



Article Original

Factors Associated with Low Birth Weight of Children in the Communities of Bamako (Mali)

Facteurs associés au faible poids de naissance des enfants dans les communes de Bamako au Mali

Ghislain G. Poda^{1,3*}, Hawa Kone¹, Hamsatou Cisse², Fatoumata Traore³, Niani Mounkoro⁴, Djelika Diallo³, Prisca Poda⁵

¹ University Pedagogical Institute, Public Health Department, Bamako – Mali

² Teaching Hospital of Kati, Bamako – Mali

³ Higher Institute of Public Health, Public Health Department, Bamako, Mali

⁴ Department of Gynecology and Obstetrics Teaching Hospital, Gabriel I Touré, Bamako, Mali

⁵ African Center for Higher Studies in Management, Dakar – Senegal

Corresponding author: Dr Ghislain G Poda, PhD- Institute of Public Health, Public Health Department, Bamako, Mali- Email: podaghis@yahoo.fr ; Phone +22367403270

Keywords: Low birth weight, antenatal care, Bamako, Mali

Mots-clés : Faible poids à la naissance, consultation prénatale, Bamako, Mali

RÉSUMÉ

Introduction. Low birth weight continues to be a major global public health problem and is associated with a range of short- and long-term consequences in both developing and developed countries. The objective of the work was to assess the factors associated with low birth weight in the communities of Bamako. **Methodology.** Quantitative, descriptive, and cross-sectional study using a questionnaire to assess the associated factors of low birth weight among children in the communities of Bamako. The population of this study concerned mother-newborn couples in Bamako communes. **Results.** A total of 502 mother-child couples were included in this study. The prevalence of low birth weight was 14.5%. All mothers had benefited from antenatal care, and more than half of the mothers received 4 or more antenatal care during their last pregnancy. Diseases like malaria, urogenital infection, bleeding were declared by mothers. We found that newborn sex ($P < 0.001$), maternal age ($P < 0.001$), gravidity ($P = 0.04$) and nutritional status ($P = 0.04$) were significantly associated with low birth weight. **Conclusion.** There is a statistically significant association between low birth weight and newborn sex, maternal age, gravidity and nutritional status. The results of our study highlight the need for maternal health interventions to improve newborn health.

ABSTRACT

Introduction. L'insuffisance pondérale à la naissance continue d'être un important problème de santé publique à l'échelle mondiale et est associée à une série de conséquences à court et à long terme, aussi bien dans les pays en voie de développement que dans les pays développés. L'objectif de ce travail est d'évaluer les facteurs associés au faible poids de naissance dans les communes de Bamako au Mali. **Méthodologie.** Étude quantitative, descriptive et transversale utilisant un questionnaire pour évaluer les facteurs associés du faible poids de naissance chez les enfants dans les communes de Bamako au Mali. La population de cette étude a concerné les couples mères-nouveaux nés dans les communes de Bamako, au Mali. **Résultats.** Au total 502 couples mère-enfant ont été inclus dans cette étude. La prévalence du faible poids de naissance était de 14,5%. Toutes les mères avaient bénéficié de consultation prénatale et plus de la moitié des mères avaient bénéficiées de 4 consultations prénatales ou plus lors de leur dernière grossesse. Des pathologies comme le paludisme, l'infection uro-génitale, le saignement ont été expérimentées par les mères. Cette étude a trouvé que le sexe du nouveau-né ($P < 0,001$), l'âge des mères ($P < 0,001$), la gestité ($P = 0,04$) et l'IMC ($P = 0,04$) étaient significativement associés au faible de poids de naissance. **Conclusion.** Le sexe de l'enfant, l'âge de la mère, la gestité et l'état nutritionnel (IMC) sont significativement associés au faible poids de naissance. Les résultats de cette étude mettent en évidence la nécessité d'interventions de santé maternelle pour améliorer la santé des nouveau-nés.

INTRODUCTION

Low birth weight continues to be a major global public health problem and is associated with a range of short- and long-term consequences in both developing and developed countries. Globally, an estimated 15-20% of all births are low birth weight, accounting for more than 20 million births per year (WHO, 2022). Babies with low

birth weight are more likely to die in their first month of life, and those who survive face lifelong consequences, including a higher risk of stunting (Christian et al., 2013), lower IQ (Gu et al., 2017), and chronic diseases in adulthood such as obesity and diabetes (Jornayvaz et al., 2016).

More than 80% of the 2.5 million newborns who die each year worldwide are low birth weight because they are preterm at birth or small at gestational age (WHO, 2022). In Mali, despite the successes achieved in recent years in the health sector, the health situation remains characterized by persistently high morbidity and mortality, particularly for mothers and children. Around 54 per 1000 cases of infant deaths were recorded at the end of 2018 (DHSM VI, 2018). In addition, the Ministry of Health through DHIS2 reports that 16613 and 18402 cases of low birth weight are recorded in 2019 and 2021, respectively (Ministry of Health of Mali, 2021). This situation reflects a real concern and concern for Mali, like all other countries, which would like to contribute to the achievement of the Sustainable Development Goals. It is in this sense that this study would like to evaluate the factors associated with the low birth weight of children in the health districts of Bamako in Mali.

This study would contribute to the achievement of Sustainable Development Goal 3 "Ensure healthy lives and promote well-being for all at all ages" through target 3.2 By 2030, eliminate preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to no more than 12 per 1,000 live births and child mortality of all children of less than 5 years to 25 per 1,000 live births or less (United Nations Development Program, 2019)

MATERIALS & METHODS

Study design and setting

This was a quantitative, descriptive, and cross-sectional study using a questionnaire to assess factors associated with low birth weight in children in the communes of Bamako in Mali. Bamako is the capital and largest city of Mali. In Bamako, each commune is equivalent to one health district. There are therefore six health districts throughout the city and each neighborhood corresponds to a health area. This study used a questionnaire adapted from the results of previous studies (Sema et al., 2019; Hidalgo-Lopezosa et al., 2019) to achieve the objective of the study. The questionnaire consisted of four parts:

1. the socio-demographic characteristics of newborns and their mothers,
2. characteristics related to pregnancy and childbirth,
3. Habits and lifestyle
4. anthropometric data of mother-newborn pairs (weight, height).

Definition of low birth weight

The main outcome variable of this study was birth weight. Data on children's birth weight were collected from mothers who gave birth within a week before the survey either by accessing birth weight through record review or by the mother's report by recalling the measured weight of the child at birth.

Low birth weight has been defined by WHO as weight at birth of < 2500 grams (WHO, 2019).

According to the WHO we have:

- Low birth weight: weight less than 2,500 g (up to and including 2,499 g).
- Very low birth weight: less than 1,500 g (up to and including 1,499 g).

- Extremely low birth weight: less than 1,000 g (up to and including 999 g).

Target population

The population of this study concerned mother-newborn pairs in the communes of Bamako, Mali. At the end of 2021, 3151 cases of low birth weight were reported in the six communes of Bamako. The sample size estimate was calculated using Epi Info version 7.2. The following parameters were included: a confidence level of 95%, a margin error of 5%, and an expected frequency of 50%. Out of 3151 cases of low birthweight, the required sample is 343 participants, but this study included 502 newborns.

Data collection process

Data collection was carried out using a questionnaire A pilot study was conducted with 10% of the sample. The objective of the pilot study was to assess feasibility, time, cost, and adverse effects, and to improve the design of the study prior to conducting a large-scale research project. Data from the pilot study were used to determine the reliability of the questionnaire prior to data collection. Data collection was conducted in French from May to July 2022.

Ethical considerations

This study received approval from the National Institute for Public Health Research ethics committee of Mali. The approval was presented to the various center technical directors before data collection. Also, a written consent form was obtained from each participant before data collection. The data of the participants will be kept confidential.

Data analysis

Data analysis was performed using SPSS 22 version software (SPSS Inc., Chicago, IL). Data analysis included descriptive statistics to estimate the mean and deviation type, percentage (%), and frequency. The chi-square test determined the distribution between the variables. The level of significance considered will be set at $P < 0.05$ for all analyzes.

RESULTS

Anthropometric measurements

A total of 502 mother-child pairs were included in this study. The weight of newborns ranged from 1100 g to 4100 g with an average of 2986 g. The average age of mothers is 27.35 years. Details of anthropometric measurements are summarized in Table 1.

Table 1. Anthropometric measurements of newborns and their mothers

	Min	Max	Average	STD
Newborn weight (g)	1100	4100	2986	485
Age of mother (years)	16	44	27,35	6,0
Weight of mothers (kg)	44,0	107,0	65,122	9,9
Height of mothers (cm)	140	188	164	0,1
BMI Kg/m²	15,2	38,9	24,1	3,3

The prevalence of low birth weight in the six communes of Bamako in Mali was 14.5%

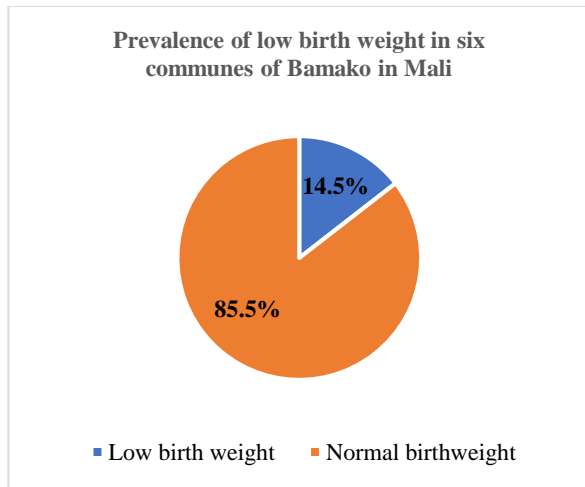


Fig 1. Prevalence of low birth weight of new babies

Factors associated with low birth weight

Sociodemographic characteristics such as newborn sex ($P < 0.001$), maternal age ($P < 0.001$), occupation ($P = 0.04$) were significantly associated with low birth weight (Table 2).

Items	Birth weight		P-value
	Low weight N (%)	Normal weight N (%)	
Sex of newborn			< 0,001
Girl	33 (45,2)	238 (55,5)	
Boy	40 (54,8)	191 (44,5)	
Age of mothers (years)			< 0,001
15-18	16 (21,9)	21 (4,9)	
19-34	52 (71,2)	345 (80,4)	
35-48	5 (6,8)	63 (14,7)	
Level of education			0,62
Out of school	36 (49,3)	227 (52,9)	
Primary	22 (30,1)	106 (24,7)	
Secondary and above	15 (20,5)	96 (22,4)	
Profession			0,05
Unemployed	46 (63,0)	274 (63,9)	
Employed	27 (36,9)	155 (36,1)	
Marital status			0,13
Bachelor	6 (8,2)	19 (4,4)	
Bride	67 (91,8)	410 (95,6)	
Monthly income			0,33
Less than 50,000	56 (76,7)	316 (73,7)	
50,000 to 100,000	5 (6,8)	53 (12,4)	
101,000 and over	12 (16,4)	60 (14,0)	

In terms of health characteristics, gravidity ($P = 0.04$), number of sleeping hours ($P = 0.02$) and BMI ($P = 0.04$)

were significantly associated with low birth weight (Table 3).

Items	Birth weight		P
	Low weight N (%)	Normal weight N (%)	
Parity			0,21
1 delivery	22 (30,1)	107 (24,9)	
2-3 deliveries	33 (45,2)	188 (43,8)	
4 deliveries or more	18 (24,7)	134 (31,2)	
Gravidity			0,04
1 pregnancy	21 (28,8)	85 (19,8)	
2-3 pregnancies	33 (45,2)	193 (45,0)	
4 or more pregnancies	19 (26,0)	151 (35,2)	
Number of ANC's			0,69
1 to 3 ANC's	32 (43,8)	197 (45,9)	
4 ANC and more	41 (56,2)	232 (54,1)	
Number of sleeping hours			0,02
4 to 6 hours	22 (30,1)	92 (21,4)	
7 to 8 hours	51 (69,9)	337 (78,5)	
BMI of mothers Kg/m²			0,04
Inf. 18,5	7 (9,6)	14 (3,3)	
18,5-24,9	45 (61,6)	271 (63,2)	
25.0 and over	21 (28,8)	144 (33,6)	

DISCUSSION

This study reported that the prevalence of low birth weight was 14.5%. The results of our study are slightly lower than the global LBW prevalence, which varies between 15 and 20% worldwide (WHO, 2022). Our results are also better than a previous study conducted in the town of Dire Dawa in eastern Ethiopia where the prevalence of low birth weight was 21% (Sema et al., 2019). Low birth weight is one of the main determinants of perinatal survival, infant morbidity and mortality, and the risk of developmental disorders and disease in future lives. A previous study based on secondary data sources from the Demographic and Health Survey (DHS) of 35 sub-Saharan countries reports a lower prevalence than ours. The pooled prevalence of low birth weight of newborns measured at birth in sub-Saharan Africa is 9.76% with (95% CI: 9.63% to 9.89%) (Tessema et al., 2021). This situation could be explained by the fact that since 2020, Mali, in addition to COVID-19, has been experiencing security and food crises. This figure is confirmed by the results of an earlier study conducted in selected African countries that reported levels of LBW prevalence in Burkina Faso, Ghana, Malawi, Senegal, and Uganda of 13.4%, 10.2%, 12.1%, 15.7%, and 10%, respectively (He et al., 2018).

This study reported that more than half of the mothers were illiterate. A previous study conducted in several low- and middle-income countries reports that higher levels of education are a protective factor in low-birth birth (Godah et al., 2021). All mothers had antenatal care (ANC) and more than half achieved appropriate ANC during their last pregnancy. Adequate coverage of antenatal care during

pregnancy is beneficial in preventing low birth weight in low- and middle-income countries (Bellizzi et al., 2020). Existing antenatal care services accessible in low- and middle-income countries are directly associated with better birth outcomes and longer-term reductions in child mortality and malnutrition (Kuhnt et al., 2017). The acceptable prevalence of LBW in the six communes of Bamako could be explained by the fact that all women have experimented with ANC. Our results are confirmed by the findings of a previous study that shows a statistically significant association between antenatal care and low birth weight in 10 countries in sub-Saharan Africa. Women with eight or more antenatal visits were less likely to give birth to low-birth-weight children. Multiple antenatal visits may be a protective factor against low birth weight (Weyori et al., 2022).

This study reported that malaria was the pathology experienced by mothers during their last pregnancy. Malaria infection during pregnancy remains a public health concern as it could affect both the mother and the newborn. The World Health Organization (WHO) recommends intermittent preventive treatment with ≥ 3 doses of Sulfadoxine-pyrimethamine during pregnancy in areas of moderate and high malaria transmission in Africa (Bakken et al., 2021). Maternal nutrition during pregnancy is a key factor influencing birth outcomes. This study reported that most mothers ate breakfast and had a normal body mass index reflecting good nutritional status. The acceptable prevalence of LBW in our study could be explained by the good nutritional status of mothers. This figure is confirmed by the results of previous studies whose results showed that low maternal dietary diversity during pregnancy may be associated with the risk of low birth weight, more specifically in developing countries. This study highlighted some potential factors that can impact birth weight. Maternal age (Jeena et al., 2020) and sex of the newborn were significantly associated with low birth weight in this study. This figure is confirmed by a previous study which reported that the age of the mother (< 30 and ≥ 35 years), education (lower), unplanned pregnancy, household property situation (the poorest), inbreeding, female sex, during pregnancy were significant risk factors for low birth weight (Islam et al. 2020). Multiple pregnancies (Kargbo et al., 2021) and suboptimal attendance at antenatal care (Bater et al., 2020) have been reported as factors impacting low birth weight.

CONCLUSION

This study highlighted the factors associated with low birth weight in the communes of Bamako in Mali. The prevalence of low birth weight was more present for housewives and uneducated mothers including low monthly income. All the mothers benefited from ANC during their last pregnancy. Pathologies such as malaria, urogenital infection, and bleeding were experienced by mothers. Newborn sex, maternal age, gravidity, and nutritional status (BMI) were significantly associated with low birth weight. The results of this study highlight the need for maternal health interventions to improve newborn health.

ACKNOWLEDGMENT

We would like to thank all of mother-newborn pairs who participated in this study

AUTHORS' CONTRIBUTIONS

All authors participated in the conceptualization and the design of this manuscript. In addition, they provided essential comments for the data analyzes and the manuscripts. The co-authors have read and approved the final version for submission.

COMPETING INTERESTS

The authors declare that they have no competing interest in the preparation of this document.

CONSENT FOR PUBLICATION

There are no individual details, videos, or images used in this study. Therefore, consent to post is not applicable. Data was collected in the communes of Bamako, Mali. The datasets used for all analyzes in this study are available from the corresponding author.

FUNDING

The authors received no financial support for this study.

REFERENCES

1. World Health Organization. Global nutrition targets for 2025. Guidance notes on low birth weight. Geneva, WHO; 2022. Available at the following link: file:///C:/Users/podag/Downloads/WHO_NMH_NHD_14.5_eng.pdf and accessed February 19, 2022
2. Christian P, Lee SE, Donahue Angel M, Adair LS, Arifeen SE, Ashorn P, Barros FC, Fall CH, Fawzi WW, Hao W, Hu G, Humphrey JH et al. Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low- and middle-income countries. *Int J Epidemiol.* 2013 Oct;42(5):1340-55.
3. Gu H, Wang L, Liu L, Luo X, Wang J, Hou F, Nkomola PD, Li J, Liu G, Meng H, Zhang J, Song R. A gradient relationship between low birth weight and IQ: A meta-analysis. *Sci Rep.* 2017 Dec 21;7(1):18035.
4. Jornayvaz FR, Vollenweider P, Bochud M, Mooser V, Waeber G, Marques-Vidal P. Low birth weight leads to obesity, diabetes, and increased leptin levels in adults: the CoLaus study. *Cardiovasc Diabetol.* 2016; 15: 73.
5. National Institute of Statistics (INSTAT), Planning and Statistics Unit Health-Social Development and Family Promotion Sector (CPS/SS-DS-PF) and ICF. 2019. Demographic and Health Survey in Mali 2018. Bamako, Mali and Rockville, Maryland, USA: INSTAT, CPS/SS-DS-PF and ICF
6. Ministry of Health of Mali. 2020 DHIS2 data, Bamako, Mali, 2021.
7. United Nations Development Program. UNDP support for the implementation of the 2030 Agenda for Sustainable Development. UNDP, 2019
8. Sema A, Tesfaye F, Belay Y, Amsalu B, Bekele D, Desalew A. Associated Factors with Low Birth Weight in Dire Dawa City, Eastern Ethiopia: A Cross-Sectional Study. *Biomed Res Int.* 2019 Dec 9;2019:2965094. DOI: 10.1155/2019/2965094. PMID: 31886197; PMCID: PMC6925748
9. Hidalgo-Lopezosa P, Jiménez-Ruz A, Carmona-Torres JM, Hidalgo-Maestre M, Rodríguez-Borrego MA, López-Soto PJ. Sociodemographic factors associated with preterm birth and low birth weight: A cross-sectional study. *Women Birth.*

- 2019 Dec;32(6):e538-e543. doi: 10.1016/j.wombi.2019.03.014. Epub 2019 Apr 9. PMID: 30979615.
10. UNICEF-WHO Low birthweight estimates: Levels and trends 2000-2015. Geneva: World Health Organization; 2019 (<https://www.who.int/nutrition/publications/UNICEF-WHO-lowbirthweight-estimates-2019/en/>).
 11. Tessema ZT, Tamirat KS, Teshale AB, Tesema GA. Prevalence of low birth weight and its factor associated with birth in sub-Saharan Africa: a generalized linear mixed model. *PLoS one*. 2021 Mar 11;16(3):e0248417. doi: 10.1371/journal.pone.0248417. PMID: 33705473; PMCID: PMC7951905.
 12. He Z, Bishwajit G, Yaya S, Cheng Z, Zou D, Zhou Y. Prevalence of low birth weight and its association with maternal body weight status in selected African countries: a cross-sectional study. *BMJ Open*. 29 Aug 2018;8(8):e020410. doi: 10.1136/bmjopen-2017-020410. PMID: 30158218; PMCID: PMC6119454.
 13. Godah MW, Beydoun Z, Abdul-Khalek RA, Safieddine B, Khamis AM, Abdulrahim S. Maternal Education and Low Birth Weight in Low- and Middle-Income Countries: Systematic Review and Meta-Analysis. *Matern Child Health J*. 2021 Aug;25(8):1305-1315. doi: 10.1007/s10995-021-03133-3. Epub 2021 May 4. PMID: 33945084.
 14. 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.
 15. Kuhnt J, Vollmer S. Antenatal care services and its implications for vital and health outcomes of children: evidence from 193 surveys in 69 low-income and middle-income countries. *BMJ Open*. 2017 Nov 15;7(11):e017122. doi: 10.1136/bmjopen-2017-017122. PMID: 29146636; PMCID: PMC5695442.
 16. Weyori AE, Seidu AA, Aboagyie RG, Holmes FA, Okyere J, Ahinkorah BO. Attendance at antenatal care and low birth weight in institutions in sub-Saharan Africa. *BMC Pregnancy delivery*. 2022 Apr 5;22(1):283. doi: 10.1186/s12884-022-04576-4. PMID: 35382792; PMCID: PMC8985289.
 17. Bakken L, Iversen PO. The impact of malaria during pregnancy on low birth weight in East Africa: a current affairs review. *Malar J*. 2021 Aug 24;20(1):348. doi: 10.1186/s12936-021-03883-z. PMID: 34429121; PMCID: PMC8386002.
 18. Jeena PM, Asharam K, Mitku AA, Naidoo P, Naidoo RN. Maternal demographic and prenatal factors, low birth weight and preterm birth: results from the Mother and Child in the Environment (MACE) cohort, Durban, South Africa. *BMC Pregnancy delivery*. 2020 Oct 16;20(1):628. doi: 10.1186/s12884-020-03328-6. PMID: 33076865; PMCID: PMC7574237.
 19. 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 Oct 13;26(10):1273-1284. doi: 10.26719/emhj.20.096. PMID: 33103755.
 20. Kargbo DK, Nyarko K, Sackey S, Addo-Lartey A, Kenu E, Anto F. Determinants of low-birth-weight deliveries in five referral hospitals in the urban district of the Western Zone, Sierra Leone. *Ital J Pediatr*. 2021 Oct 28;47(1):212. doi: 10.1186/s13052-021-01160-y. PMID: 34711248; PMCID: PMC8554995.
 21. Bater J, Lauer JM, Ghosh S, Webb P, Agaba E, Bashaasha B, Turyashemererwa FM, Shrestha R, Duggan CP. Predictors of low birth weight and preterm birth in rural Uganda: Findings from a birth cohort study. *PLoS Un*. 2020 Jul 13;15(7):e0235626. doi: 10.1371/journal.pone.0235626. PMID: 32658895; PMCID: PMC7357758.