2022 SCIENCELINE
Journal of Life Science and Biomedicine
Volume 12, Issue 3: 48-55; May 25, 2022

ISSN 2251-9939

DOI: https://dx.doi.org/10.51145/jlsb.2022.6

Factors associated with the low birth weight of children under five years in North Center of Burkina Faso

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ABSTRACT

Introduction. Low birth weight (LBW) is a major public health problem, in both developed and developing countries, due to its magnitude and strong association with infant morbidity and mortality. Aim. To estimate the prevalence of low birth weight and identify associated factors in children under five years old. Methods. This is a cross-sectional study carried out in 8 villages in the commune of Pissila in north-central Burkina Faso, involving 262 mother-child pairs. The factors associated with low birth weight were identified according to the odds ratio (OR) raw and the 95% confidence interval (95% CI) in the bivariate analysis and according to the adjusted OR in the multivariate analysis. Sociodemographic characteristics, reproductive history, previous morbidity and factors related to prenatal care were studied. Results. A total of 262 children with birth weights based on official documents were involved in this study. The proportion of low birth weight children was estimated at 10.7%. For maternal factors, we observed that the low level of education (adjusted OR=2.6), the fact of carrying out an itinerant activity (adjusted OR=3.4) and rural socialization (adjusted OR=0.3) were significantly associated with low birth weight. Additionally, maternal parity (adjusted OR=5.5) and large household size (adjusted OR=15.0) were also associated with low birth weight. Conclusion. These results confirm the conclusions of previous studies. Family planning, pre-conception intervention, financial empowerment of women and maternal education should be strengthened to reduce the incidence of low birth weight.

Research Article

PII: S225199392200006-12

Rec. 06 March 2022
Rev. 24 May 2022
Acc. 25 May 2022

Keywords

**Associated factors,
Burkina Faso,
Children,
Latrine,
Low birth weight**

INTRODUCTION

Low birth weight (LBW) is defined by World Health Organization (WHO) as birth weight that is strictly less than 2,500 grams, regardless of the term of pregnancy [1]. It is a major public health problem, in both developed and developing countries, due to its magnitude and its strong association with infant morbidity and mortality. It constitutes 17% of live births in the world. This frequency ranges from 7% to 19% in developed countries and developing countries, respectively. It is responsible for the death of 9.1 million children each year worldwide [2]. Low birth weight can be the result of premature birth, intrauterine growth retardation, or a combination of both. A premature birth is a birth that takes place before 37 full weeks of pregnancy. A newborn with intrauterine growth retardation (IGR) is a newborn whose weight is below the 10th percentile of standard birth weight for gestational age [3]. According to UNICEF and WHO estimates, more than 20, 5 million children are born with LBW worldwide, which represents 15.5% of all births most of these low-birth-weight births (96%) take place in developing countries [4]. In these countries, the proportion of LBW (16%) is double that of developed countries. Birth weight is therefore an important indicator mothers's health and nutritional status before ans during the pregnancy. It is also an important predictor of child survival and subsequent development [5]. Of the 11.6 million deaths of children under 5 years old in developing countries in 1995 and 6.3 million (53%) were associated with low birth weight [6]. In the medium term, LBW is associated with a deficit in cognitive and physical development with reduced intellectual capacities of the child [7, 8]. These children are also predisposed

to chronic and cardiovascular pathologies linked to diet in adulthood [9]. This has major consequences for societies, in terms of losses in human capital and economic productivity. The causes and consequences of LBW are complex and play an important role in the life cycle of the individual. This cycle constitutes the nutritional environment which is an important determinant of an individual's state of health and subsequent growth.

Infant mortality remains very high and of great concern in developing countries and it is therefore entirely justified to continue investigations on this key indicator of birth weight [10]. In developing countries, low birth weight is observed in different ways, particularly with quite disparate prevalence within countries. In Burkina Faso, very few studies are been conducted.

The objective of this study was to identify factors associated with low birth weight in children under five years old in Pissila municipality of Burkina Faso. More specifically, this involved estimating the prevalence of low birth weight and identifying factors associated with low birth weight.

MATERIALS AND METHODS

Ethical approval

This research was granted by the health authorities of the region and approved by the Institutional Health Research Ethics Committee of the Institute of Health Sciences Research under the number 86-2019/CEIRES of 04 November 2019. The objectives of the survey were explained in detail to the participants. Participation was voluntary and each participant signed an informed consent form after which she was interviewed. In addition, they were free to withdraw from the study at any time.

Study area

This study was carried out in the rural commune of Pissila in Nord Center region of Burkina Faso. In 2015, this commune was made up of 68 administrative villages and its population was estimated at 100,353 inhabitants distributed among 13,639 households for an area of 1678 km^2, i.e. a density of 60 inhabitants per km^2 [5].

Data collection procedure

Authorization was obtained from the North Center regional health directorate to carry out the surveys. Explanations on the conduct and purpose of the study were provided to all participants before obtaining informed consent. The information was collected from the mothers and from the pregnancy follow-up files using a questionnaire established for this purpose. The data collected were mainly the characteristics of the mother, the household and the anthropometric parameters of the child. The anonymity of the questionnaires ensured the confidentiality of the data.The informed consent of the respondents was a prerequisite for any collection of information by our teams of investigators. In addition, the study was conducted with strict respect for the populations and their cultural values. In addition, the information relating to the respondents was anonymous.

Sampling procedure

This is a cross-sectional study, covering mothers and children under five years. We used a random sampling method with the three-stage cluster sampling technique as follows: A) the first degree concerned the villages of the department; B) the second degree was the choice of households; C) in the third degree, we have children under five years.

The selection procedure consisted of a random draw of 15 villages out of the 68 in the commune. Then we did a random draw of 300 households, or an average of 20 households per village. In each selected household, all records of mother-child couples were reviewed. Excluded from the study are mother-child couples whose records do not contain information on the variables studied (date of birth, prenatal consultation follow-up, etc.).

The minimum size was estimated at 235 children. In order to take into account the imponderables, we added to this number 10% and we obtained 258 children. The final sample becomes 262 children, or 17 children per village. We previously trained six investigators in taking anthropometric measurements, in translating certain concepts of the questionnaires into the local language and in the clinical criteria of malnutrition. Investigators were divided into three teams of two pairs in the field. Each team had a supervisor in charge of data collection. Community health workers acted as guides to facilitate our access to households.

A pretexted three-part questionnaire was used to collect informations such as:

-the first part focused on the children, namely their socio-demographic characteristics, their feeding practices, their vaccination status and their nutritional status and associated morbidity;

-the socio-demographic characteristics of the children were: gender, age in months, birth order, birth weight. The date of birth of the children was collected from official documents (birth certificate extract, supplementary judgment, health record);

-the second part concerned maternal characteristics such as age, current occupation, level of education, marital status, place of residence and place of delivery of the mother;

-the third part focused on the characteristics of the households: the existence of latrines, the source of drinking water, the number of people living in the household and the characteristics of the dwelling.

Statistical analysis

The data were analyzed under STATA 12.0. A description of the population according to different maternal characteristics, parameters related to the societal environment and birth weight was expressed by means and standard deviations and proportions. Comparisons were made to identify factors associated with low birth weight (LBW). Birth weight, divided into two groups (<2,500 grams and ≥2,500 grams) was considered as the dependent variable. Maternal characteristics such as age, level of education, occupation as well as household characteristics were the independent variables. Chi-square (X^2) and Student statistical tests were used with a significant cutoff of 5%. Univariate analysis was performed to find the most relevant variables. The adjustment was made using logistic regression. Factors achieving a significance level of $P<0.05$ were selected as candidate variables for multivariate analysis. They were introduced into a series of multiple logistic regression models by the block entry method.

RESULTS

A total of 262 children were recruited with birth weights on official documents. The results for the birth weight of children values are shown in Table 1. It emerged from this study that more than one in ten children (10.7%) had low birth weight (less than 2,500 g) and 78 children (29.8%) weighed between 2,500 and 2,800 g. Among children born at normal weight, around one third of children (29.8%) weighed between 2,500 and 2,800 g. The average of low birth weight was 2242.8±240.3 g with extremes of 1200 and 2450 g. The proportion of low birth weight children is higher in female children (57.1%) compared to that found in male children (42.9%; Table 1).

Nutritional status of children

We note that children with low birth weight presented a very alarming nutritional situation. Indeed, nearly (39.3%) with a birth weight less than 2,500 g suffer from growth retardation against 26.9% in children with a birth weight greater than or equal to 2,500 g (Figure 1). Underweight affects half (50%) of children born at low birth weight compared to 22.6% of children with normal birth weight. In addition, 14.3% of low birth weight children are wasted compared to 8.6% of children with normal birth weight. The prevalence of the different types of malnutrition observed in low-birth-weight children are more or less critical according to the WHO (2006) [11].

Maternal factors associated with low birth weight in logistic regression

The proportion of children with low birth weight was highest among first-time mothers (42.9%). On the other hand, it is weaker in pauciparous (25.0%) and multiparous mothers (32.1%). This difference is statistically significant (P=0.001). The distribution of birth weights according to the characteristics of the mother is recorded in Table 2.

Table 1. Distribution of the birth weight of children in comparison with sex.

Sex / Birthweight (g)	Girls, n (%)	Boys, n (%)	All
< 2500	16 (57.1)	12 (42.9)	28 (10.7)
2500-2800	40 (51.2)	38 (48.8)	78 (29.8)
2801-3000	30 (58.8)	21 (41.2)	51 (19.5)
> 3000	54 (51.4)	51 (48.6)	105 (40.1)
Total	140 (53.4)	122 (46.6)	262 (100.0)

n= Number

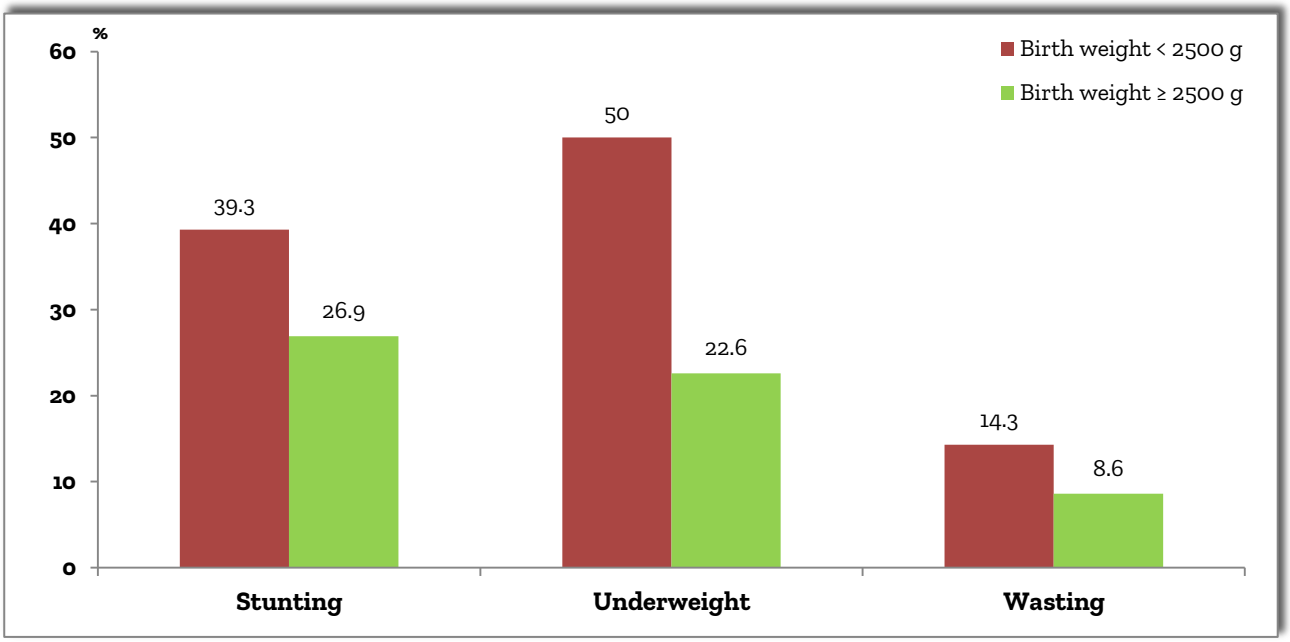

Figure 1. Nutritional status of children

Table 2. Maternal factors associated with low birth weight.

	Birth weight		Univaried analysis		Logistic regression	
Variables	**< 2500 g**	**≥ 2500 g**	**Crude OR [CI 95%]**	**p**	**OR adjusted [CI 95%]**	**P value**
Mother's occupation	(%) (n=28)	(%) (n=234)				
Any activity	17.8	41.1	1		1	
Street vendors	57.2	47.0	3.6 [2.1-9.4]	0.002	4.4 [2.5-9.4]	0.003
Food vendors	25.0	11.9	1.4 [0.9-8.6]	0.051	1.1 [0.7-9.6]	0.061
Mother's education level						
High school	3.6	5.6	1		1	
Without level education	75.0	85.5	3.5 [1.5-8.7]	0.007	2.6 [0.9-6.4]	0.006
Primaryschool	21.4	8.9	2.7 [0.9-7.5]	0.064	2.1 [0.8-7.4]	0.054
Mother's marital status						
Monogamous	32.1	40.5	1		1	
Polygamous	67.9	59.5	4.5 [5.3-9.7]	0.003	5.6 [6.5-9.9]	0.002
Mother's age at childbirth						
> 30 years	3.6	25.2	1		1	
< 20 years	75.0	04.3	3.5 [1.4-8.6]	0.007	3.8 [1.5-9.6]	0.005
20-30 years	21.4	70.5	2.7 [1.1-7.4]	0.043	2.8 [0.9-7.5]	0.053
Prenatal consultations (PNC)						
≥ 4 PNC	89.3	85.9	1		1	
< 4 PNC	10.7	14.1	1.8 [1.0-2.6]	0.049	1.4 [0.3-4.6]	0.092
Mother's parity						
Multiparous	32.1	47.9	1		1	
Primiparous	42.9	14.9	3.9 [1.5-5.6]	0.002	5.5 [1.6-18]	0.001
Pauciparous	25.0	37.2	1.8 [1.6-3.3]	0.062	1.8 [1.5-3.3]	0.060

OR: Odd Ratio; CI: Confidence Interval. Only the values of P less than 0.05 associated with a Confidence Interval not including the value 1 are significant and indicated in bold characters

The proportion of low birth weight was higher (57,2%) among mothers with gainful activity compared to 17.8% who did not have any activity (P<0.05). A percentage of 75% of low birth weights are from mothers with no educational attainment and only 3.6% have reached at least high school. Polygamous mothers had the highest proportion of children (67.9%) born low birth weight compared to 32.1% among monogamous mothers

(P<0.05). We were able to show a statistically significant difference (P<0.05) between the proportion of children with low birth weight among mothers under 20 years old (75%) compared to mothers aged 20 and over (25%) (Table 2).

Mothers had an average age of 26.7 years old with extremes ranging from 17 to 49 years old. Mothers over the age of 30 had a low proportion of children (3.6%) born with low birth weight. Nearly one in ten children (10.7%) born with a low weight received at most four prenatal consultations carried out by their mothers compared to 89.3% who had at least four prenatal consultations (P=0.394). Regarding the mother's parity, it appears that the proportion of low birth weight is highest (42.9%) among first-time mothers (mothers who have had their first childbirth). On the other hand, this proportion was 32.1% among children of multiparous mothers and 25% among pauciparous (P<0.05). Several factors were identified by univariate analysis (Table 2). The exercise of a walking activity as well as the low level of study of the mother were significantly associated with low birth weight (OR [95% CI]=3.6 [2.1-9.4], P<0.05) and (OR [95% CI]=3.5 [1.5-8.7], P<0.05) respectively. Polygamy (OR [95% CI]=4.5 [5.3-9.7], P<0.05), young age of the mother (OR [95% CI]=3.5 [1.4-8.6], P<0.05) and primiparity (OR [95% CI]=3.9 [1.5-5.6], P<0.05) increased the risk of occurrence of LBW. In logistic regression, the factors associated with LBW were maternal age less than 20 years (OR=3.5 [1.4-8.6], exercise of a walking activity (OR=4.6 [2.1-10.4], low level of education (OR=3.5 [1.4-8.7]) and mother's parity (OR=3.93 [1.5-5.6]. Only prenatal consultations were not significantly associated with LBW (OR [95% CI]=1.4 [0.3-4.6], P<0.05).

Societal environment

Environmental factors associated with low birth weight are listed in Table 3. The mother's socialization environment, the proportion of low birth weight children was highest among women who grew up in rural areas compared to 25% of those who grew up in urban areas (P<0.05). In terms of sanitation, more than half (53.6%) of children born with a low weight lived in households without latrines and used the bush as a toilet place against 46.6% living in households with latrines (P=0.05). Factors related to the societal environment associated with low birth weight were identified by univariate analysis. These are the large household size (five people and more) (OR=14.9 [1.9-23.6], P<0.05), the mother's socialization in rural areas (OR=10.1 [6.4- 15.7], P<0.05 and the absence of latrines in the household (OR=1.5 [1.1-2.4], P=0.043) which were significantly associated with LBW. The association between the presence of latrines in the household and the LBW, although significant in univariate analysis disappeared during logistic regression analysis (P=0.052).

Table 3. Environmental factors associated with low birth weight

	Birthweight		Univariated analysis		Logistic regression	
Variables	**< 2500 g**	**≥ 2500 g**	**Crude OR [CI 95%]**	**P value**	**OR adjusted [CI 95%]**	**P value**
Household size	(%)(n=28)	(%)(n=234)				
< 5 people	3.6	6.4	1		1	
5-10 people	53.6	50.4	14.9 [1.9-23.6]	0.009	15.0 [1.9-23.6]	0.007
≥ 11 people	42.8	43.2	0.68 [0.13-4.64]	0.592	0.7 [0.1-4.7]	0.558
Mother's socialization environment						
Urban	25.0	9.8	1		1	
Rural	75.0	90.2	10.1 [6.4-15.7]	0.002	11 [6.5-15.9]	0.001
Existence of latrines in the household						
Yes	46.4	39.3	1		1	
No	53.6	60.7	1.5 [1.1-2.4]	0.04	1.6 [1.4-2.7]	0.052

OR: Odd Ratio; CI: Confidence Interval. Only the values of p less than 0.05 associated with a confidence interval not including the value 1 are significant and indicated in bold characters.

DISCUSSION

The study revealed some factors related to low birth weight in a rural context in Burkina Faso. Low birth weight is higher in this study. The high proportion of LBW among mothers under 20 could be explained by the early marriage of girls, which is very common in rural areas. In addition, several studies have shown the influence of maternal nutrition during pregnancy on the weight of newborns [12-15]. This supports the thesis of a real public health problem. Higher prevalence has been reported by others studies which were 14.3% and 20.1% and

respectively [16, 17]. However, our result was lower than that found by Chaman et al. [18] which was 7.2%. A study by Kusin et al. [15] published in the Lancet in 1992 showed that in a community where women of childbearing age with chronic energy deficiency gave birth to low birth weights.

In rural areas in Burkina Faso, prevalence of 17% and 16% of LBW higher than our study were reported in 2004 and 2006 respectively [19]. Birth weight is an important indicator of the health and nutritional status of the mother before and during pregnancy. It is also an important predictor of child survival and subsequent development [20]. The proportion of underweight children at birth (7.8%) is comparable to that found in Kenya (6.9%) and Lesotho (7.7%), but it is lower than the value found in health centers (10.6%) and in hospitals (between 12% and 18%) in Tanzania [21]. The young age of the mother was associated with LBW in multivariate analysis ($P<0.05$). This is consistent with the results of other studies which have concluded that the birth of a low birth weight is more common at the extremes of reproductive life (<19 years old and >35 years old) [22-24]. The younger mother, the lower the birth weight, the greater the risk of giving a low birth weight. This observation has been made in several studies [15, 25]. The vast majority of children born with an LBW belonged to very young first-time mothers, the hypotheses mentioned would be a physiological immaturity of the maternal organism on the one hand and on the other hand an insufficiency of energy reserves according to certain authors [26].

The mother's remunerative activity was strongly associated with LBW ($P<0.05$). Several studies have shown that a woman who has a professional activity is subject to a certain number of professional risks (stress, intense physical work, etc.). The involvement of these professional risks, especially stress (physical or psychological) would be responsible in the occurrence of LBW in general and in premature birth in particular [27, 28]. Studies have shown that primiparity is a protective factor against unfavorable fetal outcomes and especially LBW and the increase in parity is a factor favoring unfavorable pregnancy outcomes in the mother and child fetus [29, 30]. For educational attainment, a statistical association was observed between the mother's low level of education and the proportion of low-birth-weight children ($P<0.05$). Some studies reported that the level of education of mother is a socio-economic factor important related to birth weight of the newborn [31-33]. A higher maternal education level may be associated with higher family income and better nutrition, which could lead to improved birth weight. Research has shown that risk factors such as low maternal education or low family income could affect pregnancy outcome regardless of the appropriateness of using antenatal care [32, 34]. We also noted a link between mother's parity and the proportion of LBW children. In fact, children of first-time mothers were more exposed to low birth weight than those of multiparous mothers in our study ($P<0.05$). The observations are similar to those of some authors who reported that primiparity was a predisposing factor to LBW [16]. In this study, a significant association was not observed between the number of antenatal visits and LBW during logistic regression analysis ($P=0.394$). Yet, it is recognized that a low number of antenatal visits is associated with a higher risk of LBW [35-37].

Some authors have reported that the risk of having LBW was higher in pregnant women who did not follow PNC [16, 38]. On the social level, our study found a correlation between the proportion of children with low birth weight and the size of the household of at least five people living there ($P<0.05$). Most large households in rural areas live in disadvantaged conditions. These households often face chronic food insecurity exposing women to undernourishment and malnutrition. In addition, authors have reported that maternal malnutrition is a major determinant of LBW [39, 40]. In addition, it was found that the proportion of children with LBW was strongly correlated with the socialization of the mother in rural areas ($P<0.05$). Most of these mothers who grew up in this environment are not educated and do not have enough knowledge and information about antenatal care.

CONCLUSION

The study revealed that low birth weight is a major public health problem with harmful consequences on morbidity, mortality, growth and psychomotor development of the child, during the first three months of life. More generally, low birth weight is a factor that threatens the survival of the child, both during the neonatal and infantile period. Child health is a key issue for the future of a country. It emerges from this study that the birth weight of the child is strongly linked to maternal characteristics such as occupation, age, parity and level of education. In addition, the societal environment such as the mother's socializing environment and household size influences birth weights. It is therefore urgent, particularly for developing countries, to continue and intensify their efforts to improve the living conditions of women of childbearing age in order to considerably

reduce low birth weight. To do this, it is essential to focus health interventions at all levels of the system in order to identify LBW problems and to act more for the benefit of maternal and child health.

DECLARATIONS

Authors' contributions

All authors contributed equally to the conception and design of the study.

Competing interests

The authors declare no conflicts of interests

Consent to publication

The authors unanimously agree that the information in this manuscript will be taken into account by your journal for publication and confirm that the results of this manuscript have not been published elsewhere.

Acknowledgments

The authors would like to thank the University Joseph KI-ZERBO for the funding which made it possible to finalize this work. Also, we thank the Institute for Research in Health Sciences (IRSS) for having provided the materials necessary for data collection. We grateful to the Regional Directorate of Health of the North Center and the health district of Kaya for having granted an investigation authorization within the framework of this study and the district of Pissila for their support in the data collection.

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Citation: Bougma S, Garanet F, Hama-Ba F, Cisse H, Tarnagda B, Zio S, Traore Y and Savadogo A. Factors associated with the low birth weight of children under five years in North Center of Burkina Faso. *J Life Sci Biomed,* 2022; 12(3): 48-55. DOI: https://dx.doi.org/10.51145/jlsb.2022.6