

***Original Research Article*****Associated factors of low birth weight among newborns at hospitals in Kisangani, Democratic Republic of Congo****Abstract :**

**Background:** Low birth weight remains a major public health problem in every country in the world. It is a predictor of early neonatal mortality, morbidity and long-term health. The aim of this study was to determine the prevalence of low birth weight and to identify the associated factors in a hospital setting in Kisangani.

**Material and methods:** An unmatched case-control study was used including all live and full-term births was conducted from 1 December 2023 to 31 May 2024 in the maternity wards of Makiso-Kisangani General Referral Hospital, Mangobo General Referral Hospital, Tshopo General Referral Hospital and Alwaleed Health Centre. A sample of 646 newborns was selected: 86 cases (newborns weighing less than 2500 grams) and 560 controls (newborns weighing 2500 grams or more). Factors associated with prehypertension were identified using logistic regression.

**Results:** The prevalence of low birth weight was 13.4%. Factors associated with low birth weight were maternal age less than 18 years, intergenital interval less than 2 years, maternal infection during pregnancy, high blood pressure, level of primary education and urban residential environment.

**Conclusion :** This study shows that low birth weight remains a public health problem in Kisangani. In addition to shedding light on the other contributing variables and the connections between them, prospective national research would enable the development of preventative measures.

**Key words:** Prevalence, associated factors, low birth weight, Kisangani, Democratic Republic of Congo

**INTRODUCTION**

Low birth weight (LBW) is defined as a weight of newborns at birth less than 2500 gram by World Health Organization. More than 20 million infants are born with low birth weight in worldwide [1, 2].

LBW continues to remain a major public health problem worldwide, especially in the developing countries. The birth weight of an infant is the single most important determinant of its chances of survival, healthy growth, and development [3]. There is widespread agreement that having LBW at birth disadvantages the child. LBW accounts for 60 to 80% of all newborn deaths. Along with short- and long-term infant and childhood morbidity, it is a significant cause of perinatal mortality. Infants born with birthweights of less than 2500 g had a mortality rate that was up to 40 times greater, and they had a significantly increased chance of developing long-term disabilities [4–10].

In 2020, the prevalence of LBW was greater than 10% in most African countries, and more specifically greater than 15% in 16 countries, with the highest rate (23%) recorded in the Comoros. The prevalence of LBW was around 10% or less in eight countries (Algeria, Eswatini, Kenya, Democratic Republic of Congo, Rwanda, Sierra Leone, Tunisia and United Republic of Tanzania) [11].

National measures to enhance mother and child health have been implemented, but the Democratic Republic of the Congo (DRC) still faces a public health crisis related to LBW. For a number of reasons, including the fact that the underlying mechanisms causing LBW remain poorly understood, it is challenging to prevent risk factors. Very little is known about LBW and its contributing causes in Kisangani. This is the context for our study, the first of its kind in our community, which aims to better target and combine interventions to prevent LBW.

## **MATERIALS AND METHODS**

### **1. Study design**

An unmatched case-control study was used.

### **2. Setting and study period**

This study was conducted in the maternity wards of Makiso-Kisangani General Hospital, Mangobo General Hospital, Tshopo General Hospital and Alwaleed Health Centre. These maternity units were chosen because of the high number of births recorded and their easy geographical accessibility. This work was carried out over a period running from 1 December 2023 to 30 May 2024.

### **3. Study target population**

The target population for this study was newborns born live at term in the above-mentioned health facilities during the study period.

### **4. Sampling and sample size**

Non-probability convenience sampling was used. A total of 646 respondents were enumerated for this study.

### **5. Selection of respondents (inclusion and exclusion criteria)**

Live newborns born at term with no known risk factors (i.e. intrauterine growth retardation) for low birth weight were included in the study.

Mothers who gave birth prematurely (before 37 completed weeks of gestation) and newborns from twin pregnancies were excluded from the study.

Mothers who gave birth to newborns weighing less than 2500 grams were cases and newborns  $\geq 2500$  grams were controls.

### **6. Study variables**

For the variables studied, cases comprising newborns with LBW were compared with controls, comprising all full-term newborns with a birth weight of between 2500 and 4000g. The dependent variable was low

birth weight. The independent variables were the mother's socio-demographic data (age, profession and socio-economic level), parity and medical history, as well as the course of the last pregnancy (pathologies during pregnancy, follow-up, term, gestational age), the characteristics of the delivery (mode) and the characteristics of the newborn (term, weight, size, sex, malformations and transfer to the neonatology department). Anaemia in pregnant women was defined as an Hb level of less than 10g/dl. Arterial hypertension was defined as a blood pressure greater than 135/85mmHg. Maternal infection was defined as any bacterial, viral, parasitic or mycotic infection occurring during gestation. The nutritional status of the mothers was assessed by calculating the body mass index (BMI) determined by the ratio of body weight (in kilograms)/square of height (in metres). A BMI of between 18.5 and 24.9 kg/m<sup>2</sup> corresponded to good nutritional status. Malnutrition was defined as a BMI of less than 18.5 kg/m<sup>2</sup>.

### **7. Data collection**

Data were collected retrospectively, using a documentary analysis technique. We used women's medical delivery records and registers using a pre-established data collection form containing the study variables.

### **8. Data processing and analysis**

The data were entered and processed using SPSS software (IBM SPSS Statistics 22).

Frequencies, percentages, means and standard deviations were used to describe maternal sociodemographic and obstetric characteristics. Factors associated with prehypertension were identified using logistic regression.

## **RESULTS**

### **1. General characteristics of term newborns in the study sites**

The data from this study indicate that the majority of newborns were male, both among those with LBW and those of normal weight. The mean weight of term newborns ranged from 1958±339 g among LBW births to 3329 ±480 g among normal weight births. The above data are presented in Table 1.

### **2. Socio-demographic data of the study participants**

These data show that most of the study participants were aged between 18 and 35, were Christian, had no occupation, were illiterate and lived in urban areas. These data are presented in Table 2.

### **3. Obstetrical characteristics of study participants**

The obstetric data provided the following information :

- the majority of the women surveyed had an intergenital interval of less than 24 months and a normal BMI ;
- Most of them had no history of abortion or stillbirth and had given birth vaginally;
- The majority were multiparous, normotensive and had not contracted any infection during pregnancy;

- Anaemia was found in 53.5% of mothers who had given birth to LBW babies, compared with 25% of those who had given birth to babies of normal weight. These data are given in Table 3.

#### **4. Prevalence of low birth weight in the study sites**

Of the 646 full-term newborns in the study sites, 86 were of low birthweight, representing a prevalence of 13.4%.

#### **5. Association between maternal, obstetric and neonatal characteristics and newborn birth weight**

Multivariate analysis indicated that maternal age less than 18 years, **interpregnancy interval** less than 2 years, maternal infection during pregnancy, arterial hypertension, primary education level, urban residential environment and male sex of the newborn were significant predictors of LBW. These data are presented in Table 4.

### **DISCUSSION**

#### **1. General characteristics of the study population**

The aim of this **unmatched case-control study** was to determine the prevalence of LBW in hospitals in Kisangani and to identify associated factors. Previous studies have matched one case to one control [12, 13], while other authors have matched more than one control to a case. In the present study, we matched 6 controls to one case [14-16].

#### **2. Prevalence of low birth weight**

**Our study revealed a prevalence of low birth weight of 13.4%.** This prevalence is close to that found in studies conducted in other regions of DR Congo, i.e. 11.6% and 11.8% respectively [17,18]. However, it remains high compared with the national rate according to the demographic and health survey, which reported a rate of 7% and 6.3% for Katanga province [19].

High prevalence rates have also been reported in studies carried out in Zimbabwe and Morocco, where they were 19.9% and 22% respectively [20,21]. The differences in prevalence observed in these studies could be explained by the multiplicity of risk factors, in particular malnutrition, inadequate monitoring of pregnancy, malaria and repeated urogenital infections during pregnancy [22].

#### **3. Factors associated with LBW**

##### *3.1. Maternal age under 18 years*

According to the results of studies carried out in Tunisia and DR Congo, maternal age under 18 years was a factor in the occurrence of LBW [14, 22, 23]. Our results concur with these studies, with a statistically significant difference ( $p=0.003$ ). Several factors could explain this finding, including competition for nutrients between the growing adolescent and the foetus, which appears to be at the root of the problem, and competition between pregnancy and growth, which has a particularly unfavourable effect on the micronutrient status of adolescent girls [14, 22].

##### *3.2. Intergenerational interval of less than 2 years*

It appears that an intergenerational interval of less than 2 years was associated with low birth weight in the maternity units visited in Kisangani during the present study ( $p= 0.002$ ). This result is similar to that of Letaief et al and Mamba et al [17, 23]. Maternal exhaustion syndrome describes what happens when a woman's body is used without rest and without time to recover. Other factors, such as the energy costs of pregnancy and lactation, particularly in the context of close reproductive cycles with no recovery time for the woman, lead to a cumulative deterioration in maternal nutritional status, which can lead to LBW [14].

### *3.3. Maternal infection during pregnancy*

Our study showed that maternal infection during pregnancy was identified as a predictor of LBW. This result corroborates the observations made by other authors on this subject [16,17,24,25]. However, a study from Benin found no correlation between infection during pregnancy and the birth of a newborn with LBW [25]. The normal course of pregnancy can be disrupted by infections, firstly because of the inflammatory reaction that accompanies any infection and secondly because, during an infection, the woman is weakened and obliged to draw on her own nutritional and energy reserves [26].

### *3.4. Hypertension*

The bivariate and multivariate analyses ( $OR =0.453 ; 0.277-0.747 ; p= 0.002$ ) performed with our data indicate that there is a correlation between hypertension and LBW. This result is similar to that of Mabilia-Babela et al and Nkwabong E et al [13,27]. High blood pressure is thought to disrupt blood circulation and consequently placental exchanges, leading to a reduction in both oxygen and micronutrient supply from the mother to the foetus during pregnancy [17].

### *3.5. Level of primary education*

According to the results of this study, mothers with a high level of education were less likely to give birth to a low birth weight baby than those with a primary education. This observation is consistent with several studies associating LBW with maternal education [28,29].

### *3.6. The urban residential environment*

In this study, the probability of giving birth to a low birth weight baby was significantly higher among urban women, which is consistent with studies conducted in Ethiopia and Bangladesh [30,31].

According to another study conducted in Zambia, women living in urban areas were unaware of the benefits of starting antenatal care early, and lacked sufficient knowledge about such care and early antenatal attendance [32]. This constatation confirms the observation made in this study ( $OR 0.523 (0.335-0.814; p=0.004)$ ).

### *3.7. Anemia*

According to this research, it has been shown that there is a relationship between anaemia and LBW. Similar results have been obtained by other researchers [33,34]. Gestational anaemia can lead to a number of complications, one of the most significant of which could be the development of LBW due to poor

intrauterine growth associated with disruption of foeto-placental blood flow, resulting in reduced micronutrient and oxygen intake [26].

## LIMITATIONS

In this study, the main limitation lies in the data used to carry out the analyses. It was collected primarily for routine healthcare rather than for a specific intervention. It is therefore possible that errors were made when documenting the records. Lastly, this study's analysis of the data only captures the reality of a small number of public health facilities. Consequently, the findings cannot be extrapolated to moms who gave delivery at home or in private healthcare facilities.

## CONCLUSION

This study shows that low birth weight remains a public health problem in Kisangani. The research was carried out in four maternity units in the city and revealed certain factors predictive of LBW, such as maternal age under 18, birth interval under 2 years, maternal infection during pregnancy, hypertension, primary education level, urban residential environment and anemia. In addition to shedding light on the other contributing variables and the connections between them, prospective national research would enable the development of preventative measures.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

## Ethical Approval

Before starting the survey, a request for authorisation was sent to the medical-health and administrative authorities of the health facilities concerned. The anonymity of the questionnaires ensured the confidentiality of the data.

## Consent

As per international standards, parental written consent has been collected and preserved by the author(s).

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Table 1. General characteristics of term newborns in the study sites

General characteristics	Weight	
	< 2500 grams n (86)	≥ 2500 grams n (560)
Sex of newborn		
Male[n (%)]	45 (52,3)	287 (51, 2)
Female [n (%)]	41 (47,7)	273 (48,8)
Newborn weight [mean ± SD]	1958±329 grams	3329±480 grams

Table 2. Socio-demographic data of mothers taking part in the study

Socio-demographic data	N	%
Age (years)		
< 18	29	4,5
18-35	517	80
>35	100	15,5
Residence		
Urban environment	581	90
Rural	65	10
Religion		
Christian	587	90,8
Muslim	32	4,9
Kimbanguist	19	3
Other	8	1,5
Profession		
With profession	529	81,8
No profession	117	18,2
Level of education		
Illiterate	387	58,5
Primary	129	20
Secondary	77	12
University	53	9,5

Table 3. Obstetric characteristics of study participants (N= 646). Bivariate analysis.

Obstetrical characteristics	Case (n= 86)	Control (n= 560)	Pearson Chi- square
Intergenic interval			0.000
< 24 months [n (%)]	69 (80,2)	406 (72,5)	
≥ 24 months [n (%)]	17 (19,8)	154 (27,5)	
Hypertension			0.007
Yes [n (%)]	4 (4,6)	14 (2,5)	
No [n (%)]	82 (95,4)	546 (97,5)	
Anemia			0.002
Yes [n (%)]	46 (53,5)	140 (25)	
No [n (%)]	40 (46,5)	420 (75)	
Maternal infection during pregnancy			0.000

Yes [n (%)]	27 (31,3)	168 (30)	
No [n (%)]	59 (68,7)	392 (70)	
<b>BMI</b>			<b>0.453</b>
< 18,5 [n (%)]	9 (10,4)	39 (6,9)	
18,5 - 24,9 [n (%)]	58 (67,4)	392 (70)	
25 - 29,9 [n (%)]	13 (15,1)	95 (17)	
≥ 30 [n (%)]	6 (7,1)	34 (6,1)	
<b>Number of pregnancies</b>			<b>0.089</b>
1 [n (%)]	29 (33,7)	201 (35,8)	
2 [n (%)]	18 (21)	128 (22,8)	
3 [n (%)]	39 (45,3)	231 (41,4)	
<b>History of stillbirth</b>			<b>0.167</b>
Yes [n (%)]	3 (3,4)	9 (1,6)	
No [n (%)]	83 (96,6)	551 (98,4)	
<b>Route of delivery</b>			<b>0.345</b>
Vaginal delivery [n (%)]	77 (89,5)	498 (88,9)	
Caesarean section [n (%)]	9 (10,5)	62 (11,1)	
<b>History of abortion</b>			<b>0.875</b>
Yes	13 (15)	67 (12)	
No	73 (85)	493 (88)	

**Table 4. Association between maternal, obstetric and neonatal characteristics and birth weight of newborns.**

Characteristics	Adjusted OR (95% CI)	p
Maternal age under 18	1.045 (1.013-1.070)	0.003
Interpregnancy interval less than 2 years	1.810 (1.264-2.602)	0.002
Maternal infection during pregnancy	3.960 (2.718-5.565)	0.000
Hypertension	3.324 (1.697-6.468)	0.000
Primary education level	0.453 (0.279- 0.747)	0.002
Urban residential environment	0.523 (0.334- 0.814)	0.004
Anemia	1,22 (1,07-1,47)	0,002