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Factors Associated with Low Birth Weight in Reference Hospital Structures in Kisangani, Tshopo Province in Democratic Republic of the Congo

Judith Kabamba Nsampu[1], Nelly Madiya Dikamba PhD, Mdh[2]

[1]Learner Public Health School of Kinshasa (ESPK), Faculty of Medicine, University of Kinshasa (UNIKIN)
Email: *kabibi1306[at]gmail.com*

[2]Department of Epidemiology and Health of Families and Specific Groups, School of Public Health (ESPK), University of Kinshasa (UNIKIN)

Abstract: ***Context and objective: Low Birth Weight (LBW) is a health phenomenon which exposes one to morbid perinatal, neonatal and post-neonatal mortality and which sometimes presents irreversible handicaps. According to the World Health Organization (WHO), LBW is associated with almost 80% of neonatal deaths worldwide and approximately 20 million children are born each year worldwide with a birth weight less than 2500g. The objective of the present study was to determine the factors associated with FPN in order to contribute to the reduction of morbid infant mortality in the city of Kisangani. Methods: A matched case-control study was carried out with 124 cases against 248 controls in 4 reference maternity hospitals in the city of Kisangani thanks to the documentary review of the medical files of mothers carrying single-fetal pregnancies who gave birth to live children from January 2021 to December 2021. The files were divided into two groups: cases (mothers with newborns whose BW was <2500 gr) and controls (mothers with newborns whose BW was ≥ 2500 g). The data were collected electronically, with the ODK collection V 2022.2.3 application and analyzed using IBM SPSS version 25 software. Multivariate logistic regression at the 5% significance level made it possible to identify the factors associated with FPN. Results: The magnitude of FPN was 9.5% (95% CI 7.9-11.1%); primiparity ORa 1.810 (95% CI 1.029-3.184) and overweight ORa 0.562 (95% CI 0.325-0.972) were significantly associated with FPN in the Kisangani reference structures. Conclusion: In this study, mothers' primiparity constituted the only risk factor associated with LBW. Thus, actions will be focused on health education and community awareness of first-time mothers to fight against FPN.***

Keywords: magnitude, associated factors, low birth weight, perinatal, morbid mortality

1. Introduction

Development stakeholders remain concerned about the reduction in neonatal mortality in view of the 2030 challenges which aim to reduce neonatal mortality to no more than 12% $_0$ live births in all countries. Globally in 2019, nearly 2.4 million children died during their first month of life, or 46.2% of deaths from preventable causes among children aged under 5 years (1). Between 2019 and 2021, estimates from the United Nations inter-agency group showed that the global increase in neonatal mortality was fairly stationary at around 18% $_0$ live births and that sub-Saharan Africa recorded the highest neonatal mortality rate in the world. approximately 27% $_0$ live births (2). In the Democratic Republic of Congo (DRC), the same source reported that the DRC, the third most affected sub-Saharan country after Nigeria and Ethiopia, now occupied second place with a neonatal mortality rate equivalent to that of Africa. sub-Saharan (2).

Causes of neonatal deaths include premature births, low birth weight (LBW), and delivery-related complications such as asphyxia, infections, and congenital malformations (1) . According to UNICEF, More than 80% of children who die in the neonatal period suffer from LBW due to prematurity or intrauterine growth retardation (3).

FPN is defined as a birth weight less than 2500 grams regardless of gestational age (4). FPN is of great importance in public health in both high- and low-income countries; due to its magnitude and its different implications on the health of the newborn in the short and long term. Globally, nearly 20 million births were low birth weight for a prevalence of 14.6% in 2015; nearly 3 quarters of these births were concentrated in South Asia and sub-Saharan Africa (3). This prevalence varied greatly depending on the region of the world, respectively 9% in Latin America and the Caribbean, 6% in East Asia, 28% in South Asia (5), 13.7% in Africa, 15% in Angola and in the Central African Republic, 14% in Gabon, 12% in Congo Brazza and Cameroon and 11% in the DRC (5.6) . Between 2014 and 2018, according to national surveys, the national prevalence of FPN was stationary and estimated at 7.1%. Those of the Orientale Province and Tshopo were respectively 7% and 4.9% (7.8).

FPN is an important indicator of the chances of survival and subsequent health of the newborn, due to the link between this weight and infant morbidity and mortality (4) ;and newborns who survive FPN are more likely to present later in life with growth retardation, developmental and physical health disorders but also non-communicable diseases such as diabetes and cardiovascular diseases (3).
The pace of progress in reducing the FPN is hardly encouraging; progress still remains low in view of the global nutritional challenges of reducing the prevalence of LBW by 30% between 2012 and 2025. In other words, a reduction of 3% per year is desirable to hope to achieve global objectives. The different regional progressions estimated by the WHO were almost 0.01% in high-income countries of North America and Europe; 1.4% in South Asia and 1.1% in sub-Saharan Africa (3) . Thus, to hope to achieve global nutritional goals; It is important to know the risk factors for

FPN and to propose well-targeted, evidence-based interventions to accelerate progress in reducing FPN.

There are several risk factors associated with the occurrence of LBW: young age of the mother, smoking, excessive alcohol consumption, induction of labor, elective cesarean sections, fertility treatments which increase the risk of multiple pregnancies, obstetric complications, chronic maternal illnesses including hypertension, diabetes; infections such as malaria, urogenital infections, unfavorable nutritional status, as well as environmental factors such as indoor pollution and drug addiction (3,4).

In the DRC precisely in its eastern part, some studies have been carried out including those of Mamba in Bukavu and Apollinaire S. in Katwa (9,10). These studies found that LBW was associated with young maternal age, inter-birth space < 24 months, the presence of infection during pregnancy (9) , primiparity, malnutrition. of the mother (10) and hypertension during pregnancy (9,10). Concerning the city of Kisangani, capital of Tshopo , beyond the research work of J. Likwela which reported that preventive treatment with Sulfadoxine pyrimethamine (SP) reduced the risk of occurrence of FPN (11) ; there is no other publication that has integrated the above-identified factors. This is the reason which justifies our scientific approach with the objective of determining the factors associated with FPN in the reference hospital structures of Kisangani.

2. Methods

Types and framework of the study

This was a matched case-control study (1/2 ratio) based on a documentary review of the files of mothers (CPN form, outpatient consultation form, partogram, CPN and maternity register) who gave birth in 4 most frequented reference hospital structures with good archiving (CSR Alwaleed, Mokili , St Joseph and HGR de Lubunga) in the city of Kisangani, capital of the Tshopo province between July 21 and August 12, 2022 The city includes 6 administrative communes grouped into 5 health districts (Makiso - Kisangani, Tshopo, Kabondo, Mangobo and Lubunga) which have a total of 12 reference structures including 5 general hospitals and 7 health centers; 10 structures are located in urban areas and 2 others in rural areas.

Population and inclusion criteria

The study included all mothers carrying a single-fetal pregnancy who were exempt from stillbirth during the period from January 1, ^{2021} to December 31, 2021 and who had complete files (i.e. containing all the information necessary for the 'study). The case was defined as any newborn whose birth weight (BW) was strictly less than 2500 g and controls defined as any newborn with a birth weight of at least 2500 g. Each case was matched to two newborns of the same sex and born on the same day (within 24 to 48 hours) within the same structure.

Sampling techniques

We sorted all the files of mothers admitted for childbirth in the 4 structures; and the selection of cases was carried out exhaustively and that of the two identified controls was carried out randomly using the Random application Genarator number in case more than 2 witnesses are obtained for the case. In total, 1304 files were sorted; 124 case files versus 248 witness files were included in the study.

Study variables

The dependent variable of the study was the newborn's birth weight expressed in grams. The independent variables included the sociodemographic characteristics of the mother (age, educational level, occupation, place of residence), the gyneco-obstetric characteristics of the mother (parity, gestation, inter-birth space), the mother's morbid complications (nutritional status at CPN1, anemia during pregnancy), the mother's lifestyle habits (monitoring of prenatal CPN consultations) as well as neonatal data (sex of the newborn).

Data collection and analysis

The data that were collected using smartphones configured with the Open Data Kit ODK collection v2022.2.3 application came from the mother's complete files established since CPN1; then exported to MS Excel 2019 software for processing and analyzes were carried out using IBM SPSS statistics version 25 software. We carried out univariate, bivariate and then multivariate analyses. Categorical variables were summarized by a table of their relative frequencies and numerical variables by their measures of central tendency. After the bivariate logistic regression, all variables that were significant at the level of at least 0.20 were reintroduced into the multivariate logistic regression model at the 5% significance level.

Ethical considerations

After the approval of the authorities of the Kinshasa School of Public Health (ESPK), we obtained the consent of the health authorities (Head of the Provincial Division of Tshopo , the four chief doctors of Kabondo zones , Makiso - Kisangani, Tshopo and Lubunga and medical directors of the identified structures). The anonymity and confidentiality of the data were respected.

3. Results

During the study period, 1711 births were declared in the registers of the 4 structures. Of the 1304 (i.e. 76%) usable files, 124 (9.5%) concerned FPN newborns and 1180 (90.5%) concerned those with a PN greater than or equal to 2500g. Analyzes carried out, the median weight (±EIQ) of the cases was 2300 (±400) gr (Min.1400 gr; Max.2480gr) and that of the controls was 3100 (±673) g (Min.2500gr; Max.4600gr). The median age (±IQR) of the mothers who gave birth to the case was 23 (±10) years (Min. 13 years; Max. 41 years), while that of mothers with normal weight children was 24 (± 9).) years (Min. 15 years; Max. 42 years).

Table I describes that 9 out of 10 controls had a weight less than or equal to 3999g and the majority of cases (more than 95%) had a weight between 1500g and 2499g. Among cases, approximately 3 out of 100 newborns were very LBW.

Regarding the profile of mothers, nearly 8 out of 10 women who gave birth in hospital structures in the city of Kisangani in 2021 came from an urban environment, the majority of them were married or in a common-law relationship. Nearly

9 out of 10 women were unemployed, and almost 6 out of 10 women had an age category between 20 - 35 years and a low level of education. They were more primiparous (4 out of 10), almost 6 out of 10 women had not suffered from anemia during pregnancy and had a normal nutritional status at CPN1. Most of them (7 out of 10) had followed ANC (Table II). In addition, Table II at the 5% significance level reveals that in bivariate analysis the FPN is significantly associated with young age OR 1.451 (0.89-2.35), with lack of profession OR 2.462 (1. 11-5.47), primigestity OR 2.054 (1.21-3.5), primiparity OR 2.206 (1.28 -3.79) and maternal overweight at CPN1 OR 0.494 (0. 29-0.841). After adjusting the FPN with the other factors according to a conditional top-down stepwise data entry model, ***primiparity*** ORa 1.810 (1.029-3.184) and ***overweight*** ORa 0.562 (0.325-0.972) were associated with FPN.

4. Discussion

The magnitude of FPN found by our study was 9.5% (95% CI 7.9–11.1%), which was different from that of previous research (12–15) . LUHETE and colleagues found a relatively low magnitude of 6.4% (95% CI 4.96-7.8) (13). Indeed, their investigations were carried out in essentially urban hospital structures in the city of Lubumbashi. Furthermore, the studies of KAMALA, KANGULU and TSHINZOBE found higher proportions of FPN respectively 21% (95% CI 20.6-21.4%); 14.3% (95% CI 11.3-17, 4%) and 13.27% (95% CI 12.14-14.4%) (12,14,15) . The work of KAMALA and TSHINZOBE was carried out in the main large reference structures respectively in Tanzania “Muhimbili National Hospital” and the west of the health province of Kinshasa “Kingasani Hospital Center (CH Kingasani)”. Those of TSHINZOBE and KANGULU included multiple pregnancies, which are strongly associated with the occurrence of LBW (12,15) . However, this magnitude was close to those of the studies carried out at the CSR of Douentza in Mali 9.2% (95% CI 8.08-10.32) and in the reference hospitals of Bukavu in the DRC 11.6% (95% CI 10 .28-12.92) (9.16) . This could be justified by the similarity of the inclusion criteria under study and the urban -rural environments where the research was carried out. Indeed, all mothers' files exempt from stillbirth, multiple pregnancy and missing information necessary for the study were selected.

In both bivariate and multivariate analysis, the present study did not report a significant association between young age and FPN. Previous studies by ILUNGA and TSHINZOBE in the DRC (15,17) would have made the same observation, unlike those by DEMELASH in Ethiopia which would have established a significant association between FPN and young age < 20 years. This could be explained by the fact that in our sample, the proportion of LBW newborns (cases) was not significantly greater than that of controls for the mothers' age group strictly below 20 years; but also by the fact that the median age of the mothers who gave birth to cases and controls was included in the non-critical range from 20 to 35 years.

Regarding the type of occupation without profession of the mother, the present study did not find a significant association with FPN after multivariate logistic regression although it existed in bivariate analysis. This result was similar to the observation made by DEMELASH (18).

Regarding the mother's gyneco-obstetric history, primiparity was significantly associated with LBW both in the bivariate analysis and in the multivariate analysis. Several authors in Nepal, Mali and the DRC had mentioned the same results (12,16,19,20) . This convergence is due to the fact that the proportion of cases was significantly greater than that of controls in the primiparous group but also to the fact that primiparity in our study was strongly associated with young age (strictly less than 20 years). However, TSHINZOBE in Kinshasa concluded that there was a low risk of LBW occurring in first-time mothers. Unlike previous studies by DEMELASH, N. TELLY AND MAMBA (9,16,18) , no significant association was revealed between FPN and low birth space in our study; both in bivariate and multivariate analysis. The different fluctuations in sampling could explain this surprising result.

Regarding the nutritional status of the mother, maternal overweight at CPN1 was significantly associated with FPN in both bivariate and multivariate analysis. This observation was also made by ILUNGA; indeed, the risk of giving birth to a LBW child decreases with women with a high body mass index (BMI) (17). The present study did not reveal a significant association between low maternal BMI at CPN1 and FPN in both bivariate and multivariate analysis. This result is similar to that of research by Mamba and colleagues in Bukavu. However, research by DEMELASH and ILUNGA reportedly confirmed that low maternal BMI was associated with more spontaneous preterm births and LBW (17,18) . SHARIFZADEH during a longitudinal study carried out in Iran would have made the same observations as the latter two. Indeed, the poor nutritional status of the mother at CPN1 would result in a reduction in micronutrient intake at the level of mother-fetus exchanges and lead to LBW (21) . These different findings from each other could be explained by the difference in the methodologies used to assess the nutritional status of the mothers and the times of occurrence of CPN1 when the weight was systematically taken.

Contrary to the research of DEMELASH and ILUNGA (17,18) , the results of our research did not conclude that there was a significant association between non-monitoring of ANC and the occurrence of FPN. Our results seem a little surprising; in fact, monitoring of prenatal care would have a direct protective effect on the risk of occurrence of FPN. It would be necessary for further studies to be carried out to verify the reproducibility of our results.

5. Conclusion

The results of our study showed that primiparity was significantly associated with low birth weight. As this is a non-modifiable factor, targeted and coordinated community education and awareness sessions for first-time mothers are necessary to reduce the risks of LBW occurrence.

Conflicts of interest

No conflict of interest was pursued during the completion of this work.

Author contributions

All authors contributed in one way or another to the completion of this article from start to finish.

Conceptualization, methodology: NSAMPU K, PhD DIKAMBA MN Data collection, analysis, and writing: NSAMPU K. Validation of analyzes and revision of the article: PhD DIKAMBA MN

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Tables and Figures

Table I: Distribution of birth weight by category in the 4 structures surveyed

Birth weight (by category in gr)	Witnesses 248	Case 124	Overall 372
Very FPN ≤ 1499	0 (0%)	4 (3.2%)	4 (1.1%)
FPN [1500-2499]	0 (0%)	120 (96.8%)	120 (32.3%)
Normal [2500-3999]	228 (91.9%)	0(0%)	228 (61.3%)
Large PN ≥4000	20 (8.1%)	0 (0%)	20 (5.4%)

gr : weight in grams

Table II: Factors associated with FPN in bivariate and multivariate analysis by logistic regression

Independent Variables	TERMS	Witnesses	Case	Total	Raw Gold (95% CI)	P-Value	ORA (95% CI)	P-Value2
Age	<20	62 (25.0%)	41 (33.1%)	103 (27.7%)	1.451(0.895-2.352)	0.131	--	
	20-35	158 (63.7 %)	72 (58.1%)	230(61.8%)	1			
	>35	28 (11.3%)	11 (8.9%)	39 (10.5%)	0.862 (0.407-1.827)	0.699	--	
Place of Residence	Rural	57 (23%)	28 (22.6%)	85 (22.8%)	1.023(0.612-1.712)	0.93	--	
	Urban	191 (77%)	96 (77.4%)	287 (77.2%)	1			
Marital Status	Bachelor	27 (10.9%)	21 (16.9%)	48 (12.9%)	1.65(0.09-3.06)	0.112	--	
	Married/common law	210 (84.7%)	99 (79.8%)	309 (83.1%)	1			
	Don't know (no information)	11 (4.4%)	4 (3.2%)	15 (4%)	0.771(0.24-2.48)	0.663	--	
Educational Level	Low level	150 (60.5%)	71 (57.3%)	221 (59.4%)	1.758 (0.73-4.24)	0.209	--	
	Intermediate level	72 (29%)	46 (37.1%)	118 (31.7%)	2.373 (0.95-5.91)	0.064	--	
	High level	26 (10.5%)	7 (5.6%)	33 (8.9%)	1			
Occupation	No occupation	212(85.5%)	116(93.5%	328 (88.2%)	2.462 (1.11-5.47)	0.027*	--	
	With profession	36 (14.5%)	8 (6.5%)	44 (11.8%)	1			
Gesture	Primigest	70 (28.2%)	52 (41.9%)	122 (32.8%)	2.054 (1.21-3.5)	0.008*	--	
	Paucigest	84 (33.9%)	38 (30.6%)	122 (32.8%)	1.25 (0.72-2.16)	0.42	--	
	Multigesture	94 (37.9%)	34 (27.4%)	128 (34.4%)	1			
Parity	Primiparous	80 (32.3%)	61 (49.2%)	141 (37.9%)	2,206 (1,281 -3,799)	0.004*	1.810(1.029-3.184)	0.039*
	Pauciparous	87 (35.1%)	35 (28.2%)	122 (32.8%)	1.164 (0.650-2.082)	0.609	1.121(0.621-2.022)	0.705
	Multiparous	81 (32.7%)	28 (22.6%)	109 (29.3%)	1		1	
Anemia During Pregnancy	No	149 (60.1%)	77 (62.1%)	226 (60.8%)	1			
	Yes	99 (39.9%)	47 (37.9%)	146 (39.2%)	1.09 (0.7 -1.7)	0.707	--	
Nutritional Status at CPN1	Underweight	4 (1.6%)	6 (4.8%)	10 (2.7%)	2.48 (0.68-9.02)	0.168	2.115 (0.57-7.843)	0.263
	Normal weight	152 (61.3%)	92 (74.2%)	244 (65.6%)	1		1	
	Overweight	77 (31%)	23 (18.5%)	100 (26.9%)	0.49 (0.29-0.84)	0.009*	0.562 (0.325-0.972)	0.039*
	Obesity	15 (6.0%)	3 (2.4%)	18 (4.8%)	0.33 (0.09-1.17)	0.09	0.400 (0.111-1.440)	0.161
ANC Monitoring	No	82 (33.1%)	39 (31.5%)	121 (32.5%)	1.08 (0.68 -1.71)	0.754	--	
	Yes	166 (66.9%)	85 (68.5%)	251 (67.5%)	1			
SAE **	Inf 24 months	87 (51.5%)	34 (54.8%)	121 (52.6%)	1.144 (0.638-2.053)	0.651		
	Sup or equal	82 (48.5%)	28 (45.2%)	110 (47.6%)	1			
*P SIGNIFICANT ** MISSING DATA								

Figures

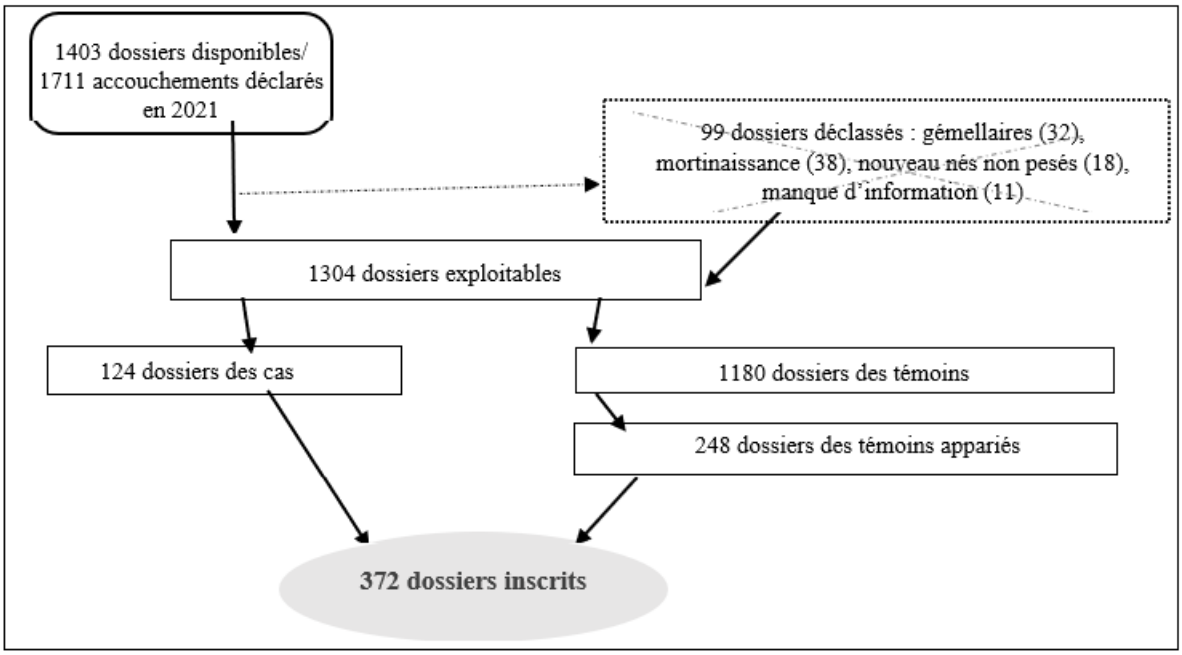

Figure 1: Flow chart of selected files