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Determinants of low birth weight during severe pre-eclampsia at University Clinics of Kinshasa in the Democratic Republic of the Congo: monocentric cross-sectional study

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Abstract

Background and Aims: Low birth weight is a major factor in neonatal morbidity and mortality and constitutes a real public health problem, both in developed and in developing countries. The aims of this study was to determine the frequency of low birth weight and its determinants in newborns during severe preeclampsia at the University Clinics of Kinshasa.

Methods: Cross-sectional and analytical study concerning a series of children born to mothers with preeclampsia in the Department of Gynecology between January 1, 2006 and December 31, 2015. Birth weight was measured at birth.

Results: The frequency of low birth weight was 60.4% in these children. An increase in SBP and PAD is associated, respectively, with 62.4% (r = 0.624, p <0.001) and 62.5% (r = 0.625, p <0.001) of the decrease in birth weight. After multivariate adjustment, gestational age <28 WA (aOR = 6.75 95% CI: 1.81-9.74, p = 0.013), the αmethyl Dopa + Nifedipine + Diazepam + MgSO4Pritchard scheme (aOR = 2.88 95% CI %: 1.87-4.07, p = 0.011) and maternal complications (aOR = 3.98 95% CI: 1.89-4.44, p = 0.010) were independent determinants of low birth weight of children.

Conclusion: The frequency of low birth weight in children born to preeclampsia mothers is high. This frequency is associated with certain risk factors such as gestational age below 37 weeks, the use of diazepam in the treatment regimen and maternal complications.

Keywords: low birth weight, severe preeclampsia, determinants, university clinics of Kinshasa

Introduction

Preeclampsia is a multisystem condition in pregnant women, characterized by maternal placental and vascular dysfunction [1, 2]. Pre-eclampsia is defined by the occurrence of arterial hypertension (hypertension) from the twentieth week of pregnancy, associated with renal impairment with proteinuria greater than 0.3g / 24h, it is thus distinguished from hypertension chronic and transient hypertension of pregnancy, as defined by the report of the "National High Blood Pressure Education Program Waring Group On High Blood Pressure In Pregnancy" [3, 4].

In most cases, follow-up helps prevent serious complications. The only way to save the mother is then to extract the fetus and its placenta, whether the fetus is already viable or not. Low birth weight (LBW) is a major factor in neonatal morbidity and mortality and constitutes a real public health problem, in both developed and developing countries [5, 6], due to its magnitude and its extent. Strong association with infant morbidity and mortality. It is an important predictor of child survival and subsequent development [1, 7] since it predisposes in the short and medium term to many pathologies such as respiratory distress syndrome, infections, necrotic enterocolitis, hydrocephalus and mental retardation [8]. It also increases the risk of developing certain conditions in adulthood such as coronary heart disease, high blood pressure, type 2 diabetes and depression [9, 10]. Birth weight is an important indicator of maternal health and nutritional status before and during pregnancy and reflects the quality of health care services [5]. This is why we conducted an analytical study whose objective was to determine the frequency of low birth weight and its determinants in newborns during severe preeclampsia at the University Clinics of Kinshasa.

Patients and Methods

This study took place in the Gynecology Department of the University Clinics of Kinshasa. This is a cross-sectional and analytical study concerning a series of children born to mothers with preeclampsia in the Gynecology Department between January 1, 2006 and December 31, 2015. The children born to these mothers with preeclampsia were either kept with their mothers. Or transferred to Neonatology. To include children, their mothers should meet the two criteria defined by group II of the classification of the National High Blood Pressure Education

Program of United States [11]: arterial hypertension onset after the twentieth week of amenorrhea (based on history and data from antenatal consultations) and proteinuria assessed by the test strip method and / or a test in urine collected over 24 hours. Children whose weight was not known were not included in this study.
The data were collected on a computerized sheet containing the following parameters: medical and surgical history, prenatal consultations, clinical examination on entry, additional examinations carried out, medical treatment instituted, progress under treatment, childbirth, postpartum follow-up for the mother. On the child side, gender, gestational age, weight, APGAR at the 1st, 5th and 10th minutes and the vital outcome.

Statistical analyzes

The evaluation, validation (univariate analysis, frequency, percentage, Pearson's Chi-square test, Student's t-test) and multivariate analysis (discriminant analysis, multiple logistic regression) of the data were respectively performed. Pearson's Chi-square test compared weight percentages of newborns (dependent variable) and socio-demographic and clinical factors. Logistic regression in univariate and multivariate analysis was generated to identify risk factors of low birth weight and degree of influence by calculating crude and adjusted OR; and 95% confidence intervals. The value of Probability P <0.05 was considered to be the threshold of statistical significance. All statistical analyzes were performed with IBM * SPSS (Statistical Package for Social Sciences) software on Windows version 24 (New York, USA).

Results

Frequency of low birth weight during PE

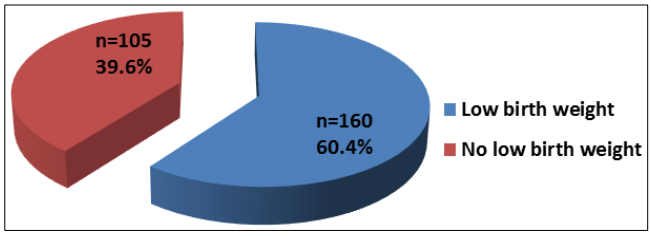


Fig 1: Frequency of low birth weight during preeclampsia

Of all the children born to preeclampsia mothers, 160 children, or 60.4%, had a low birth weight (Figure 1).

Table 1: Sociodemographic characteristics according to birth weight

Variables	Over all n=265	LBW n=160	Normal Weight n=105	p
Age	31.8±5.8	32.2±5.3	31.1±6.4	0.202
<20 years	4(1.5)	1(0.6)	3(2.9)	
20-35 years	178(67.2)	112(70.0)	66(62.9)	
>35 years	83(31.3)	47(29.4)	36(34.3)	
Level of study				0.492
Primairy	72(27.2)	45(28.1)	27(25.7)	
Secondary	96(36.2)	61(38.1)	35(33.3)	
University	97(36.6)	54(33.8)	43(41.0)	
Profession				0.389
Unemployed	203(76.6)	124(77.5)	79(75.2)	
Employment	62(23.4)	36(22.5)	26(24.8)	
Parity				0.271
Primiparous	107(40.4)	57(35.6)	50(47.6)	
Pauciparous	86(32.5)	57(35.6)	29(27.6)	
Multiparous	51(19.2)	33(20.6)	18(17.1)	
Large multipare	21(7.9)	13(8.1)	8(7.6)	
Gesture				0.204
Primigest	76(28.7)	41(25.6)	35(33.3)	
Paucigeste	86(32.5)	49(30.6)	37(35.2)	
Multigest	67(25.3)	47(29.4)	20(19.0)	
Large multigest	36(13.6)	23(14.4)	13(12.4)	

The average age of the mothers was 31.8 ± 5.8 years, most of them had a university level (36.6%), unemployed in most cases (76.6%), primiparous and paucigest. Sociodemographic characteristics did not influence the birth weight of the children, the difference was not statistically significant.

Table 2: Clinical characteristics according to birth weight

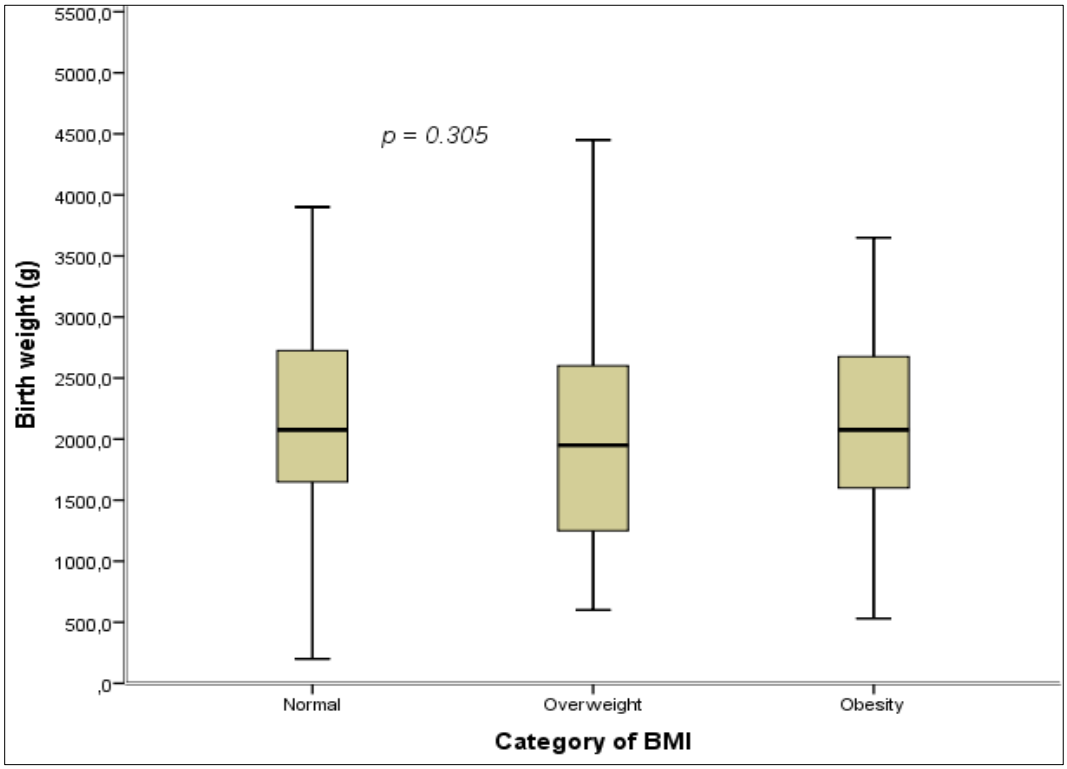
Variables	Over all n=265	LBW n=160	Normal Weight n=105	p
BMI, Kg/m^2	28.9±3.9	28.9±3.9	28.9±4.0	0.802
Normal	44(16.6)	25(15.6)	19(18.1)	
Overweight	117(44.2)	73(45.6)	44(41.9)	
Obesity	104(39.2)	62(38.8)	42(40.0)	
SBPmmHg	174.3±19.1	176.9±20.8	170.3±15.3	0.005
DBP mmHg	114.9±10.5	116.4±11.7	112.5±7.7	0.003
History of mather				
Preeclampsia	66(24.9)	48(30.0)	18(17.1)	0.012
Caesarean	38(14.3)	25(15.6)	13(12.4)	0.291
Proteinuria				0.075
++	19(7.2)	8(5.0)	11(10.5)	
+++	246(92.8)	152(95.0)	94(89.5)	
Œdema	222(83.8)	137(85.6)	85(81.0)	0.200
Traitement				
Scheme 1	96(36.2)	53(33.1)	43(41.0)	0.122
Scheme 2	81(30.6)	58(36.3)	23(21.9)	0.009
Scheme 3	22(8.3)	15(9.4)	7(6.7)	0.294
Scheme 4	66(24.9)	34(21.3)	32(30.5)	0.061
Complications	80(30.2)	62(38.8)	18(17.1)	<0.001
HRP	20(7.5)	14(8.8)	6(5.7)	0.252
IRA	7(2.6)	7(4.4)	0(0.0)	-
OAP	5(1.9)	3(1.9)	2(1.9)	0.658
CIVD	1(0.4)	1(0.6)	0(0.0)	-
Eclampsia	7(2.6)	5(3.1)	2(1.9)	0.427
Retinopathy Hypertension	47(17.7)	38(23.8)	9(8.6)	0.001

Regarding the clinical characteristics of the mothers, we note that the PAS (p = 0.005) and PAD (p = 0.003) were significantly higher in mothers who had children of low birth weight compared to those with children of normal weight. The frequency of low PN was higher in children whose mothers had a history of preeclampsia (p = 0.012), mothers with complications (p <0.001) and those treated under scheme 2 (p = 0.009) also had a frequency high of children with low birth weight.

Table 3: Characteristics of the newborn according to birth weight

Variables	Over all n=265	LBW n=160	Normal Weight n=105	p
Fetal heart sound				**0.040**
Absent	41(15.5)	31(19.4)	10(9.5)	
well	182(68.7)	101(63.1)	81(77.1)	
Disturbed	42(15.8)	28(17.5)	14(13.3)	
Gestational age on admission	34.9±3.6	33.1±3.3	37.9±1.5	<0.001
<28 WA	8(3.0)	8(5.0)	0(0.0)	
28-34 WA	96(36.2)	94(58.8)	2(1.9)	
>34 WA	161(60.8)	58(36.3)	103(98.1)	
Gestational age at birth	35.1±3.5	33.3±3.1	37.8±2.0	<0.001
<28 WA	6(2.3)	5(3.1)	1(1.0)	
28-36 WA	140(52.8)	128(80.0)	12(11.4)	
>36 WA	119(44.9)	27(16.9)	92(87.6)	
Delivery route				0.063
Low	81(30.6)	55(34.4)	26(24.8)	
Caesarean	184(69.4)	105(65.6)	79(75.2)	
Weight (gr)	2055.2±786.9	1534.6±465.6	2848.6±434.1	<0.001
High (cm)	44.0±5.1	40.9±4.2	48.4±1.9	<0.001
Cranial perimeter (cm)	31.2±3.3	29.3±2.8	34.0±1.6	<0.001

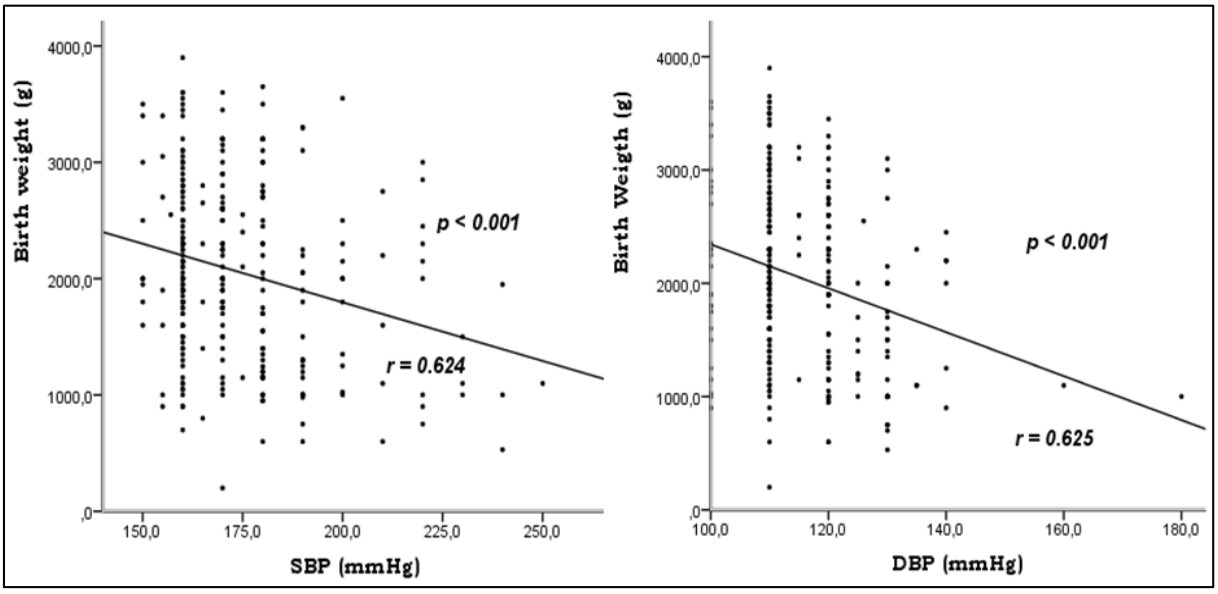
The characteristics of the children according to their birth weight are described in Table 3 and show that the frequency of low PN was significantly higher in children with absent / disturbed BCF (p = 0.040) and in children with gestational age less than 34 WA (p <0.001).



Mean values of PN according to the weight status of the mother

Fig 2: Mean values of BW according to the weight status of the mother

In this figure, it shows the mean BW values were lower in obese mothers than in overweight or normal mothers but the difference was not statistically significant (p = 0.305).



Linear correlation between weight and maternal blood pressure

Fig 3: Linear correlation between weight and maternal blood pressure

There is a significant negative linear correlation between the birth weight of children and SBP on the one hand (r = 0.624, p <0.001); and PAD on the other hand (r = 0.625, p <0.001). An increase in PAS and PAD is associated, respectively, with 62.4% and 62.5% of the decrease in PN.

Table 4: Determinants of low birth weight

Factors	*Univariate analysis*		*Multivariate analysis*	
	p	*Unadjusted OR (95%CI)*	*p*	*Adjusted OR (95%CI)*
History of PE				
No		1		1
Yes	0.019	2.07(1.13-3.81)	0.994	1.03(0.42-2.41)
Gestationnal age				
≥37 WA		1		1
28-36 WA	0.505	1.47 (0.51-4.35)	0.543	1.50 (0.51-4.77)
<28 WA	0.011	7.04 (1.91-10.15)	0.013	6.75 (1.81-9.74)
Scheme 2				
No		1		1
Yes	0.014	2.03(1.15-3.56)	0.011	2.88 (1.87-4.07)
Complications				
No		1		1
Yes	<0.001	3.06(1.68-5.57)	0.010	3.98 (1.89-4.44)

Abbreviations: αmethyl Dopa + Nifedipine + Diazepam + MgSO4Pritchard, OR: Odd Ratio, CI: Confidence interval

In univariate analysis, maternal history of PE, gestational age <28 WA, αmethyl Dopa + Nifedipine + Diazepam + MgSO4Pritchard pattern, and maternal complications were the determinants of low birth weight.

After multivariate adjustment, gestational age <28 WA (aOR = 6.75 95% CI: 1.81-9.74, p = 0.013), the αmethyl Dopa + Nifedipine + Diazepam + MgSO4Pritchard (aOR = 2.88 95% CI %: 1.87-4.07, p = 0.011) and maternal complications (aOR = 3.98 95% CI: 1.89-4.44, p = 0.010) were the independent determinants of low birth weight of children.

Discussion

A newborn baby's chances of survival are closely related to their birth weight. Mortality is higher and physical health problems are more common in low birth weight infants (<2500 g) than in those with normal birth weight [12, 14].

The frequency of FPN in this study is 60.4% (160 newborns), which is relatively high compared to the national average of 3.7% in 2005 reported in Algeria [15]. Several factors combine to explain this increase. On the one hand, the fact that the children were born to preeclamptic mothers. Preeclampsia causes hypo perfusion of the placenta (insufficient nutrition and oxygenation) which sees its own circulation deteriorate, resulting in ischemic placental lesions with fetal repercussions, hence the number of premature births and low birth weight high. On the other hand, the increase in the age of childbirth and the increased use of birthing techniques such as provocation of childbirth and cesarean section are other explanatory factors. This proportion of low birth weight newborns is almost analogous to the rate found by El Mhamdi *et al*. (51%) [13]. This value is closer to the values reported in studies of several developed countries [14]. On the other hand, this rate is high compared to that reported in African studies including that of the maternity ward of the Vélingara Senegal health center (23.78%) and those observed in most hospitals in Tanzania (12-18%) [16, 17].

We found a significant correlation between maternal blood pressure and birth weight. The more pressure the mother has, the lower the birth weight. This decrease in weight during the increase in pressure is explained by the fetal distress associated with hypoperfusion associated with the decrease in nutritional exchange during the increase in blood pressure [18].

After multivariate adjustment, gestational age <28 WA (ORa = 6.75 95% CI: 1.81-9.74, p = 0.013), the αmethyl Dopa + Nifedipine + Diazepam + MgSO4Pritchard (ORa = 2.88 95% CI %: 1.87-4.07, p = 0.011) and maternal complications (ORa = 3.98 95% CI: 1.89-4.44, p = 0.010) were independent determinants of low birth weight of children in this study.

Regarding gestational age, it was found that the gestational age of less than 37 weeks is one of the factors most strongly associated with low birth weight (p = 0.013), this finding is consistent with those reported by d other authors [19, 21]. Prematurity is one of the two main causes of low birth weight according to the literature.

The complications of preeclampsia in our study, as in the literature [22, 24], constitute a vital maternal and fetal emergency, they constitute a factor hindering nutritional exchanges between mother and child. This fact, already proven in the literature, is due to an increase in peripheral resistance leading to an increase in blood pressure [25].

Regarding the αmethyl Dopa + Nifedipine + Diazepam + MgSO4Pritchard scheme, the side effects of diazepam on the fetus (neurological depression, low APGAR, decrease in circulatory exchanges), would be responsible for the low birth weight.

Conclusion

The frequency of low birth weight in infants born to preeclampsia mothers is high. This frequency is associated with certain risk factors such as gestational age below 37 weeks, the use of diazepam in the treatment regimen and maternal complications. This work could help health care providers at all levels of the system better understand the problems of low birth weight and do more to benefit maternal and child health.

Conflict of Interest
The authors declare no conflict of interest

Acknowledgements
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Author's Contributions
RVV and ANN designed and analyzed the statistical data for the study. MTC, VND, TVA, MNB, and MFS contributed to the data collection. RRT, MMJM, ME and LMB supervised the study. All authors have read and approved the final and revised version of the manuscript.

References
1. Touimi AB, Benchrifi Y, Mahdaoui S, Samouh N. Epidémiologie de la pré-éclampsie dans la région du grand Casablanca. The Pan Afr Med J, 2020, 2:112. Published 2020 Mar 16. Doi: 10.11604/pamj-cm.2020.2.112.20677.
2. Cissé CT, Faye Dieme ME, Ngabo D, Mbaye M, Diagne PM, Moreau JC, *et al*. Indications thérapeutiques et pronostiques de l'éclampsie au CHU de Dakar. J Gynecol Obstet Biol Reprod. 2003; 32(3 pt 1):239-245.
3. Imane N. Les nouveau-nés de mères pré-éclamptiques. Rabat année Thèse N°14, 2020.
4. National high blood pressure education program working group on high blood pressure in pregnancy, Report of the National High Blood Pressure Education Program Working Group on High Blood Pressure in pregnanby. Am J Obstet Gynecol. 2000; 183(1):S1-S22.
5. Hassoune S, Bassel S, Nani S, Elbouri H, Zine K, Maaroufi A, *et al*. Les facteurs maternels associés au faibles pois de naissance: étude cas-témoins dans un hôpitalpublic marocain [Maternal factors associated with low birth weight: case-control study in a Moroccan public hospital]. The Pan Afr Med J, 2015, 20:303. Doi: 10.11604/pamj.2015.20.303.2659.
6. Bwana KI, Kilolo NUE, Kabamba NM, Kalenga MKP. Facteurs de risque de faible poids de naissance en milieu semi-rural de Kamina, République Démocratique du Congo [Risk factors for low birth weight in semi-rural Kamina, Democratic Republic of Congo]. Pan Afr Med J, 2014, 17:220. Published 2014 mars 20. Doi: 10.11604/pamj.2014.17.220.2366.
7. Coutinho P, Guilherme Cecatti J, Garanhani Surita F, De Souza JP, Siani de Morais S. Factors associated with low birth weight in a historical series of deliveries in campinas, brazil. Rev Assoc Med Bras. 2009; 55(6):692-9.
8. World Health Organization. Country, regional and global estimates. Geneva: WHO, 2005.
9. Barker DJ. Adult consequences of fetal growth restriction. Clin Obstet Gynecol. 2006; 49(2):270-83.
10. Costello EJ, Worthman C, Erkanli A, Angold A. Prediction from low birth weight to female adolescent depression: a test of competing hypotheses. Arch Gen Psychiatry. 2007; 64(3):338-44.
11. National high blood pressure education programm. Report of working group on high blood pressure in pregnancy. Am J Obstet Gynecol. 2000; 183(suppl 1):S1-S22.
12. Health Surveillance, Alberta Health and the Neonatal Research Unit, University of Calgary. Maternal Risk Factors in Relationship to Birth Outcome. 199 http://www.health.gov.ab.ca/resources/publications. Consulté le 31 juillet 2020.
13. Wen SW, Kramer MS, Liu S *et al*. Mortalité infantile d'après l'âge gestationnel et le poids à la naissance dans les provinces et territoires au Canada, naissances entre 1990 et 1994. Maladies chroniques au Canada. 2000; 21(1):15-24.
14. El Mhamdi S, Lifi B, Bouanène I, Hadded A, Sriha A, Letaief M, *et al*. Caractéristiques épidémiologiques et chronologiques du faible poids de naissance dans la région de Monastir (Tunisie) entre 1994 et 2007. Rev Med Brux. 2011; 32(3):147-153.
15. Ministère de la Santé et de la Population. Enquête nationale sur les objectives de la fin décennie Santé mère et enfant EDG Algérie 2000 (MICS). République Algérienne Démocratique et Populaire. Institut National de santé publique, 2001.
16. Lamine D. Analyse et interprétation des données relatives aux poids des enfants à la naissance, à la maternité du centre de Santé de Vélingara (Sénégal), Bibliothèque ISED. 20 http://www.ised.sn/epi.htm. Consulté 31 juillet, 2020.
17. Piechulek H, Mendoza AJ. Les enfants de poids insuffisant à la naissance: les exigences d'un programme de surveillance nutritionnelle exemple: la zone rurale de la province du littoral (Cameroun). Médecine d'Afrique Noire. 1996; 43(2):70.
18. Epiney M, Boulvain M, Irion O. Facteurs de risque psychosociaux et accouchement avant terme. Rev Med Suisse. 2011; 7(314):2066-2069
19. Letaief M, Soltani MS, Ben Salem K, Bchir A. Epidémiologie de l'insuffisance pondérale à la naissance dans le Sahel tunisien. Santé publique. 2001; 13(4):359-366.
20. L'insuffisance de poids à la naissance - La coalition communautaire pour la prévention de l'insuffisance de poids à la naissance, Causes de l'insuffisance de poids à la naissance, 2003. http://www.successby6ottawa.ca/lbwfpn/francais/causes_of_lbw.html. Consulté le 10 juin 2013.
21. Alihonou E, Augueh V. Dénutrition de la femme enceinte et de la femme allaitante. Louvain Méd. 2000; 119:290-292.
22. Jayi S. La prééclampsie sévère. Médecine Humaine; Fès, 2005, 50.
23. Panchals, Arria A, Labhsetwar. Maternal mortality during hospital admisel for delivery: a retrospective analysis using state maintained database. Anesth Analg. 2001; 93:134-41.
24. SFAR. Réanimation des forms graves de pééclampsie. Conférences d'experts. Elsevier, Paris, 200, 255.
25. Thiam M, Goumbala M, Gring S. Pronostic maternel et foetal de l'association hypertension et grossesse en Afrique Subsaharienne. Perret Service de Dakar Cardiologie, Hôpital Principal de Dakar. 2003; 32:35-36.