of the studies have tried to look at the factors that affect birth weight by considering ordinal nature of birth weight. Additionally, the minimal research undertaken in different regions of Somalia, there is a lack of comprehensive understanding at the national level regarding the socio-economic and other factors that contribute to birth weight. This study aims to explore the factors associated with both LBW and HBW, providing a comprehensive understanding of birth weight outcomes using ordinal logistic regression analysis. Thus, the implication of this study is to provide evidence for policymakers in Somalia by strengthening maternal and child health intervention programs and provides context specific information to program planners and policy makers.

2. Methods and materials

2.1. Study design and data

The study was conduct in Somalia which is divided into eighteen prewar geographical regions. The Demographic and Health Survey (DHS) data collection was not conducted in two regions, Lower Shabelle and Middle Jubba, due to the interference of al-Shabaab.

Secondary data based on cross sectional study design from Somali Health and Demographic Survey (SHDS) was used. This survey is the first and nationally large scale dataset of demographic and health survey that was conducted by the cooperative of Government of Somalia, through the Ministry of Planning, Investment, and Economic Development, Somali National Bureau of Statistics and the Ministry of Health together with united nation food population fund (UNFPA) from 2018–2019. A total of 16,360 households were selected for the sample, of which 15,870 were occupied. Of the occupied households, 15,761 were successfully interviewed. All women aged 15–49 years were eligible to be interviewed. Of all the child dataset related to birth weight, 7462 infants are eligible to this study. All newborn babies who have a measured weight in SHDS 2020 survey at birth in the survey are included and children who didn't have measured weight are excluded in this study.

2.1.1. Outcome variable

The outcome variable for this study is the birth weight, which is categorized as: low birth weight (<2.5 kg), normal birth weight (2.5–4 kg), and high birth weight (>4 kg) which is an ordinal response variable.

2.1.2. Independent variables

The independent variables included in this study were selected based on epidemiological information, previous studies, a review of the relevant published demographic studies and the available information in the DHS datasets.[27,28,30,31] Therefore the factors considered in this study are mother age, parity, birth order, sex of the baby, mother educational status, wealth index of family, ANC visit, malaria, iron supplementation, type of birth, pregnancy wanted, birth interval, gestational age, media exposure, and place of residence.

2.2. Data management and analysis

The data were cleaned and analyzed using STATA 14 Software and descriptive statistics were conducted to describe the characteristics of the study participants. In order to identify the potential risk factors for birth weight, ordinal logistic regression models were fitted. Uni-variable ordinal logistic regression model was used to identify the relationship between each explanatory variable and the outcome variable. In the multivariable ordinal logistic regression analysis, factors having a *p*-value less than 0.05 in the uni-variate analysis were included. For final model, variables were found to have a statistically significant relationship with birth weight status if their *p*-value was less than 0.05. A 95 % confidence interval with its adjusted odds ratio was used to evaluate the association's strength.

2.3. Statistical method

Ordinal logistic regression models are used to model the relationship between risk factors and an ordinal response variable when the response variable category has a natural ordering.[32] The proportional odds model estimates the odds of being at or below a particular level of the response variable. It considers the probability of that event and all events before it. If the proportional odds assumption, i.e., the relationship between the independent variables and the dependent variable, does not change as the dependent variable's categories is not met, then other different ordinal models are used to identify important explanatory variables. Let Y takes categorical response variable with K ordered categories, the proportional odds model then models the log odds of the first $K-1$ cumulative probability as:

$$\text{logit}(pr(Y \leq k)) = \log\left(\frac{pr(Y \leq k)}{1 - pr(Y \leq k)}\right) = \alpha_k - (\beta_1 x_1 + \ldots + \beta_p x_p) = \alpha_k - \sum_{l=1}^{p} \beta_p x_p$$

$$0 \leq \pi_k \leq 1 \quad \text{for} \quad l = 1,\ 2, \ldots,\ p \quad \text{and} \quad k = 1, 2, \ldots, K-1$$

where, k indexes the cut-off points for all categories (K) of the response variable, α_k represents a separate intercept or threshold value for each cumulative probability which satisfies the condition $\alpha_1 \leq \alpha_2 \leq \alpha_3 \leq \ldots \leq \alpha_k$ and their values do not depend on the values of the independent variable for a particular case and $\beta = (\beta_1, \beta_2, \ldots, \beta_k)$ is the vector of the unknown regression coefficient corresponding to $x_1, x_2, \ldots, x_p$.[33]

A parallel line test using Brant testing method was also applied to check the proportionality assumption of the model. If the proportionality assumption satisfied, that the correlation between the independent variables and the dependent variable remains constant as the categories of the dependent variable vary.[34]

3. Results

3.1. Descriptive statistics

Out of a total of 7462 babies, 1196 (16.03 %), 5304(71.08 %) and 962(12.89 %) were born with low, normal and high birth weight, respectively. The prevalence of low birth weight for males was 52.26 % and 47.74 % for females. The prevalence of new-born that was born from mothers who have no formal education was 85.12 % and 82.94 % low and normal birth weight, respectively. The highest percentage of low birth weight was observed from young mothers aged between 15–19 years. Children born from mothers who don't have ANC visit have higher low birth weight as compared with mother who had ANC utilization. The percentage of newborns with low birth weight from nomadic dwellers is higher as compared to urban and rural dwellers (Table 1).

3.2. Data analysis using ordinal logistic regression

An ordinal logistic regression with un-variable analysis was first fitted and variables with a p-value of <0.05 were selected for the multivariable ordinal logistic regression analysis model. In the multivariable logistic regression analysis, mother age, mother educational level, wealth index of family, gestational age, antenatal care visit, place of residence have shown a statistically significant association with birth weight at 95 % level of significance (Table 2). Furthermore, the Brant test of parallelism showed that odds ratios appeared to have held constant across all cut-off points of new born birth weight status for the final model at 5 % level. Since the parallel lines assumption was held, the

Table 1
Results of descriptive summary of birth weight among newborns in Somalia based on SHDS, 2020.

Factors	Categories	Birth weight status				chi^2 (p-value)
		Frequency (%)	LBW N (%)	NBW N (%)	HBW N (%)	
Mother age	15–19	492(6.59)	91(7.61)	356 (6.71)	45(6.59)	32.001 (0.001)
	20–24	1555(20.84)	28,323.66)	1087(20.49)	185(19.23)	
	25–29	2023(27.11)	323(27.01)	1462(27.56)	238(24.74)	
	30–34	1481(19.85)	211(17.64)	1068(20.14)	202(21.00)	
	35–39	1240(16.62)	183(15.30)	861(16.23)	196(20.37)	
	40–44	507(6.79)	76(6.35)	355(6.69)	76(7.90)	
	45–49	164(2.20)	29(2.42)	115(2.17)	20(2.08)	
Mother education	No education	6155(82.41)	1019(85.13)	4402(82.92)	734(76.22)	38.86 (<0.001)
	Primary	928(12.42)	131(10.94)	649(12.22)	148(15.37)	
	Secondary and higher	386(5.17)	47(3.93)	258(4.86)	81(8.41)	
Sex of child	Male	3909(52.39)	631(52.76)	2772(52.26)	506(52.60)	0.117 (0.943)
	Female	3553(47.61)	565(47.24)	2532(47.74)	456(47.40)	
Type of birth	Single	7359(98.62)	1175(98.24)	5244(98.87)	940(97.71)	9.465 (0.009)
	Multiple	103(1.38)	21(1.76)	5304(1.13)	962(2.29)	
Sex of household head	Male	4897(67.62)	822(70.68)	3447(66.91)	628(67.62)	4.177 (0.064)
	Female	2345(32.38)	341(29.32)	1705(33.09)	299(32.25)	
Wealth index of family	Poor	3123(41.85)	553(46.24)	2244(42.31)	326(33.89)	66.692 (<0.001)
	Middle	1493(20.01)	273(22.83)	1044(19.68)	176(18.30)	
	Rich	2846(38.14)	370(30.94)	2016(38.01)	460(47.82)	
Iron supplementation	No	4978(66.71)	805(67.31)	3571(67.33)	602(62.58)	8.497 (0.014)
	Yes	2484(33.29)	391(32.69)	1733(32.67)	360(37.42)	
Malaria	No	6929(92.86)	1094(91.47)	4938(93.10)	897(93.24)	4.148 (0.126)
	Yes	533(7.14)	102(8.53)	366(6.90)	65(6.76)	
Parity	One	911(12.21)	155(12.96)	661(12.46)	95(9.89)	7.230 (0.124)
	2–5	4025(53.95)	638(53.34)	2870(54.12)	517(53.80)	
	6 and above	2524(33.83)	403(33.70)	1772(33.42)	349(36.32)	
Birth order of child	First	2064(27.66)	338(28.26)	1462(27.56)	264(27.44)	1.511 (0.825)
	2–3	4622(61.94)	725(60.62)	3294(62.10)	603(62.68)	
	4 and above	776(10.40)	133(11.12)	548(10.33)	95(9.88)	
Pregnancy wanted	No	701(9.39)	125(10.45)	447(8.43)	129(13.41)	3.418 (0.170)
	Yes	6761(90.61)	1071(89.55)	4857(91.57)	833(86.59)	
Birth interval	first	2748(36.83)	459(38.38)	1960(36.95)	329(34.20)	25.615 (<0.001)
	less than 24 month	1336(17.90)	209(17.47)	963(18.16)	164(17.05)	
	24 and above	3378(45.27)	528(44.15)	2381(44.89)	469(48.75)	

Table 2
Uni-variable and multivariable ordinal logistic regression analysis of the factors affecting birth weight among newborns in Somalia based on SHDS, 2020.

Variables	Categories	COR (95 % CI)	*p*-value	AOR (95 % CI)	*p*-value
Mother age	15–19 (ref)	1		1	
	20–24	1.12(0.90,1.40)	0.295	1.06(0.84,1.33)	0.633
	25–29	1.23(0.99,1.52)	0.059	1.13(0.89,1.44)	0.310
	30–34	1.42(1.141.77)*	0.002	1.34(1.03,1.74)*	0.031
	35–39	1.52(1.21,1.90)*	<0.001	1.48(1.12,1.96)*	0.005
	40–44	1.45(1.11,1.90)*	0.006	1.47(1.07,2.01)*	0.016
	45–49	1.16(0.79,1.70)	0.444	1.15(0.76,1.75)	0.513
Mother education	No education (ref)	1		1	
	Primary	1.30(1.12,1.51)*	0.001	1.12(0.96,1.32)	0.150
	Secondary and higher	1.74(1.39,2.18)*	<0.001	1.51(1.19,1.92)*	0.001
Wealth index of family	Poor (ref)	1		1	
	Middle	1.03(0.89,1.18)	0.683	1.13(0.98,1.30)	0.090
	Rich	1.53(1.37,1.71)*	<0.001	1.46(1.29,1.65)*	<0.001
Iron supplementation	No (ref)	1		1	
	Yes	1.12(1.01,1.24)*	0.034	0.94(0.82,1.07)	0.090
Parity	One (ref)	1		1	
	2–5	1.15(0.99,1.35)	0.073	1.12(0.93,1.34)	0.224
	6 and above	1.19(1.01,1.41)*	0.035	1.05(0.84,1.32)	0.645
Birth interval	first	0.89(0.79,0.99)*	0.032	0.99(0.86,1.16)	0.994
	less than 24 month	0.94(0.82,1.08)	0.357	0.95(0.83,1.09)	0.467
	24 and above (ref)	1		1	
Gestational age	less 37 months (ref)	1		1	
	37 and above months	1.88(1.26,2.81)*	0.002	2.02(1.34,3.03)*	0.001
ANC visit	no (ref)	1		1	
	Yes	1.32(1.19,1.47)*	<0.001	1.24(1.09,1.41)*	0.001
Residence	Rural	2.13(1.87,2.43)*	<0.001	2.20(1.93,2.51)*	<0.001
	Urban	1.82(1.62,2.05)*	<0.001	1.87(1.66,2.10)*	<0.001
	Nomadic (ref)	1		1	

* Significant at 0.05, ref= indicates reference categories.

interpretation of the result obtained by modeling each possible pairs of birth weight status were the same. The odds of being at higher birth weight status among new-born whose mothers had secondary and above education level were 1.51 times more compared to those new-born whose mothers had no formal education (AOR = 1.51 (95 % CI: 1.19–1.92); *p* value 0.001). Similarly, mothers who had antenatal care visits were 1.24 times more likely to give higher birth weighted babies than mothers who have no antenatal care utilization with (AOR = 1.24 (95 % CI: 1.09–1.41), *p* value = 0.001). Additionally, the odds of being at higher birth weight status was nearly two times higher for maternal gestational age above 37 weeks as compared to maternal gestational age below 37 weeks (AOR: 2.20; 95 % CI: 1.34–3.03). Those women from rich households were 46 % more likely to have babies weighed at higher categories (OR: 1.46, 95 % CI: 1.29–1.65; *p* value <0.001) compared to those from the poor households.

Likewise, the likelihood of being at higher birth weight status of new born whose mothers age 30–34, 35–39, and 40–44 years were 34 % (AOR = 1.34; 95 % CI: 1.03–1.74; *p*-value = 0.031), 48 % (AOR = 1.48; 95 % CI: 1.12–1.96; *p*-value = 0.005), and 47 % (AOR = 1.47; 95 % CI: 1.07–2.01; *p*-value = 0.016) higher than those new born babies whose mothers are 15–19 years. Those mothers who were urban and rural residents were 1.87 (AOR: 1.87; 95 % CI: 1.66–2.10; *p* value <0.001) and 2.20 (AOR = 2.20; 95 % CI: 1.93–2.51; *p* value <0.001) times more likely to have higher birth weight new born babies as compared to the nomadic dwellers (Table 2).

4. Discussions

In least developed countries like Somalia which was in a conflict for decades, abnormal birth weight among new-born was continued to be a serious public health issue. In this study, the proportion of LBW was 16.03 %, which is relatively in line with a study in Angola (15.3 %), Gabon (16.8 %), Madagascar (17.1) and Senegal (15.7 %).[35,36] But, it is higher than some studies like Nigeria (7.3 %),[37] Sub-Saharan Africa (9.47 %),[30] and Kenya (12.3 %).[38] The possible explanation might be the difference in geographical variation, food security and self-sufficiency, nutritional status of mother, socio-demographic, economic, health care system differences. But, it had relatively lower prevalence when compared with study finding conducted in India, Uttar Pradesh which was about 40 %,[39] in Kersa demographic and Surveillance and Health research Center (KDS–HRC) which showed a prevalence of 28.3 %,[40] and systematic and meta-analysis results in Ethiopia (18 %).[21] The possible explanation of these variations might be the difference in characteristics of study population which might had difference in health service utilization, maternal feeding habit and nutritional status of mothers during pregnancy.

On the other hand, the results of this study found that the proportion of HBW was 12.89 % which is relatively consistent with the study in Hawassa city, Southern Ethiopia (11.86 %),[41] Ethiopia (10.7 %).[42] But, it is higher than a study conducted in Tanzania (2.3 %).[12] The study also showed that the proportion of LBW is higher than HBW and this might be due to many of respondents considered in this study being from the rural and nomadic area which may increases the rate of low birth weight of new born child. Moreover, most pregnant women who came from these areas have lower rate of ANC utilization during their pregnancy and have low literacy rate.[43]

According to this study, those mothers who had ANC visits were 1.24 times more likely to give birth at higher birth weight as compared to mothers who had no ANC visits. This result was consistent with the finding conducted in Morocco,[44] Italy,[45] and Nepal.[46] This could be due to the fact that the World Health Organization strongly recommends during pregnancy the utilization of antenatal care for early identification of risky pregnancy, influence improvements in dietary practices, improve maternal nutritional status during pregnancy, improve neonatal outcomes, monitor and encourage recommended weight gain during pregnancy, prevention and management of anemia and other pregnancy related complications by early detection and treatment of disease that improve birth outcomes.[47,48]

Maternal age was an important determinant of birth weight of new born in this study. Mothers who had greater than 30 years at the time of delivery gave a higher newborn birth weight status babies as compared to mothers whose age were less than 20 years old. This outcome is comparable to the research carried out in Nepal,[46,49] Ethiopia,[50] India,[51] from developing countries,[52] Cameron,[53] Bangladesh.[54] This could be due to the fact that, young mothers are still in the process of biological growth and may not be physically and emotionally mature enough to know the importance of child bearing, self-care and good nutrition during pregnancy.[55]

Furthermore, in this study, we also found that gestational age of 37 and above weeks was found to be a higher birth weight status for newborns as compared to gestational age less than 37 weeks. Supportive finding were obtained from studies conducted in Bale zone, Southeast Ethiopia,[56] Amhara regional state, Ethiopia,[57] Belgium,[58]Ghana,[59] Sudan,[60] and Tanzania.[61] This could be because premature babies have less time in the mother's womb to grow and gain weight because their growth is so rapid in the final weeks of pregnancy. Low birth weight is most commonly caused by the fetus not reaching the optimal gestational age of 37 weeks.

Maternal educational level appeared to be another important determinant of the birth weight in this study. Mothers who attended secondary education were 1.51 times more likely to give high birth weight baby than mothers who did not have formal education [AOR = 1.51; 95 % CI: 1.19–1.92]. This finding is parallel with the previous study conducted in Ethiopia,[62] Ghana,[59] India,[63] Kenya,[64] and other developing countries.[52] A possible reason would be, increased maternal educational level improves ANC attendance,[65] which combats the incidence of low birth weight.[66] Moreover, low educational status may also lead to limited access to prenatal care, mainly in places where mothers are expected to pay for service and limits women from having independent decisions and good access to family resources which are very important for better nutrition.[67]

This study indicated a significant difference among resident of mothers with regard to birth weight of a newborn baby. Mothers who reside in urban were 1.87 times higher odds of delivering high birth weight baby compared to nomadic residents. This result is in line with studies conducted in Hadiya Zone, Ethiopia,[68] and India[69] and possible reason would be the life styles of people in urban resident characterized by high infrastructures, information and nutritional awareness, lower physical work and higher access to basic services were more prominent than the nomadic dwellers. Another possible explanation for the difference might be the study settings, such as access to the health facility and acquiring maternal care education through media is more common in urban than nomadic settings. Moreover, the low socioeconomic statuses of nomadic women restrict access to information and health services, antenatal care follow ups, danger signs of pregnancy, nutritional status and fetal growth, thus increasing the risk of low birth weight.

The findings of this study also showed strong association between birth weight and wealth index of family which implied that rich wealth indexed family reduced the risk of low birth weight. This result is in line with studies conducted in Nigeria,[5] Ghana,[70,71] Sub-Saharan Africa,[72] and India.[73] This could be due to families with rich economic status can have the power to purchase basic requirements such as medical care, good maternal nutritional intake among mothers with lower socioeconomic status as found in other studies.[55]

This study is based on the large nationally representative data, using ordinal logistic regression model considering ordered nature of birth weight which is appropriate to model such response and used to show the severity of each birth weight category. The limitation of this study was that the cross-sectional nature of the study design which may affect causality and other important variables which did not assess variables related to maternity that affect birth weight, like: mother's weight gain during pregnancy, mid-upper arm circumference, maternal history of disease were not available in the secondary data used for this study.

5. Conclusion

In this study, we have explored ordinal logistic regression to analyze the birth weights of newborn using 2020 Somalia Health and Demographic Survey data. The study found that place of residence, maternal age, wealth index, gestational age, ANC visit and mother education level were found to be significantly association with birth weight. When it comes to improving maternal health, both governmental and non-governmental organizations should prioritize pregnant women and pregnancy related outcomes. Specifically, the stakeholders should pay close attention to women from nomadic communities who have low wealth indices and develop a strategy to raise their educational attainment and create awareness on pregnancy related health benefits. It would be beneficial for the medical professionals to highlight the prenatal programs that are available to reduce the incidence of low birth weight.

Ethics approval and consent to participate

Not applicable.

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CRediT authorship contribution statement

Denekew Bitew Belay: Writing – original draft, Visualization, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Nigussie Adam Birhan:** Writing – original draft, Formal analysis, Data curation. **Mahad Ibrahim Ali:** Writing – original draft, Data curation, Conceptualization. **Ding-Geng Chen:** Writing – review & editing, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

The data used in this study were Somalia Health and Demographic Survey 2020 data (SHDS 2020) and can be obtained or accessed from the Somalia National Bureau of Statistics (SNBS) at https://microdata.nbs.gov.so/index.php/catalog/50. The dataset is publicly available and can be accessed for research purposes.

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