Original Article

Quality of Antenatal Care as a Means of Safeguard for Low Birth Weight: A Longitudinal Study in Hadiya Zone Centeral Ethiopia regional state Ethiopia.

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Abstract

Background: A child's birth weight is an important indicator of a child's vulnerability to the risk of childhood illness and the chances of survival. Quality antenatal care is expected to improve the birth weight. The main aim of this study was to determine the effect of quality antenatal care on birth weight.

Method: A facility-based prospective follow-up study design was conducted among 859 mothers with gestational age ≤ 16 weeks. The pregnant mothers who came for their first antenatal visit were recruited and followed until the delivery time. A standardized observational checklist was adopted and adapted to collect the longitudinal data. During the first visit, data on socio-demographic, obstetric, and medical history was collected using an interview-administered questionnaire, and during delivery weight of the baby was taken. Quality antenatal care service was considered to be good, provided that mothers received 75% of the essential component of the ANC services. General estimating equation logistic regression analysis was done to determine the effect of quality antenatal care on low birth weight.

Result: A total of 859 babies were included in this analysis, resulting in a response rate of 100%. The incidence of low birth weight was 17.9% (95% CI: 15.5% −20.6%). Good quality of ANC services was strongly associated with reduced risk of having LBW by 98% (AOR=0.020 (95%CI =0.005, 0.054). In addition, the risk of having a low birth weight baby was higher among mothers who had a history of abortion, premature delivery, and monthly income.

Conclusion: The study highlights a high incidence of low birth weight in the study area, emphasizing the urgency for stakeholders to take decisive action to address this problem. Increasing the quality of Antenatal Care (ANC) services emerges as a pivotal strategy in mitigating the risk of low birth weight. Federal Ministry of Health and other partners working in the area should promptly design and implement effective strategies to enhance the standards of ANC services, aiming for a significant reduction in the incidence of low birth weight within the community. [*Ethiop. J. Health Dev.* 2024; 38(1): 00-00]

Keyword: Antenatal care, Ethiopia, Hossana, Longitudinal, Low birth weight, Quality

Background

According to the World Health Organization (WHO), Low Birth Weight (LBW) is defined as a weight at birth of less than 2.5 kilograms, regardless of gestational age (1). Globally, approximately 24% of all births are affected by LBW, leading to significantly short- and long-term health consequences (2,3). LBW emerges as a major determinant of mortality, morbidity, and disability in infancy and childhood, wielding a profound impact on infants' physical, survival, and mental growth (4,5). Low birth weight is identified as the single most important predictor of infant mortality, particularly within the first months of life (6, 7, 8). Beyond its predictive value for infant outcomes, birth weight serves as a reflection of the mother's past and present health status (9). Factors contributing to LBW are multifaceted, encompassing HIV infection, malaria, malnutrition, anemia during pregnancy, maternal age, primi-gravida status, history of stillbirth or miscarriage, unplanned pregnancy, short inter-pregnancy spacing, chronic diseases, obesity, low socio-economic status, and substance use (10, 11, and 12). Studies conducted in various countries have consistently demonstrated the positive implication of the quality of ANC on the incidence of Low Birth Weight (LBW). For example, a study done in 42 economically disadvantaged regions of western China highlighted a clear correlation between comprehensive ANC and reduced rates of LBW, emphasizing the role of timely and targeted interventions during pregnancy (13). Similarly, in Rwanda, the integration of specific ANC components, such as nutritional counseling and infection management, has yielded promising results in mitigating the risk of LBW (14). These global insights underscore the universal nature of the relationship between ANC quality and LBW, emphasizing the necessity for a nuanced understanding of this dynamic within the Ethiopian context.

Despite progress in recent decades, Ethiopia has registered a high neonatal mortality rate, currently with 37 neonatal deaths per 1000 live births, surpassing the sub-Saharan African regional average of 29 neonatal deaths per 1000 live births (15, 16, 17). The Ethiopian Demographic Health Survey (EDHS) indicated the urgency of accelerating interventions to safeguard newborn lives through simple, cost-effective measures, emphasizing the critical role of quality care before, during, and after birth (15). In Ethiopia, achieving tangible reductions in neonatal mortality necessitates locally relevant, evidence-based interventions that are both feasible and cost-effective (18, 19). This study in

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Ethiopia, particularly in the southern region, aims to investigate the effect of quality antenatal care on birth weight. Ethiopia faces significant maternal and neonatal health challenges, and variations in healthcare access, cultural practices, and socio-economic factors may exist across regions. The southern part might have distinct healthcare infrastructure and unique challenges affecting maternal and child health outcomes. By focusing on this region, the study aims to provide insights into the specific determinants of birth weight, contributing valuable information for tailored interventions and policies. The research addresses a potential gap in understanding the relationship between antenatal care quality and birth weight, ultimately aiming to improve maternal and child health in this specific context. This study also seeks to contribute to reducing neonatal mortality by specifically examining the effects of quality Antenatal Care (ANC) on birth weight. Therefore, th a study aimed to investigate the effect of quality antenatal care on birth weight in Hossana town, Southern Ethiopia.

Method

Study Design, Area, and Population

Prospective follow-up study design was commenced from July 2017 to July 2018 in Hosanna town,Centeral Ethiopia regional state), which is located in the Southern part of Ethiopia. The SNNPR Finance and Economic Development Office projected that the total number of childbearing women in Hosanna town was 24,551. Out of this, about 4.3 % (3,646) of them are estimated to be pregnant every year.

All public health facilities which provide maternal health services were included in the study. The study of the population for this study was those mothers who have gestational age less than or equal to 16 weeks, attended ANC and followed until delivery, and who gave live birth. The inclusion criteria for this study were mothers aged 18 and above, those mothers who accepted the consent, and those mothers who gave birth at home and who visited the health facility within 24 hours. The exclusion criteria included those mothers who were unable to give verbal and written consent and unable to speak and hear.

Sample Size and Sampling Technique

The present study is part of a large follow-up study with multiple objectives. The details of the sample size collection assumptions to address all objectives are designated in other parts of the study published by Hindawi (20). For the present study a sample size was calculated with the prevalence of low birth weight among women with greater than 3 antenatal visits (21). However, having ANC follow-up cannot be a guarantee for getting acceptable standard quality ANC service, using this as a baseline data with a risk ratio of 1.5 % and 80% power,95% confidence level, the ratio of unexposed (women who received unacceptable quality ANC service) to exposed (women who received acceptable quality ANC service) is 2:1and 20% loss to follow up. The final calculated sample size was 594. However, to increase the power of the study, taking the first objective into consideration, all 859 women who gave birth to single and alive babies were included in the analysis. After being distributed proportionally among all public health facilities in the town, we employed systematic random sampling techniques (every 2) to ensure the representativeness of the sample and minimize any potential selection bias.

Data Collection Procedure

Four experienced female Bachelor of Science midwives data collectors and two female MSc midwifery nurse supervisors who were not the staff members in the study area were recruited to observe the quality of ANC service provided to pregnant women during their ANC visits using a pretested standard structured observation checklist adapted from maternal and child health integrated program(22). The data collection tool was modified based on the local situation and the guideline (focused ANC) used during pregnancy, which is currently used by the Ministry of Health of Ethiopia (23). During the first visit to ANC, an interview-administered questionnaire was also employed, which encompasses socio-demographic characteristics, obstetric history, and maternal and neonatal history. during delivery, the weight of the newborn was measured using a calibrated balanced scale and recorded to the nearest 0.1gm. If the mother did not visit health facilities for delivery, the data collectors, in collaboration with the health extension workers found in the town, were supposed to trace them at home, based on their address registered during the first visit, and bring them to start their postnatal follow up within 24 hours of delivery.

To ensure the reliability of the study investigating the impact of quality ANC on birth weight, a range of methodological approaches were implemented. Standardized data collection procedures were established to guarantee consistent measurement techniques and tool usage across all participants. Training and calibration sessions were conducted for data collectors to minimize inter-rater variability, and pretesting was carried out to identify and address potential issues with the research design or instruments before initiating the primary data collection.

Variables and Operational Definitions

Dependent Variable

The main outcome variable of this study was birth weight

Birth Weight: The first weight of the newborn, which was measured within 1 hour of birth.However, in this study, since 52% of all births were measured after 1 hour, it becomes feasible for this study to consider those birth weights measured within 24 hours of birth (24). Finally, LWB was defined as a birth weight <2.5 kg, and those 2.5 kg and above were considered normal and above normal (25).

Independent- quality of ANC service was the main exposure of interest. It was measured by the extent to which the pregnant women received the essential ANC services (appropriate history taking, physical examination, prescribing the appropriate treatments and tests and counseling related to antenatal care, technique process (how care is delivered), and interpersonal process which all encompasses the

manner in which care is delivered))in each visit using 77 items. If the essential ANC services were given, it was coded as 1; otherwise, 0; based on this idea, if women get 75% or more of the expected essential ANC services, it is called "good quality of care," and if not "poor quality" of ANC care (26,27)

The other exposure variables include socio-demographic factors, obstetric history, and medical history.

Data Analysis

Data was entered into EpiInfo version 3.5 and transferred to STATA Version 14 software for analysis. Descriptive statistics were used to describe the data. Generalized estimating equation analysis with binary response variable using a robust estimator and exchangeable working correlation matrix was carried out to control the cluster effect of the data among women who received ANC services within the same facility by the same ANC provider. Logistic regression guide, a p-value < 0.2 was considered to select eligible variables for the final model, and a p-value < 0.05 was considered to identify statistically significant predictor variables for birth weight.

Data Quality Assurance

In ensuring observer objectivity, observers underwent training to maintain neutrality, with clear guidelines provided to minimize interpretation bias. Pre-observation briefings were conducted with care providers, emphasizing the importance of maintaining their usual practices during assessments to reduce the likelihood of altered behavior. Observations spanned an extended nine-month period to normalize the presence of observers and minimize short-term alterations in behavior. Naturalistic observation integrated ANC services into everyday situations, reducing the chances of providers modifying their behavior.

Moreover, the use of standardized tools and checklists guided observations, ensuring a focus on predetermined criteria and minimizing subjective biases. Ethical guidelines were followed, with informed consent obtained from care providers to observe ANC services, maintaining ethical standards throughout.

Training for data collectors and supervisors covered the data collection instrument and observational techniques. During training, data collectors were standardized through mock observations on a standardized pregnant client. Weighing scales were regularly checked and adjusted between measurements. Supportive supervision was provided throughout the data collection period, and immediate checks for completeness and consistency were conducted by data collectors, supervisors, and the investigator after data collection.

Content validity was established by a panel of experts, including gynecologists, obstetricians, public health experts, midwives, and statisticians. The questionnaire's validity was tested after translation into Amharic, ensuring lexical equivalence through back translation. To minimize attrition, baseline information, including addresses and phone numbers, was collected and stored separately from observed data in a relational database to preserve confidentiality.

Ethical Consideration

Ethical clearance was obtained from the Research and Ethics Committee, Department of Health Studies, University of South Africa (UNISA). Approval to collect data was obtained from the SNNPR Health Bureau and Hossana City Government Health Bureau. Both ANC clients and providers were informed about the purpose of the study, and verbal and written informed consent was also obtained before data collection by explaining the goals of the study, the credibility of the researchers' confidentiality, anonymity, and the freedom to opt out of the study at any stage without negative consequences. Furthermore, report writing does not refer to a specific respondent with identifiers.

Result

Background characteristics of respondents

A total of 859 babies were included in this analysis, resulting in a response rate of 100%. With mothers aged less than 20 years, while 34(4%) of them were mothers aged 35 years and older whereas the remaining majority were mothers between 20 and 35. The mean (SD) age of mother was 25 ±4.2). Most of the mothers had attended grades 9-10, 225(26.2%), and 138(16.1%) had joined higher education colleges and universities. With regard to the occupation of the mothers, around 399(46.4%) were housewives, and more than half, 539(62.7%) of the mothers had monthly family income less than 2000 birr. The majority of the mothers, 601(70%), reside in urban areas (Table 1).

Table 1: **Socio-demographic characteristics of the mother in public health facilities of Hossana town Centeral Ethiopia regional state, administration (N = 859), July 2017 to June 2018**

S/N	Socio-demographic	Frequency	Percentage
1	Age		
	<20	154	18
	20-34	671	78
	>34	34	4
2	Marital status		
	Married	830	96.6
	Never married & divorced	29	3.5%
3	Residence		

	Urban	601	70
	Rural	258	30
4	Religion		
	Protestant	478	55.6
	Orthodox	168	19.6
	Hawariyat	106	12.3
	Muslim	104	0.3
	Catholic	3	
5	Educational status		
	Illiterate	70	8.1
	Read and write	49	5.7
	Grade 1-6	149	17.3
	Grade 7-8	128	14.9
	9-10	225	26.2
	11-12	100	11.6
	Higher level(12+)	138	16.1
6	Occupation		
	Housewife	399	46.4
	Merchant	131	15.3
	Gov't employee	131	15.3
	Daily laborer	120	14
	Others(farmer &pastor)	78	9.1
	Monthly income		
	<2000 birr	539	62.7
	≥2000 birr	320	37.3

Obstetric history

One hundred eighty (28.5%) of the mothers were primiparous, 418(66.1%) of them gave 2-4 births, and the rest, 34(5.4%), gave 5 and more births. With regard to abortion history, 458(53.3%) had an abortion history at least once, and around 236 (27.5%) had a history of stillbirth (Table 2).

Table 2: **Obstetric history of the mother in public health facilities of Hossana town** Centeral Ethiopia regional state**, administration (N = 859), July 2017 to June 2018**

S/n	Variables	Frequency	Percentage
1	Gravidity		
	1	203	23.6
	2-4	360	41.9
	>4	296	34.5
2	Parity		
	1	180	28.5
	2-4	418	66.1
	>4	34	5.4
3	Abortion history		
	No	401	46.7
	Yes	458	53.3
4	History of Stillbirth		
	No	623	72.5
	Yes	236	27.5
5	History of neonatal death		
	No	650	75.7
	Yes	209	24.3
6	History of premature birth		
	No	719	83.7
	Yes	140	16.3

Previous medical history and Body mass index

One hundred twenty-nine (15%) of the mothers had greater than thirty body mass index during the first trimester. Additionally, 69(8%), 60(7%), 9(1%), and 9(1%) of mothers had pre-existing diabetic mellitus, hypertension, cardiac case, and history of mental health problems, respectively (Figure 1).

Magnitude of low birth weight

The incidence of LBW among newborn babies in Hossana town public health facilities was 17.9% (95%CI: 15.5%-20.6%) Figure 2.

Predictors of low birth eight

In the GEE multivariate logistic regression analysis, controlling potential confounders, maternal age, gestational age, parity ,presence of a previous history of abortion, and quality of ANC were found to be significant predictors of LBW.

The variables examined in the study encompass ANC quality, residence, age, occupation, marital status, educational status, gravidity, parity, history of abortion, history of premature delivery, history of stillbirth, gestational age, pre-existing diabetes mellitus (DM), and BMI at the first ANC visit.

Noteworthy findings include a significantly reduced risk of LBW associated with good-quality ANC (AOR: 0.02, 95% CI: 0.005-0.054). Younger age, particularly below 20 years, was linked to a lower risk of LBW (AOR: 0.04, 95% CI: 0.013-0.167). Furthermore, factors such as lower gravidity (1, AOR: 0.98, 95% CI: 0.917-1.054) and the absence of a history of abortion (AOR: 0.34, 95% CI: 0.165-0.694) were linked to a decreased risk of LBW. On the other hand, higher parity (1, AOR: 1.4, 95% CI: 1.170-1.569), gestational age less than 37 weeks (AOR: 0.01, 95% CI: 0.001-0.054), and a BMI over 30 at the first ANC visit (AOR: 0.47, 95% CI: 0.211-1.031) were associated with an increased risk of LBW. Table 3).

Table 3: **Multivariable ANC quality and low birth weight among the study participants in public health facilities of Hossana town Centeral Ethiopia regional state Ethiopia, administration (N = 859), July 2017 to June 2018**

S/N	Variable	LBW		COR(95%CI)	AOR(95%CI)
		Yes	NO		
1	Quality ANC				
	Poor quality	149	411	0.78(0.753,0.809)*	0.02(0.005,0.054)*
	Good quality	5	293	1	1
2	Residence				
	Urban	98	501	1.1(0.994,1.116)*	0.99(0.928,1.069)
	Rural	56	204	1	1
3	Age				
	<20	49	103	0.79(0.702,0.902)*	0.04(0.013,0.167)*
	20-34	102	573	0.94(0.850,1.048)	0.86(0.773,0.951)
	>34	3	29	1	1
4	Occupation				
	Housewife	68	332	0.99(0.903,1.081)	0.92(0.826,1.018)
	Merchant	22	105	0.98(0.886,1.094)	0.98(0.872,1.091)
	Daily labourer	42	80	0.82(0.738,0.934)*	0.83(0.725,0.952)
	Gov. employee	10	124	1.1(0.989,1.193)*	0.99(0.879,1.135)
	Others*	12	64	1	1
5	Marital status				
	Never married divorced	6	26	0.99(0.864,1.138)	
	Married	148	679	1	
6	Educational status				
	Illiterate	27	41	0.75(0.661,0.852)*	0.92(0.813,1.048)
	Read and write	7	42	0.97(0.867,1.081)	1.1(0.994,1.281)
	Grade 1-6	19	131	0.98(0.914,1.058)	1.1(1.028,1.268)
	Grade 7-8	18	110	0.97(0.897,1.049)	1.1(0.91,1.225)
	Grade 9-10	37	186	0.95(0.881,1.015)*	1(0.938,1.162)
	Grade 11-12	30	66	0.82(0.735,0.908)*	0.87(0.763,1.006)
	Higher level(12+)	16	129	1	1
8	Gravidity				
	1	39	164	0.98(0.917,1.054)	
	2-4	64	296	0.99(0.943,1.059)	
	>4	52	245	1	
9	Parity				
	1	23	159	1.3(1.089,1.532)*	1.4(1.170,1.569)
	2-4	71	347	1.2(1.046,1.462)*	1.2(1.064,1.413)
	>4	13	21	1	1
10	History of abortion				
	No	84	316	0.94(0.897,0.994)*	0.34(0.165,0.694)*
	Yes	70	389	1	1
11	History of premature delivery				
	No	127	602	1(0.959,1.115)	

	Yes	27	103	1	
12	History of Stillbirth				
	No	113	512	0.99(0.939,1.053)	
	Yes	41	193	1	
13	Gestational age				
	< 37weeks	24	1	0.008(0.001,0.057)*	0.01(0.001,0.054)**
	≥37weeks	130	704	1	1
14	Pre-existing DM				
	No	147	646	0.52(0.233,1.165)*	0.93(0.381,2.320)
	Yes	7	59	1	1
15	BMI at first visit				
	≤30	140	596	0.55(0.304,0.983)*	0.47(0.211,1.031)
	>30	14	109	1	1

N.B. 1 = Reference Category, ** = Significant at p-value <0.05 in multivariate analysis,* Significant at p-value <0.2 in bivariate analysis, COR: Crude Odds Ratio, AOR: Adjusted Odds Ratio, CI: Confidence interval.

Discussion

The findings of the current study revealed that 17.9% (95% CI: 15.5% −20.6%) of the live births were low birth weight; this is consistent with a study done in Kambata Tembaro zone Southern Ethiopia in which 18% of the live birth were reported to be low birth weight (28). This finding is also consistent with the systematic review and meta-analysis study conducted in Ethiopia, in which the pooled prevalence of LBW was 17.3 %(29.). This study is higher compared to the study conducted in the Amahara region of Ethiopia which has a prevalence of 15.6%(30). Moreover, This study was also higher compared to the study conducted in Danglila Amhara Region Ethiopia which was 10.3%(31), with the study conducted in Debre Tabor Hospital, Amhara Region, Ethiopia, which was 12%(32), with the findings in Addis Ababa public hospitals which was 13.03% (33)and with the study conducted in Jimma University Medical Center (JUMC), Jimma Zone, Oromia Region, and South–Western Ethiopia which was 6.7% (34). The difference might be attributed to various factors such as varied demographic characteristics, socio-economic status, and health behaviors among study populations that contributed to LBW rate differences. Temporal variations, changes in healthcare infrastructure, and evolving access to maternal care services may also impact LBW rates over time. Disparities in nutritional status, dietary patterns, socio-economic conditions, and cultural practices related to pregnancy might have influenced fetal growth and LBW prevalence. Variances in the quality of maternal care services, including antenatal care and skilled attendance during childbirth, might contribute to the observed discrepancies. Methodological differences in study design, sample size, and data analysis methods might also influence the reported LBW rates. The present study is also higher compared to the study conducted in Sub Saharan Africa, which was 9.76 %(35), and with the study done in Jordan f(Jordan Population and Family Health Survey), which was 13.8 %(36). These differences may occur as a result of the differences in study settings and the variation in the methodology.

According to IOM recommendation, advice is supposed to be given to mothers during pregnancy pertaining to nutrition, which is considered to be the most essential strategy to improve birth outcomes like birth weight (37, 38 & 39).

It is noted in this study that the quality of ANC and BW was positively associated. This means good quality of ANC significantly reduced the risk of LBW (AOR: 0.02, 95% CI: 0.005-0.054). (This finding was also in line with the study conducted in public hospitals of Addis Ababa, Ethiopia, and for under five children in Ethiopia (40, 41). Furthermore, this study is also consistent with studies conducted in rural hospitals in Nigeria and middle-income countries (42, 43). This could be owing to the systematic review of randomized clinical trials study conducted on nine studies, which concluded that educational practice during the ANC period contributed to favorable obstetric outcomes like birth weight (44).

The findings of this study are also concurrent with the study conducted in 42 poor countries of West China (14) and with the study conducted in India, which indicated that the risk of delivering LBW was five times higher in women exposed to inadequate ANC (454). According to the study done in Dhaka City, Bangladesh, it was reported that quality ANC was strongly related to the low birth weight of neonates (46). Moreover, it is similar to the national survey study conducted in Bangladesh, which showed that mothers who received poor quality of ANC were more likely to deliver low birth babies compared to mothers who had received good quality of ANC (47).

In addition, this study showed that LBW was significantly associated with gestational age. This is in line with the study conducted in Dangla Amhara region, Ethiopia (31, 48, and 49). This finding underscores the importance of addressing maternal health holistically in prenatal care programs. It emphasizes the need for tailored interventions that consider the nutritional status of pregnant women, promoting healthy weight management and overall well-being. Strategies aimed at preventing and managing maternal obesity may not only contribute to reducing the risk of LBW but also have broader implications for the long-term health trajectories of both mothers and their offspring.

Limitation

This study might have been subjected to observer bias despite the fact that stringent measures were taken to ensure the collected data. It might have also generated an exaggerated figure of quality because of the care provider's awareness of being observed. Moreover, this study might have inflated the number of low birth weights as 52 % of the birth weight was measured after 1 hour / within 24 hours of birth.

Conclusion and Recommendations

The incidence of low birth weight in public health facilities of the study area was high and adherence to the quality of ANC service had a great role in reducing low birth weight of the newborn. Moreover, being an urban dweller, income, preterm delivery, and history of abortion were the predictors associated with low birth weight of the baby. Hence, the local authorities at each level of health sector and the nongovernmental organizations should work harmoniously to improve maternal and child health needs, and further strategies should be developed to improve the quality of ANC and its outcome.

Declaration

Abbreviations:

ANC, Antenatal Care;
AOR, Adjusted Odds Ratio;
BPCRP, Birth Preparedness, and Complication Readiness Plan;
CI, Confidence Interval;
COR, Crude Odds Ratio;
FANC, Focused Antenatal Care;
LBW: Low Birth weight
GEE, Generalized Estimating Equation;
SPSS, Statistical Packages for Social Sciences;
VDRL, Venereal Disease Research Laboratory
WHO: World Health Organization
Y12HMC: Yekatit 12 Hospital Medical College.

Competing interests:

The authors declare that they have no financial or non-financial competing interests (political, personal, religious, ideological, academic, intellectual, commercial, or any other).

Accessibility of data and materials:

The result of this research was extracted from the data gathered and analyzed based on the stated methods and materials. Original data and other supplementary data that support this research project can be made accessible if asked.

Ethical Approval

The study protocol was performed in accordance with the ethics principles. Approval of the institution review board of UNISA was obtained, and approval to collect data was obtained from Southern Nations and Nationalities of Peoples' Region, Ethiopia, Health Bureau, and Hossana City Government Health Bureau. The objective and purpose of the study were clearly explained to the study subjects to obtain written informed consent before data collection. Participants were also informed that they could discontinue or decline to participate in the study at any time. Confidentiality of the information was maintained, and the data was recorded anonymously throughout the study.

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Authors' Contributions:

All authors contributed to data analysis, drafting or revising the article, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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Reference

1. World Health Organization. International Statistical Classification of Diseases and Related Health Problems-10. Disorders related to short gestation and low birth weight are not elsewhere classified. 2016.
2. UNICEF, WHO. Low Birthweight Estimates: Level and Trends 2000–2015. Geneva, Switzerland: WHO Publications; 2019. [Online] Available from: http://www.who.int/nutrition
3. World Health Organization. World Health Assembly Global Nutrition Targets 2025: Low Birth Weight Policy Brief. Geneva, Switzerland: World Health Organization; 2014. [Online] Available from: http://www.who.int/nutrition/topics/globaltargets_stunting_policybrief
4. Vilanova CS, Hirakata VN, de Souza Buriol VC, et al. The relationship between the different low birth weight strata of newborns with infant mortality and the influence of the main health determinants in the extreme south of Brazil. Popul Health Metrics. 2019;17:15. doi:10.1186/s12963-019-0195-7.
5. Brady JM, Poindexter BB. Extremely and Very Preterm Infants. In: Kliegman RM, St Geme III JW, Blum NJ, Tasker RC, Shah SS, Wilson KM, Behrman RE, eds. Nelson Textbook of Pediatrics. 21st ed. Philadelphia: Elsevier; 2020. p. 902-905.
6. World Health Organization. Global Nutrition Targets 2025. Low Birth Weight Policy Brief. World Health Organization; 2014.
7. Demelash H, Motbainor A, Nigatu A, Ashaw K, Melese A. Risk factors for LBW in Bale zone hospitals, South-East Ethiopia: A case-control study. BMC Pregnancy and Childbirth. 2015;15:264. DOI: 10.1186/s12884-015-0677-y.

8. Hee Chung E, Chou J, Brown KA. Neurodevelopmental outcomes of preterm infants: a recent literature review. Transl Pediatr. 2020 Feb;9(Suppl 1):S3-S8. doi: 10.21037/tp.2019.09.10. PMID: 32206579; PMCID: PMC7082240.
9. Cutland CL, Lackritz EM, Mallett-Moore T, Bardají A, Chandrasekaran R, Lahariya C, Nisar MI, Tapia MD, Pathirana J, Kochhar S, Muñoz FM; Brighton Collaboration Low Birth Weight Working Group. Low birth weight: Case definition & guidelines for data collection, analysis, and presentation of maternal immunization safety data. Vaccine. 2017 Dec 4;35(48 Pt A):6492-6500. doi: 10.1016/j.vaccine.2017.01.049. PMID: 29150054; PMCID: PMC5710991.
10. Cates JE, Unger HW, Briand V, Fievet N, Valea I, Tinto H, et al. Malaria, malnutrition, and birthweight: A meta-analysis using individual participant data. PLoS Med. 2017 Aug;14(8):e1002373. doi: 10.1371/journal.pmed.1002373.
11. Alamneh AA, Endris BS, Gebreyesus SH. Caffeine, alcohol, khat, and tobacco use during pregnancy in Butajira, South Central Ethiopia. PLoS ONE. 2020 May 14;15(5):e0232712. doi: 10.1371/journal.pone.0232712.
12. Huss B. Well-Being Before and After Pregnancy Termination: The Consequences of Abortion and Miscarriage on Satisfaction With Various Domains of Life. J Happiness Stud. 2021;22:2803–2828. doi: 10.1007/s10902-020-00350-5.
13. Uwimana G, Elhoumed M, Gebremedhin MA, et al. Association between quality antenatal care and low birth weight in Rwanda: a cross-sectional study design using the Rwanda demographic and health surveys data. BMC Health Serv Res. 2023;23:558. doi: 10.1186/s12913-023-09482-9.
14. Zhou H, Wang A, Huang X, Guo S, Yang Y, et al. Quality antenatal care protects against low birth weight in 42 poor countries of Western China. PLOS ONE. 2019;14(1):e0210393. doi: 10.1371/journal.pone.0210393.
15. Central Statistical Agency [Ethiopia] and ICF International. Ethiopia Demographic and Health Survey 2011. Addis Ababa and Maryland: Central Statistical Agency and ICF International; 2012.
16. Afolabi B.M. Sub-Sahara African Neonates Ghosts to Statistics. J Neonatal Biol. 2017;6(1):1-3.
17. United Nations Children's Fund (UNICEF). UNICEF Annual Report: 2012. 1-44. 978-92-806-4693-1.
18. Mekonnen, Y., Tensou, B. Telake, D.S. Degefie, T. & Bekele, A. Neonatal mortality in Ethiopia: trends and determinants. BMC Public Health,2013. 13:483:11-14.
19. Wardlaw T, You D, Hug L, Amouzou A, Newby H. UNICEF Report: Enormous progress in child survival but greater focus on newborns urgently needed. Reprod Health. 2014;11(82):110.
20. Trhas Tadesse Berehe, Lebitsi Maud Modibia. Assessment of Quality of Antenatal Care Services and Its Determinant Factors in Public Health Facilities of Hossana Town, Hadiya Zone, Southern Ethiopia: A Longitudinal Study. Adv Public Health. 2020;2020:5436324. doi: 10.1155/2020/5436324.
21. Adane AA, Ayele TA, Ararsa LG, et al. Adverse birth outcomes among deliveries at Gondar University Hospital, Northwest Ethiopia. BMC Pregnancy Childbirth. 2014;14:90. doi: 10.1186/1471-2393-14-90.
22. United States Agency for International Development (USAID). Quality of Antenatal and Delivery Care Services in Six Countries in Sub-Saharan Africa. USAID, Washington, DC, USA; 2012.
23. Federal Republic of Ethiopia Ministry of Health. Management protocol on selected obstetric topics. 2010.
24. Jember DA, Menji ZA, Yitayew YA. Low Birth Weight and Associated Factors Among Newborn Babies in Health Institutions in Dessie, Amhara, Ethiopia. J Multidiscip Healthc. 2020;13:1839-1848. doi: 10.2147/JMDH.S285055.
25. Cutland CL, Lackritz EM, Mallett-Moore T, et al. Low birth weight: case definition & guidelines for data collection, analysis, and presentation of maternal immunization safety data. Vaccine. 2017;35(48):6492.
26. Abate TM, Salgedo BS, Bayou NB. Evaluation of the quality of antenatal care (ANC) service at Higher 2 Health Center in Jimma, Southwest Ethiopia. Open Access Library Journal. 2015;2:e1398:1–e1398:9.
27. Servan-Mori E, Sosa-Rubí SG, Najera-Leon E, Darney BG. Timeliness, frequency and content of antenatal care: which is most important to reducing indigenous disparities in birth weight in Mexico? Health Policy and Planning. 2016;31(4):444–453.
28. Alemu A, et al. Low birth weight: prevalence and associated factors among newborns at hospitals in Kambata-Tembaro zone, southern Ethiopia 2018. Pan Afr Med J. 2019;34:68. doi: 10.11604/pamj.2019.34.68.18234.
29. Endalamaw A, Engeda EH, Ekubagewargies DT, et al. Low birth weight and its associated factors in Ethiopia: a systematic review and meta-analysis. Ital J Pediatr. 2018;44:141. doi: 10.1186/s13052-018-0586-6.
30. Jember DA, Menji ZA, Yitayew YA. Low Birth Weight and Associated Factors Among Newborn Babies in Health Institutions in Dessie, Amhara, Ethiopia. J Multidiscip Healthc. 2020;13:1839-1848. doi: 10.2147/JMDH.S285055.
31. Talie A, Taddele M, Alemayehu M. Magnitude of Low Birth Weight and

Associated Factors among Newborns Delivered in Dangla Primary Hospital, Amhara Regional State, Northwest Ethiopia, 2017. J Pregnancy. 2019;2019:3587239. doi: 10.1155/2019/3587239.

32. Mekie M, Taklual W. Magnitude of low birth weight and maternal risk factors among women who delivered in Debre Tabor Hospital, Amhara Region, Ethiopia: a facility-based cross-sectional study. Ital J Pediatr. 2019;45:86. doi: 10.1186/s13052-019-0683-1.
33. Tadesse T, Abebe M, Molla W, Mahamed AA, Mebratu A. Magnitude and associated factors of low birth weight among term newborns delivered in Addis Ababa public hospitals, Ethiopia, 2021. J Obstet Gynaecol. 2023;43(1). doi: 10.1080/01443615.2022.2114332.
34. Seid SS, Dinsa A. Assessment of Low Birth Weight and Associated Factor among Neonate Delivered at Jimma University Medical Center (JUMC), Jimma Zone, Oromia Region, South–Western Ethiopia. ARC J Nurs Healthc. 2018;4(3):20-24.
35. Tessema ZT, Tamirat KS, Teshale AB, Tesema GA. Prevalence of low birth weight and its associated factor at birth in Sub-Saharan Africa: A generalized linear mixed model. PLOS ONE. 2021;16(3):e0248417. doi: 10.1371/journal.pone.0248417.
36. Islam MM, Ababneh F, Akter T, Khan HR. Prevalence and risk factors for low birth weight in Jordan and its association with under-five mortality: a population-based analysis. East Mediterr Health J. 2020;26(10):1273–1284. doi: 10.26719/emhj.20.096.
37. Nana A, Zema T. Dietary practices and associated factors during pregnancy in northwestern Ethiopia. BMC Pregnancy Childbirth. 2018;18:183. doi: 10.1186/s12884-018-1822-1.
38. Mohamed HJJ, Loy SL, Mitra AK, et al. Maternal diet, nutritional status, and infant birth weight in Malaysia: a scoping review. BMC Pregnancy Childbirth. 2022;22:294. doi: 10.1186/s12884-022-04616-z.
39. Madzorera I, Isanaka S, Wang M, Msamanga GI, Urassa W, Hertzmark E, Duggan C, Fawzi WW. Maternal dietary diversity and dietary quality scores in relation to adverse birth outcomes in Tanzanian women. Am J Clin Nutr. 2020 Sep 1;112(3):695-706. doi: 10.1093/ajcn/nqaa172. PMID: 32651998; PMCID: PMC7458779.
40. Baye Mulu G, Gebremichael B, Wondwossen Desta K, Adimasu Kebede M, Asmare Aynalem Y, Bimirew Getahun M. Determinants of Low Birth Weight Among Newborns Delivered in Public Hospitals in Addis Ababa, Ethiopia: Case-Control Study. Pediatr Health Med Ther. 2020 Mar 24;11:119-126. doi: 10.2147/PHMT.S246008. PMID: 32273790; PMCID: PMC7102875.
41. Bekalo DB, Nigussie ZM, Yimer BB, Anteneh ZAA. Modeling Determinants of Low Birth Weight for Under Five-Children in Ethiopia. Ann Data Sci. 2021;8(3):475-496.
42. Chingle MP, Bupwatda Jonah M, Zoakah AI. Antenatal Care and Pregnancy Outcomes among Mothers Who Delivered in a Rural Hospital in Nigeria. Int J Innov Res Dev. 2017;6(3):7-16.
43. Bellizzi S, Padrini S. Quality utilization of antenatal care and low birth weight: evidence from 18 demographic health surveys. East Mediterr Health J. 2020 Nov 11;26(11):1381-1387. doi: 10.26719/emhj.20.055. PMID: 33226106.
44. Silva EP, Lima RT, Osório MM. Impact of educational strategies in low-risk prenatal care: systematic review of randomized clinical trials. Cien Saude Colet. 2016 Sep;21(9):2935-48. doi: 10.1590/1413-81232015219.01602015. PMID: 27653079. [English, Portuguese]
45. Mumbare SS, Maindarkar G, Darade R, et al. Maternal risk factors associated with term low birth weight neonates: A matched-pair case-control study. Indian Pediatr. 2012;49:25–28. doi: 10.1007/s13312-012-0010-z.
46. Howlader MSU, Hossain MS. Relationship among Antenatal Care Practices and Socio-economic Factors with Birth Weight of Neonates in Dhaka City. J Gynecol Women's Health. 2018;8(2):555735. doi: 10.19080/JGWH.2018.08.555735.
47. Khan JR, Islam MM, Awan N, et al. Analysis of low birth weight and its co-variants in Bangladesh based on a sub-sample from nationally representative survey. BMC Pediatr. 2018;18:100. doi: 10.1186/s12887-018-1068-0.
48. Ketema DB, Leshargie CT, Kibret GD, et al. Effects of maternal education on birth preparedness and complication readiness among Ethiopian pregnant women: a systematic review and meta-analysis. BMC Pregnancy Childbirth. 2020;20:149. doi: 10.1186/s12884-020-2812-7.
49. Hodgins S, Tielsch J, Rankin K, Robinson A, Kearns A, Caglia J. A New Look at Care in Pregnancy: Simple, Effective Interventions for Neglected Populations. PLoS One. 2016 Aug 18;11(8):e0160562. doi: 10.1371/journal.pone.0160562. PMID: 27537281; PMCID: PMC4990268.