Original article

Factors associated with low birth weight in Mali: a cross-sectional study

Facteurs associés au faible poids de naissance au Mali : une étude transversale

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Résumé

Introduction : Le faible poids de naissance (FPN) constitue un problème de santé publique tant dans les pays développés que dans les pays en développement. L'objectif de cette étude était d'évaluer sa prévalence ainsi que les facteurs de risque qui y sont associés.

Méthodologie : Cette étude transversale a été menée dans les districts sanitaires de Kita et de San de novembre 2017 à novembre 2018, et a inclus 1258 participantes dans les deux districts. Les données ont été analysées à l'aide du logiciel SPSS version 25. Un modèle de régression logistique a été utilisé pour identifier les facteurs associés au FPN. Le seuil de signification statistique a été fixé à p < 0,05.

Résultats : L'incidence du faible poids de naissance (FPN) était de 7,1 %. Après analyse de régression logistique multivariée, le statut matrimonial (célibataire), la primiparité et l'âge gestationnel (< 37 semaines) sont apparus comme des prédicteurs significatifs du FPN, avec des rapports de cotes ajustés respectifs de 2,70 [1,15 - 6,35], p = 0,023 ; 2,36 [1,40 - 3,98], p = 0,001 et 15,36 [6,92 - 34,08], p < 0,001.

Conclusion : Ces résultats suggèrent que la primiparité, le statut matrimonial non marié et un âge gestationnel inférieur à 37 semaines sont associés au FPN au Mali. Le FPN est un problème multidimensionnel nécessitant une approche intégrée incluant des mesures médicales, sociales, économiques et éducatives pour une prise en charge globale.

Mots-clés : FPN ; facteurs associés ; Mali.

Abstract

Introduction: Low birth weight (LBW) is a public health problem in both developed and developing countries. The objective of this study was to investigate its prevalence and associated risk factors.

Methodology: This cross-sectional study was conducted in the Kita and San health districts from November 2017 to November 2018. It involved 1258 participants in the two districts. Data were analyzed using the software SPSS version 25. A logistic regression model was used to identify factors associated with LBW. The significance threshold was set at p < 0.05.

Results: The incidence of low birth weight (LBW) was 7.1%. Following a multivariate logistic

regression analysis, marital status (unmarried), gravidity (primigravidity), and gestational age (<37 weeks) emerged as significant predictors of LBW, with adjusted odds ratios of 2.70 [1.15 - 6.35], p = 0.023, 2.36 [1.40 - 3.98], p = 0.001, and 15.36 [6.92 - 34.08], p < 0.001, respectively.

Conclusion: These findings suggest that primigravidity, unmarried status, and gestational age less than 37 weeks are associated with LBW in Mali. LBW is a multidimensional challenge, and an integrated approach of medical, social, economic, and educational measures is required to address this concern.

Keywords: LBW; associated factors; Mali.

Introduction

Low birth weight (LBW), defined by the World Health Organization (WHO) as a weight less than 2500 g at birth, poses a significant public health challenge due to its association with infant morbidity and mortality. Among all neonatal causes of mortality, 60–80% are attributed to LBW (1), and approximately 20 million infants are estimated to be born with LBW each year worldwide (15.5% of all births).

The LBW leads to various undesirable outcomes throughout life. Children with LBW are at risk of growth delays, infectious diseases, neurodevelopmental disorders, reduced cognitive function, and academic troubles during childhood and adulthood, with repercussions on both individuals and society (2–4).

Aware of the significant health and economic burdens that LBW represents, the World Health Organization has prioritized reducing its prevalence as a public health priority and has set an ambitious goal: a 30% global reduction in the prevalence between 2012 and 2025. Achieving this ambitious goal requires a deep understanding of the modifiable determinants of LBW. This involves a comprehensive exploration of the biological, socioeconomic, environmental, and behavioral factors that collectively influence fetal development and contribute to the risk of LBW (4).

In Mali, according to the latest Demographic and Health Survey in 2018, 15% of births with known weight were LBW (5). Despite the implementation of national initiatives to enhance maternal and child health, low birth weight (LBW) continues to be a significant public health concern in Mali. Addressing the risk factors remains challenging due to the complex interplay of multiple determinants, whose underlying mechanisms appear to be poorly understood. Considering this situation, we conducted a study aimed at examining the risk factors associated with LBW and proposing strategies to reinforce and focus interventions for its prevention.

Methodology

- **Study sites:**

This study was conducted in the health districts of San and Kita in Mali, with a total population of approximately 75.000. San is located 440 km northeast of Bamako in the Segou region and Kita is 180 km northwest of Bamako.

- **Type and study period**

This cross-sectional study was conducted in the maternity of the health districts of San and Kita from November 27, 2017, to November 28, 2018.

- **Study population**

This was of interest to all women who gave birth to the selected health centers.

- **Sample size**

The sample size at delivery was 1103 for both sites. Its calculation was made by considering a low prevalence of malaria (10%) with 80% potency and 95% confidence.

- **Selection criteria:**

Women presenting to selected health facilities for delivery were invited to participate in the study.

Inclusion criteria:

- Give free and informed consent.
- Age> =15 years (if married) and/or >=18 years

Non-inclusion criteria:

- Absence of informed consent.
- Prior occurrence of hypersensitivity reaction to

SP or its components.

- Previous administration of antimalarials or antibiotics within one month, or quinine within the past week.

- **Data Management and Analysis:**

The data were analyzed with SPSS version 25 software. Quantitative variables were expressed as an average (SD), qualitative variables were expressed in proportions and frequencies. Multivariate logistic regression was used to assess the influence of different determinants on low birth weight. The significance threshold has been set at 0.05.

- **Ethical considerations:**

The protocol for this study was approved by the Ethics Committee of the Faculty of Medicine and Dentistry (FMOS) and the Pharmacy Committee (FPHA) (N°2017/81/CE/FMPOS) before the start of collection. The agreement of the administrative and communal authorities of San and Kita has been requested and obtained. The free and informed consent of the participants was obtained. Anonymity and confidentiality have been guaranteed. Data were collected according to good clinical and laboratory practices.

Results

A total of 1.258 births were recorded in the San and Kita Health Districts. The analysis focused on live births and unique pregnancies (1.172 newborns) to identify factors associated with LBW.

Socio-demographic characteristics of participants

The average age was 24.95 (6.66) years, and the 20-48 age group accounted for 74.4%. Most of the participants were married (95.6 %). Most of them were housewives, accounting for 77.1%. Half of the women (50.7%) were uneducated. Rural women were the most represented group (68.8 %) (Table 1).

Obstetric-clinical characteristics of participants

The median gravidity was 4, with a minimum of 1 and maximum of 14. Primigravidae (Gravidity = 1) accounted for 26%. The median gestational age was 39 SA, with a minimum of 30 and a maximum of 42 SA. The gestational age between 37-42 SA was 96.9%. Women with hypertension (systolic blood pressure $\geq$ 140 mm Hg and/or diastolic blood pressure $\geq$ 90 mm Hg) during pregnancy accounted for 16.7%. The average hemoglobin level was 10.51 g/dl, with a standard deviation of 1.66. Approximately 44.5% of the pregnant women had anemia (hemoglobin $\leq$ 11 g/dl) during pregnancy. The prevalence of maternal malaria was 16.7%. Women who received less than 3 doses of Sulfadoxine-pyrimethamine (SP) for intermittent preventive treatment of malaria during pregnancy accounted for 67.5%. Additionally, 666 infants (53.3%) were male. (Table 2)

Table 1: Socio-demographic characteristics of the participants

Variables	Effectives	Percentage
Age Groups (in years)		
15 –19	322	25.6
20 – 48	936	74.4
Marital Status		
Single	55	4.4
Married	1203	95.6
Main activity		
Housewives	970	77.1
Non-housewives	288	22.9
Education level		
Out-of-school	638	50.7
Educated	620	49.3
Residence		
Urban	864	68.8
Rural	392	31.2

Table 2: Clinical and gynecological characteristics of women giving birth in the SAN and KITA health districts, Mali

Variables	Effectives	Percentage
Gravidity		
1	325	26
>1	926	74
Gestational age		
<37	36	3.1
≥37	1134	96.9
High Blood Pressure		
Yes	210	16.7
No	1048	83.3
Anemia (Hb < 11g/dl)		
No	669	55.5
Yes	537	44.5
Maternal thick smear		
Positive	210	16.7
Negative	1048	83.3
SP Doses		
<3	825	67.5
≥3	397	32.5
Sex of the newborn		
Male	666	53.3
Female	584	46.7

- **Prevalence of LBW**

The mean weight of newborns was 2988.31 (455.73) grams (Figure 1).

Of the 1172 newborns, 83 had a birth weight less than 2500 grams, i.e. a prevalence of 7.1% (Figure 2).
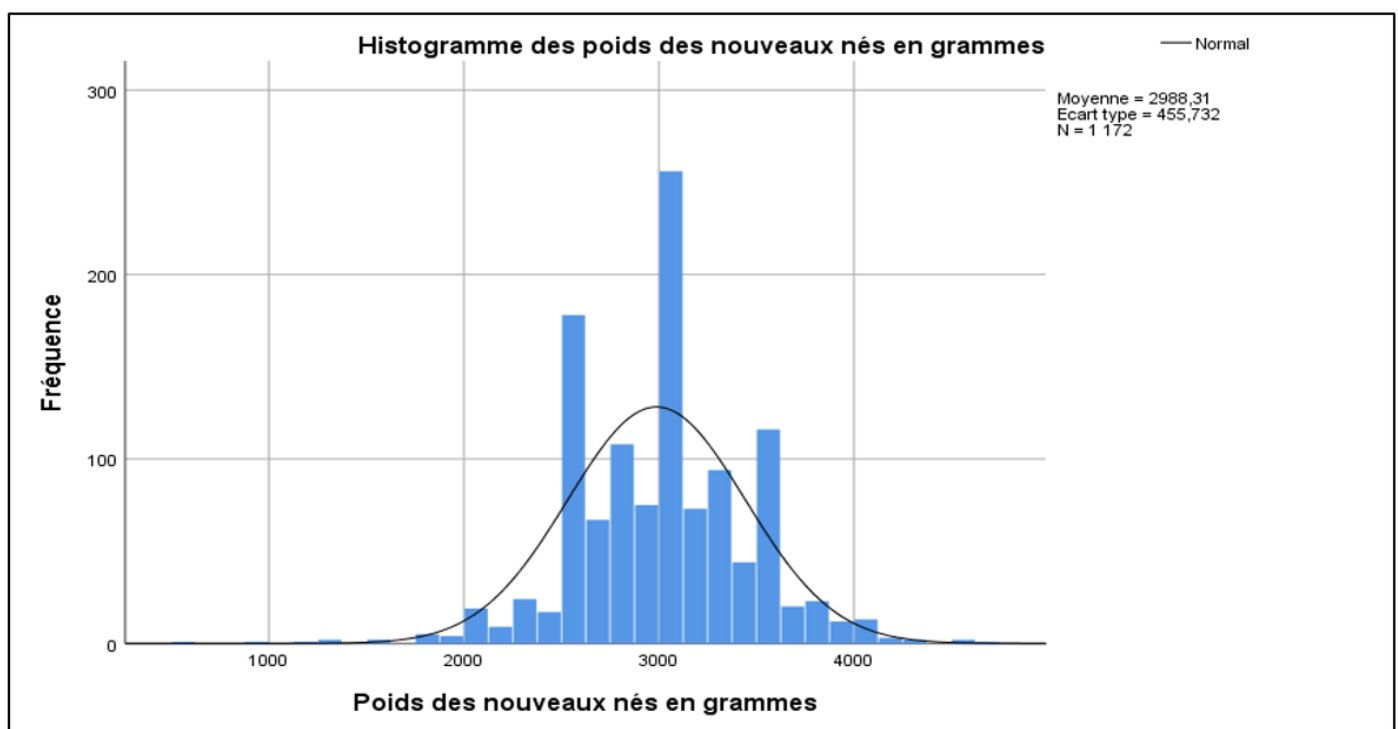

Figure 1: Histogram of newborn birth weights in the SAN and KITA health districts, Mali
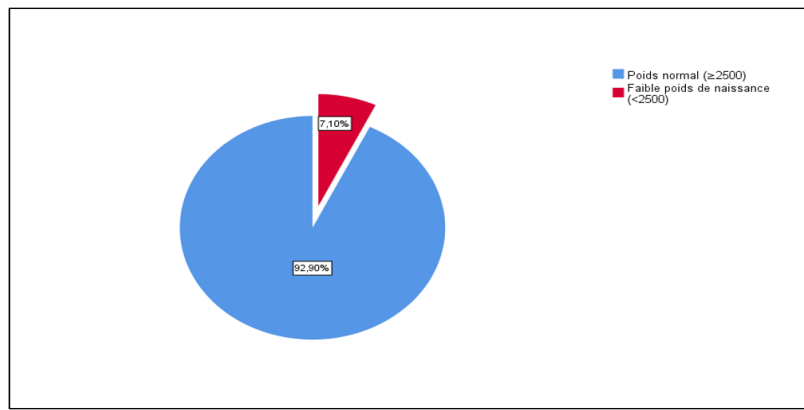
Figure 2: Prevalence of Low Birth Weight in the SAN and KITA Health Districts, Mali

• **Factors associated with LBW**

After multivariate logistic regression, the factors associated with low birth weight were unmarried marital status, primigravidity, and newborns less than 37 weeks of age. Unmarried women were about 3 times more likely AOR = 2.70 [1.15 - 6.35] to give birth to a LBW compared to married women. In addition, neonates less than 37 weeks of gestation had a 15-fold increased risk of LBW AOR = 15.36 [6.92 - 34.08] compared to neonates born at 37 weeks or older. First-time birthers were more than 2-fold more likely AOR = 2.36 [1.40 - 3.98] to give birth to a LBW infant compared to second or more procedures (Table 4).

Table 3: Factors associated with LBW in the SAN and KITA health districts, Mali

Variables	Categories	LBW (<2500) n (%)	LBW (≥2500) n (%)	OR (CI 95%)	AOR (CI 95%)	p value
Sex of the newborn	Male	41 (6.7%)	572 (93.3%)	1		
	Female	42 (7.6%)	508 (92.4%)	1.15 (0.74 - 1.80)		
Age Groups (in Years)	15 – 19	34 (11.4%)	265 (88.6%)	2.15 (1.36 - 3.40)	1.06 (0.52 - 2.16)	0.866
	20 – 48	49 (5.6%)	820 (94.4%)	1	1	
Marital status	**Single**	**12 (24.0%)**	**38 (76.0%)**	**4.66 (2.33 - 9.30)**	**2.61 (1.10 - 6.20)**	**0.03**
	Married	71 (6.4%)	1047 (93.6%)	1	1	
Main activity	Housewives	67 (7.5%)	829 (92.5%)	1.30 (0.74 - 2.28)		
	Non-housewives	16 (5.9%)	257 (94.1%)	1		
Education level	Out-of-school	48 (8.2%)	534 (91.8%)	1.42 (0.90 - 2.22)		
	Educated	35 (6.0%)	551 (94.0%)	1		
Residence	Urban	56 (6.7%)	780 (93.3%)	1		
	Rural	27 (8.2%)	303 (91.8%)	1.24 (0.77 - 2.00)		
SP Doses	<3	67 (8.9%)	690 (91.1%)	2.35 (1.32 - 4.17)	1.78 (0.96 - 3.29)	0.065
	≥3	15 (4.0%)	363 (96.0%)	1	1	
Gravidity	**1**	**41 (13.3%)**	**267 (86.7%)**	**2.97 (1.89 - 4.67)**	**2.29 (1.13 - 4.62)**	**0.021**
	>1	42 (4.9%)	812 (95.1%)	1	1	
Gestational age	**<37**	**17(53.1%)**	**15 (46.9%)**	**20.11 (9.57 - 42.25)**	**15.61 (6.78 - 35.92)**	**0.000**
	≥37	59 (5.3%)	1047 (94.7%)	1	1	
Maternal thick smear	Positive	6 (8.6%)	64 (91.4%)	1.24 (0.52 - 2.96)		
	Negative	77 (7.0%)	1021 (93.0%)	1		
Anemia (Hb < 11g/dl)	No	41 (6.5%)	588 (93.5%)	1		
	Yes	41 (8.3%)	451 (91.7%)	1.30 (0.83 - 2.04)		
HTA	Yes	18 (9.3%)	176 (90.7%)	1.43 (0.83 -2.47)		
	No	65 (6.7%)	909 (93.3%)	1		

Table 4: Parsimonious Model, Factors Associated with LBW in the SAN and KITA Health Districts, Mali

Variables	Categories	LBW (<2500) n (%)	LBW (≥2500) n (%)	AOR (CI 95%)	p value
Marital status	Single	12 (24.0%)	38 (76.0%)	2.70 (1.15 - 6.35)	0.023
	Married	71 (6.4%)	1047 (93.6%)	1	
Gravidity	1	41 (13.3%)	267 (86.7%)	2.36 (1.40 - 3.98)	0.001
	>1	42 (4.9%)	812 (95.1%)	1	
Gestational age	<37	17(53.1%)	15 (46.9%)	15.36 (6.92 - 34.08)	< 0.001
	≥37	59 (5.3%)	1047 (94.7%)	1	

Discussion

In this study, the prevalence of LBW was 7.1%, and the mean birth weight of newborns was 2988.31 g (455.73). In the multivariate logistic regression model, the factors significantly associated with LBW were single marital status, primigravidity, and gestational age of less than 37 weeks.

Our study's prevalence of LBW was lower than the national prevalence of around 15% (5), as well as those reported in other studies conducted in Mali by TRAORE B.M. et al (6) and MARIKO A.M. (7) in Burkina Faso by Kaboré P and all (8), in the Democratic Republic of Congo by Kangulu IB and all (9), and in Kenya by O. M. Muchemi and all (10), which had found 10.8%, 10.26%, 15.8%, 14.3%, and 12%, respectively. This difference may be because our study was conducted in a rural area where high-risk pregnancies are less common, and fetal weight measurements were taken only in live and single newborns (excluding stillbirths, abortions, and twin pregnancies).

The prevalence observed in our study was comparable to that observed in Guinea (7.33 %) (11). This may be due to the similarity in the study's framework, methodology, access to healthcare services, and socioeconomic conditions between these countries and Mali.

Single women are at greater risk of giving birth to a LBW infant compared to married women. Living alone may negatively affect the mother's nutrition. In fact, adequate and balanced nutrition has a positive impact on the weight of both the mother and the fetus during pregnancy. Moreover, optimal fetal growth within the uterus depends heavily on the mother's nutritional state. Several studies have found the same result (8,12–17).

For the pregnant woman, primigravidity is strongly associated with LBW. This observation is made in several studies (6,18). This could be explained by the fact that in our study, there is a strong correlation between age groups and primigravidity. It has been found that the young age of the mother could be a risk factor for LBW for biological reasons, as the mother's growth is not yet finished at this age. There is not only a container-content problem, but the uterus also not having reached its normal size, which results in a small content, hence a small birth weight. In addition, there is a nutrient conflict between the mother and the fetus, and a decrease in placental function at this age (19–22). Also, for socio-psychological reasons, due to lack of experience or that the pregnancy is not planned, they have limited access to healthcare services for fear of being stigmatized.

With regards to the gestational age, it has been observed that a gestational age of less than 37 weeks is strongly associated with the occurrence of LBW. This finding aligns with those reported by several authors (6,18,23–25). Gestation is the period that occurs between fertilization and childbirth, during which a woman is in a state of amenorrhea. When counting is started from the first day of the last menstrual period, this period lasts an average of 280 days or 40 weeks. Gestational age, combined with fetal growth velocity,

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determines the neonatal morphology at birth. Being the sole criterion used to identify premature newborns, its estimation is of paramount importance as it can lead to medical therapeutic decisions that have risks and sometimes high financial costs. It is thus clear that fetal growth depends on the duration of gestation, as a short gestation period does not allow for normal fetal growth.

Conclusion

Our study allowed us to identify three maternal factors associated with LBW, namely: marital status (unmarried), primigravidity, and gestational age (<37 weeks).

Except for primigravidity, which is an unmodifiable factor, the others are factors on which action can be taken through the implementation of an action plan to achieve the recommendations and suggestions to master them and reduce the risk of LBW, thus contributing to the reduction of infant mortality.

Finally, we hope that this study will help to better understand the problems of LBW and guide health actions to improve maternal and infant health in our country.

Limitations of the Study

Our work has permitted us to identify certain factors that influence the occurrence of LBW in the Kita and San health districts. In terms of the limitations of this study, due to the cross-sectional nature of instantaneous studies, no causal conclusions can be drawn from the results. Additionally, this is a secondary study, which means that several variables (factors) that may be associated with LBW, such as weight, height, IMC, socioeconomic status, prenatal care, inter-pregnancy interval, pregnancy-related pathologies (eclampsia), and toxic habits (active or passive smoking, alcohol consumption), were not collected.

Data Availability

All data from this study are available from the corresponding author upon reasonable request.

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Conflict of interest : None

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