

ORIGINAL RESEARCH

Determinants of low birth weight in the health district of Bounkiling in Senegal

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Abstract

Aim: Low birth weight (LBW), 9.1 million deaths per year, is a global health issue. The proportion of LBW in Senegal is estimated at 12% (in 2017) and is at 11.7% (in 2017) in the region of Sedhiou. In this regard, rigorous management is required to address this issue, especially in rural areas. The objective of the study was to identify the determinants of LBW.

Methodology: This is a case-control study which has been conducted in the district of Bounkiling. Socio-demographic characteristics of the mothers, their obstetrical and medical history, and information on the health status of the newborn in the case group were compared with that of the controls. Bivariate and multivariate analyses are performed using Epi info 7 software to identify the determinants.

Results: Low-weights accounted for 97.05% of LBW. The sex ratio was 0.87 in favor of girls. The Apgar score at birth was not good for 31.4% of newborns. Teenage mothers accounted for 17.08%. The multivariate analysis showed that the determinants of LBW ($p < 0.05$) were the female sex of the newborn, the Apgar score at birth, the maternal age ≤ 19 years, the household income < 83.96 USD, maternal history of low birth weight and physical labor during pregnancy.

Conclusion: Strengthening communication on early marriages and pregnancies, empowering women and improving pregnancy monitoring would be levers to counter the determinants of low birth weight.

Keywords: *determinants, district of Bounkiling, low birth weight, Senegal.*

Conflicts of interests: None declared.

Introduction

Infant mortality is a worldwide concern, particularly in developing countries where deaths occur more in the neonatal period (1). The efforts made by countries have led to a decrease in neonatal mortality. However, it still remains high: 36.6 per thousand in 1990 to 17.5 per thousand in 2019 (2).

The high neonatal mortality rate is closely connected with the high number of deaths among low birth weight newborns. In 2015, 20.5 million children born globally weighed less than 2500 grams at birth. Nearly 90% of these births took place in low- or middle-income countries, particularly in South Asia and sub-Saharan Africa (3). According to the World Health Organization (WHO), newborns with low birth weight (LBW) account for 17% of all live births. This frequency of LBW varies from country to country, ranging from 7% in developed countries to 19% in developing countries (4).

In sub-Saharan Africa, the prevalence of low birth weight varies between countries with 13% in Cape Verde, 15% in Togo, 16% in Benin, 19% in Burkina Faso and 23% in Mali (3).

In Senegal, the proportion of low birth weights dropped from 18% (in 2000) to 12% (in 2017) and 11.7% (5) in the region of Sedhiou.

In the health district of Bounkiling, administrative data showed that the number of children born with low birth weight in health facilities was below the data provided by demographic surveys. The proportions were 7.4% in 2019 and 10.3% in 2020 of all live births recorded in health facilities.

LBW are a predictor of the quality of child survival. They also cause the deaths of 9.1 million children worldwide each year (6). Various studies have shown that low birth weight newborns have higher mortality and morbidity rates than normal-weight infants (6-9). Low birth weights are the cause of

several very severe and sometimes irremediable disabilities (4).

Low birth-weight newborns and more particularly premature infants require rigorous care, especially in semi-rural and rural areas because of the under-equipment and lack of qualified personnel (10,11). Based on this observation, we conducted this study in the health district of Bounkiling located in the region of Sedhiou, to identify risk factors and contribute to improving the health of the mothers and children.

Methods

The study was carried out in the district of Bounkiling which covers the department of the same name (Bounkiling) located in the region of Sedhiou. It has an area of 3,005 km² and a population of 183,842 inhabitants, or 62 inhabitants per km². It also includes a health center and twenty-four health posts settled throughout three boroughs, namely Diaroumé, Bona and Bogal. According to the National Health Development Plan phase II (NHDP II) standards, the gaps in the number of health centers and health posts are four and eighteen, respectively and are characterized by the lack of personnel (doctors, nurses and midwives).

We carried out a case-control study on the different factors associated with low birth weights, based on the birth records of women found in the district maternity wards in the course of the year 2020. (Births taking place in maternities are under the responsibility of health professionals whereas those home birth are under the responsibility of non-professionals).

The study population consisted of all the mothers who gave birth in the health facilities and the newborns resulting from these deliveries.

The cases were all live newborns weighing less than 2500 grams and all women who gave birth to live newborns weighing less than 2500 grams in the district maternity

wards during the study period (from 01 January to 31 December 2020).

The controls were all live newborns weighing more than 2500 grams and all women who gave birth to live newborns weighing more than 2500 grams in the district maternity wards during the study period.

All live newborns whose birth weight is not traced, women from twin pregnancies with low birth weight and low birth weight infants whose mothers were from outside the district were excluded from the study (Excluded: low weight from twin pregnancies (13), low weight whose mothers lived outside the district (5) and those whose records were not complete (14). The number of discarded low birth weight newborns was 33.

The sampling was exhaustive and the sample size was two hundred and thirty-seven (237) on each side: low birth weight records and records of birthweights over 2500 grams (selected low birth weights 237 were matched to 237 birth weights of 2500g or more). The data was collected using a form filled with the socio-demographic characteristics of the women, the maternal history, the pathologies related to pregnancy, and the clinical examination of the newborn. To complete the data collection, a field visit was conducted and selected women were those whose health records were used. They were recorded in the sphinx software IQ then exported to Epi Info TM 7.2 in view of a descriptive and analytical analysis. As regards the description, the frequencies were calculated for the categorical variables. On the other hand, regarding the quantitative variables, calculation of the position and dispersion was made. In the analytical section, we performed a bivariate analysis using the statistical tests of Fisher and a multivariate analysis by a logistic regression.

Results

The average weight of newborns was 2581.1 (± 561.1) grams. In the group of

newborns weighing less than 2500 grams, low birth weight accounted for 97.05% and very low birth weights were 2.95%. The sex ratio was 0.87 in favor of girls. The Apgar score at birth was not normal (below 7) for 31.43% of newborns. Birth defects were found in 1.27% of births consisting mainly of polydactyly and microcephaly.

The socio-demographic characteristics collected among the mothers surveyed showed that the average maternal age was around 25.6 (± 6.2) years, teenage mothers (14 to 19 years) accounted for 17.08%, out-of-school women were 71.34% and those who lived in households with a monthly income of less than 50,000 CFA francs per month were 63.71%.

The history of abortions and stillbirths at birth was noted in 10.55% and 3.16% of the mothers surveyed, respectively. The delivery of a low birth weight child was found in the obstetrical history of 5.91% of the women surveyed. The maternal pathologies found during the study were essentially high blood pressure (3.38%), malnutrition (2.53%), anemia 0.84%. The behavioral factors which mothers presented during pregnancy were physical work (52.11%), tobacco via vaginal route (8.5%) and geophagia (3.80%).

Bivariate analysis showed that the link between the birth of a female newborn and the occurrence of low birth weight was statistically significant (p equal to 0.013). Newborns with Low birth weight were almost twice as likely (OR=1.89) to have a low Apgar score than those of normal weight.

A teenage mother aged 19 and under was more likely to give birth to a low-birth-weight child. The prevalence was 62.96% in this age group. Teenage mothers are almost twice as likely to give birth to a low birth weight child (OR=1.89 with 95% CI =1.15 - 3.09).

Women whose households was less than 77.73 USD were surveyed and they were 1.55 times more likely to give birth to a low birth weight child (OR=1.55 with 0 95% CI

=1.06 - 2, 26) than those with a regular income. The association was statistically significant, $p = 0.01$. Those exposed to strenuous labor during pregnancy were almost twice more likely to deliver a low birth weight newborn compared to those who were spared from heavy labor (OR = 1.69 with 95% CI = 1.17 – 2.43). The association was statistically significant with a p equal to 0.002.

Women with a history of low birth weight were almost 3 times more likely to give birth to an LBW child than those without a history of LBW (OR=2.89 with CI=1.67 – 4.97). A statistically significant association was found between the history of LBW and

the occurrence of a LBW birth ($p = 0.00005$).

The absence of high blood pressure in mothers would be a protective factor with regard to the occurrence of a low-weight birth ($p = 0.009$). The birth of a low birth weight newborn is significantly related to the presence of malnutrition in the mothers ($p = 0.007$). This association was not found in mothers with pathologies such as anemia, diabetes, HIV infection and malaria in their pregnancy. The bivariate analysis showed the existence of risk factors for the occurrence of low birth weight among women in the health district of Kolda (Table 1).

Table 1. Risk factors associated with low birth weight

Factors associated with LBW	P value	OR	95% IC
Female	0.013	1.53	1.06 – 2.20
Apgar score < 7	0.0007	1.92	1.29 – 2.85
Age less than 19 years	0.007	1.89	1.15 – 3.09
Monthly household income under 50000	0.01	1.55	1.06 – 2.26
Mother's height less than or equal to 150 cm	0.01	4.16	1.15 – 14.93
Hard work during pregnancy	0.002	1.69	1.17 – 2.43
Number of ANC ≤ 2	0.002	1.82	1.20 – 2.75
History of LBW deliveries	0.00005	2.89	1.67 – 4.97
Maternal malnutrition	0.007	3.58	1.30 – 9.88
History of high blood pressure	0.009	4.52	1.27 – 16.09

The risk factors correlated with the occurrence of low birth weight were the female sex of the newborns, the Apgar score < 7, the maternal age of less than 19 years, the monthly household income of less than 83.96 USD, the height of the mother less than or equal to 150 centimeters, heavy labor during pregnancy, the low number of prenatal visits (≤ 2) carried out, the existence of a history of delivery of an infant with LBW, the history of high blood pressure during pregnancy and malnutrition in the mother. These variables were under consideration in the multivariate analysis to control for possible confounding factors. Thus, the multivariate

analysis showed that the independently and significantly associated factors were maternal age less than 19 years (OR=2.42 with CI = 1.43-4.12); p equal to 0.001, household income less than 83.96 USD, (OR=1.97 with CI=1.27-3.04); p equal to 0.002, maternal history of low birth weight (OR=3.62 with IC=2.02-6.50); $p=0.000001$, physical work during pregnancy (OR=1.80 with CI=1.20 – 2.69); $p = 0.004$, the female sex of a newborn (OR=1.59 with IC=1.07 – 2.35); p equal to 0.019 and the Apgar score at birth (OR=2.79 with CI=1.77 – 4.41); p equal to 0.000001 (Table 2).

Table 2. Results of the multivariate analysis

Factors Associated with LBW	Multivariate analyze	
	OR adjusted	p
Female	1.59	0.019*
Apgar score < 7	2.79	0.000001*
Age less than 19 years	2.42	0.001*
Monthly household income under 50000	1.97	0.002*
Mother's height less than or equal to 150 cm	3.12	0.12
Physical labor during pregnancy	1.80	0.004*
Number of ANC \leq 2	1.42	0.08
History of LBW deliveries	3.62	0.000001*
Maternal malnutrition	2.83	0.06
History of high blood pressure	2.95	0.11
Tabacco via vaginal route	0.67	0.28
History of abortions	1.26	0.48
Birth defects	2.28	0.49

*Statistically significant.

Discussion

Various limitations have been identified in this work. These were representativeness biases, information biases and biases relating to case-control studies.

In view of the study carried out in 2019 (16), the representativeness biases are largely explained by the importance of home births recorded in health structures and estimated at 15% and 23%

The lack of information in some birth records was a limitation in this work and justified the use of comprehensive records of mother-child pairs.

Control case studies which are by nature retrospective, may imply drawbacks such as selection bias (over or under-estimation of the risk factor) and information bias (missing data, memorization, interviewer subjectivity). The study focused on determinants related to newborns (sex, Apgar score, birth defects) and mothers (individual, biological, socio-economic and behavioural).

Newborn characteristics

The categorization of newborns with low birth weight shows that the majority (97.05%) weighed between 1500 and 2499

grams. Based on distribution of newborns by birth weight, this same trend has been observed in other studies carried out in the health district of Kolda in Senegal (12) and in Morocco (13).

The link existing between the delivery of a female child and the low birth weight which was found in our study is similar to that found in work done in Tunisia (14) and in the Democratic Republic of Congo (15). However, this relation (13,16) was not found in other studies.

The results showed that low birth weights are about five times more likely to have an Apgar score under 7 which reflects a poor neurological condition of the newborn, than those of normal weight. This conclusion was observed in studies carried out in Cameroon, Tunisia and Madagascar (17-19). This relation was statistically significant in our study. However, this result was not found in Kolda (12). But, it had been found that LBW are more likely to have an Apgar score under 7.

Depending on the contexts of study and the determinants which were identified, we noted that the conclusions are not identical. However, the management of low birth

weight must be rigorous with regard to the consequences of a low Apgar score on newborns health.

Maternal characteristics and risk factors

Mothers under the age of 19 are 2.42 times more likely to give birth to a newborn with low birth weight. There is a statistically significant association ($p < 0.05$) between young maternal age and the delivery of a low-weight newborn. This link can be observed given that teenage pregnancy remains a public health issue for the young mother and her newborn (21). In Senegal, studies have shown that the probability for a woman to give birth to a child with low birth weight was present in adolescents (12,21) age group. These results were similar to those of studies carried out in Mali (23) and Cameroon (17). However, this link was not found in other studies (23-25). This could be explained by the significant pace of growth and of change during this period, and especially by the context of the precocity of reproductive life. Women living in families with a monthly income of less than 77.73 USD were 1.97 times more likely to give birth to a child with low birth weight ($p < 0.05$). This significant difference was found in Guédiawaye (26) and Kolda (12).

However, in Morocco, the study did not show any statistically significant link (13). In Bounkiling, the results can be explained by the fact that the region of Sédhiou is one of the poorest localities in the country. This poverty has an impact on the household income and on meeting primary needs, particularly for pregnant women (27). Women empowerment can help improve the management of the basic needs of this target.

The prevalence of low birth weight was 3.62 times higher among women with past obstetric history of low birth weight than among those who gave birth to children with normal weight in their previous pregnancy. Similar results have been found in studies conducted in Senegal and

Burkina (12,26,29). On the other hand, the study conducted in Tunisia (18) did not establish a statistically significant relation in this regard. The existence of this non-modifiable risk factor could reflect a lack of management of pregnancy (12). Women who did physical labor during pregnancy were 1.80 times more likely to give birth to a child with low birth weight than those who did not engage in physical labor. A statistically significant link was found (p equal to 0.004). Similar results were found in studies conducted in Senegal and in Burkina (26,29). However, Mangane (12) did not establish any statistically significant relation. This can be explained by the context of poverty causing women to carry out daily arduous tasks such as farming activities and trade over long distances. The lack of running water means that women also have to draw water from wells for domestic work, which is non-optional. These difficult living conditions could lead to an early onset of labor, thus, the birth of premature infants, and therefore low-weight newborns.

Conclusion

Identifying the risk factors associated with low birth weight is a prerequisite for developing prevention strategies. Scaling up strategies focused on the reproductive health of adolescent girls, strengthening communication towards adolescent girls and towards community leaders on early marriages and pregnancies, empowering women and improving pregnancy monitoring would be levers to address the risk factors for low birth weight that have been identified in the district of Bounkiling.

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