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Psychomotor Development of Low Birth Weight Infants at the "Mère-Enfant" University Hospital Centre (UHC) of Libreville

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Abstract

Introduction: Low birth weight is a key indicator of newborn health. The objective of this study was to contribute to the reduction of low birth weight-related morbidity and mortality. **Patients and Methods:** cohort study conducted from January 2019 to July 2020 at the "Mère-Enfant" University Hospital Centre (UHC) of Libreville. All newborns with a birth weight < 2500 g were included. The clinical data of patients were studied. They were followed over a period of 12 months and assessed psychomotorly by the Brunet-Lézine scale. **Results:** 1260/9035 births of low birth weight (14.0%) were observed, and 300 among them were included. The mortality rate was 27.0% (81) and 219 were followed for 12 months. The sex ratio was 0.8, the average birth weight was 2008.6 ± 215.2 g. The average gestational age was 34 ± 12 weeks with 75.3% prematurity. An infant disease was observed in 61.6% of cases and respiratory pathologies were more observed except at 3 months of age where the proportion of digestive pathologies was 20.5%. At the time of the last consultation at 12 months of life, 76.2% of infants had no pathology. The quotients of postural development, language and coordination were normal (between 110 - 70) respectively in 75.4%, 99.1% and 68% of cases at the age of 12 months. The psychomotor development quotient was correlated with the birth weight in the language area r = 0.15 (p = 0.024), posture r = 0.15 (p = 0.015) and coordination r = 0.15 (p = 0.026) respectively. **Conclusion:** Low birth weight is a public health problem at UHCME-JEF. Despite the fact that psychomotor development can be said to be satisfactory, many efforts remain to be made to reduce low birth weight levels and improve survival.

Keywords

Hypotrophy, Psychomotor Development, UHCME-JEF, Libreville-Gabon

1. Introduction

Low birth weight is defined by the World Health Organization (WHO) as birth weight below 2500 g, regardless of gestational age [1] and generally applies only to live births [2]. This is not to be confused with intra-uterine growth retardation which is defined as a birth weight below the 10th percentile of the reference curves [3]. This weight limit has been used for nearly a century [4] and categorizes neonates into low birth weight where the low birth is between 1500 g and <2500 g; very low birth weight with birth weight between 1000 g and <1500 g and extremely low birth weight defined by a birth weight <1000 g [5]. Birth weight is an easily accessible measure, particularly in a low-resource milieu, it is a key indicator of newborn health and a major factor in neonatal morbidity and mortality [2] [6]. Low birth weight may be secondary to preterm delivery, intra-uterine growth retardation, or a combination of both conditions [3]. According to Barros *et al.*, each of these conditions contributes about half to the occurrence of low birth weight [7]. This is a global public health problem as UNICEF estimates that 16% of children are born with low birth weight globally [6]. This represented more than 20 million newborns worldwide in 2015, corresponding to one in seven newborns, with a large majority (90%) of these births taking place in developing countries, especially in South Asia and Africa [8]. This category of newborns is 20 times more likely to die than those with normal birth weight [4]. In addition, they also present a higher risk of morbidity, delayed growth during childhood, poor cognitive development, as well as the occurrence of chronic diseases such as cardiovascular disease and diabetes in adulthood [3] [9] [10]. Early detection and management would improve the prognosis of these newborns [11].

The absence of recent data in Gabon on this major health problem, the vulnerability of these newborns, and the resulting morbidity and mortality motivated this study whose purpose is to contribute to improving the care of low birth weight in our country.

2. Patients and Methods

This is a longitudinal prospective study that took place over a period of 19 months (January 1st, 2019, to July 31st, 2020) in the neonatal medicine department of the University Hospital Centre "Mère-Enfant"—Jeanne Ebori Foundation (UHCME-JEF), a 3-floor hospital, located in Libreville, the capital of Gabon.

The study population included all newborns delivered at CHUMEFJE during the study period. We included all newborns with a birth weight < 2500 g whose parents had consented. Stillborn infants, those lost to follow-up, and those

whose parents did not give consent were not included. Also, children who died during follow-up were removed from the study.

2.1. Data Collection

After birth and after obtaining informed consent from parents, data of newborns of birth weight < 2500 g were collected on a standardized data collection sheet. They were then followed by pediatricians at a regular interval (1 month, 3 months, 6 months, 9 months and 12 months). We collected mothers' socio-demographic data, antenatal data, the data of the pregnancy and delivery, newborns' clinical parameters and during the first year of life. Psychomotor development was assessed at 12 months of life using the revised Brunet-Lézine scale of 150 items [12], which is a development test for newborns up to 30 months. It is easily done during a consultation and makes it possible to assess development in 4 areas, namely motor skills or posture, occulo-motor coordination, language and socialization. In our study, this was performed by a psychomotrician in the infant's environment (at home) and assessed the 4 domains. Thus, the various developmental quotients were normal if they were above 70. Below 70, psychomotricity was necessary.

2.2. Statistical Analysis

The data was recorded on Epi Info 7.2.2. We performed a descriptive analysis to determine sample characteristics and estimated the prevalence of low birth weight newborns. Quantitative data were expressed as average and standard deviation for gestational age, age of mothers, and anthropometric parameters of newborns. We calculated the median for the length of hospitalization and documented the age at death. We compared medians by the Mann-Whitney test, averages by the Kruskal-Wallis test or the Welch test when comparing by sex, because the conditions for homoscedasticity were not met between the groups to be compared. Qualitative data were expressed in frequency, and to compare them we used the chi-square test of independence. We created univariate logistic regression analyses to measure the relationship between children's and parents' parameters with low birth weight. The variables were chosen for their statistical significance in univariate models and relevance based on the literature. We assessed the relationships between psychomotor development scores, birth weight, and gestational age by calculating the Pearson correlation coefficient.

The threshold of statistical significance was set at $\alpha < 0.05$. The analysis was performed using CDC Epi Info 7.2.2, MS Excel, and the online statistical analysis software P-value (https://www.pvalue.io/fr/) which also allowed us to obtain the graphs of the correlation lines.

3. Results

3.1. Prevalence

During the study period, 1260 low birth weight newborns were recorded at

UHCME-JEF. The use of non-inclusion criteria allowed us to include 300 patients in our study. Among them, 81 (27.0%) were stillborn and 219 (73.0%) were monitored up until the age of 12 months.

3.2. Characteristics of Mothers

These newborns were delivered to 197 mothers. The age of mothers ranged from 15 years to 44 years with an average of 27.7 ± 6.2 years. The median age was 28, with Q1 at 23 and Q3 at 31. The proportion of single mothers was 48.2% (n = 95) and with no occupation in 32.5% (n = 64) of cases. In 65.5% (n = 129) of cases, the number of antenatal contacts was less than or equal to 4 and in 85.4% (n = 176) of cases, antenatal care was carried out by midwives. 35.5% (n = 70) of studied mothers were primiparous and 54.8% (n = 108) poor. The main intercurrent pathologies of pregnancy were malaria (19.3%, n = 38), hypertension (16.8%, n = 33) and vaginal infection (12.7%, n = 25). Pregnancy was unique in 89.3% of cases (n = 176). In 79.2% (n = 156) of cases, delivery was vaginal.

3.3. General Characteristics of Newborns of Low Birth Weight

Table 1 shows the characteristics of low birth weight neonates. The mean gestational age was 34 ± 12 weeks, with extremes ranging from 23 to 41 weeks. The median gestational age was 34 weeks with a Q1 of 32 weeks and a Q3 of 36 weeks. In 75.8% of cases, newborns were premature. The mean birth weight was 2008.6 g ± 215.3 g with a range of 630 g to 2480 g. LBW newborns were observed in 84.0% (n = 184) of cases. The mean cranial perimeter was 30.7 cm ± 3.5 cm, with extremes ranging from 24 to 35 cm. The mean length was 43.1 cm ± 4.2 cm, with extremes ranging from 27 to 58 cm. The sex ratio was 0.8. The intra-uterine growth retardation (birth weight< 10^{th} percentile according to the gestational age) was observed in 13.2% of the cases (n = 29). Of these, 23 showed disharmonious intra-uterine growth retardation and 6 showed harmonious intra-uterine growth retardation. Macrosomia (weight > 90^{th} percentile by gestational age) was observed in 2.3% of cases (n = 5).

3.4. Becoming Low Birth Weight Newborns during the 1st Year of Life

- **Distribution of patients according to hospitalization at birth**

At birth, 44.3% (n = 97/219) of patients were hospitalized in the neonatal medicine department. The 3 main reasons for hospitalization were neonatal infection (27.8%, n = 27), prematurity (22.7%, n = 22) and perinatal asphyxia (20.6%, n = 20). They were followed by respiratory distress (18.6%, n = 18), intrauterine growth restriction (5.2%, n = 5), neonatal jaundice (4.1%, n = 4) and ichthyosis (1%, n = 1). The average length of a hospital stay was 9.6 ± 8.2 days, with extremes ranging from 2 to 60 days. The median was 7 days with Q1 at 4 days and Q3 at 15 days.

- **Childhood pathologies presented during the first year of life**

In 61.6% (n = 135) of cases, a childhood illness was observed. Respiratory

Table 1. Characteristics of low birth weight newborns.

Parameters	Number (n = 219)	Percentage (%)
Gestational age (GA)		
<28 years	3	1,4
28 ≤ GA < 33	42	19.4
33 ≤ GA < 37	32	13.6
AG ≥ 37		
Mode of delivery		
Low channel	182	83.1
Cesarean section	37	16.9
Sex		
Masculine	101	46.1
Feminine	118	53.9
Birth weight (g)		
< 1000	3	1.4
1000 ≤ p < 1500	32	14.6
1500 ≤ P < 2500	184	84.0
Resuscitation at birth		
Yes	24	11.0
No	195	89.0
Type of milk on Day_1 of life		
Breast milk	11	5.0
Mixed	200	91.3
Artificial	8	3.7

pathologies (rhinopharyngitis, bronchopneumopathy and pneumonia) had a higher proportion than other pathologies in all age groups with respectively 37.4% (n = 82) at 1 month, 13.7% (n = 30) at 3 months, 12.8% (n = 28) at 6 months, 11.4% (n = 25) at 9 months and 8.7% (n = 19) at 12 months. At 3 months of age, the proportion of digestive pathologies (constipation, gastroenteritis, dietary error, regurgitation and wrong route) predominated (20.5%, n = 45). The overall proportion of pathologies encountered during growth decreased with age. At 12 months, 7762% of infants presented no pathology at the medical control.

3.5. Psychomotor Development of Patients at 12 Months of Life

All patients had a psychomotor development quotient > 110 at 12 months of life. Postural development quotients, language development quotient and coordination development quotient were normal (between 110 - 70) in 75.4%, 99.1% and

68% of the cases respectively at 12 months of age.

- **Language development quotient of patients at 12 months of life**

There was no association between language development quotient (LDQ) and maternal parameters or with infant pathologies contacted during the 12 months of life. Language development quotient (LDQ) in neonates with perinatal asphyxia at birth was on average 82.5 (±11.2). For those who had not been diagnosed with perinatal asphyxia, it was on average 87.1 (±7.9). There was an association between perinatal asphyxia and language development quotient with a p = 0.019 (Figure 1). The correlation coefficient between language development quotient and birth weight was r = 0.15 with p = 0.024. There is a correlation between birth weight and language development. Patients with very low birth weight had poorer language development than those with low birth weight (Figure 2).

- **Coordination development quotient (CDQ) of patients at 12 months of life**

There was no association between language development quotient (LDQ) and maternal parameters, nor with infant pathologies contacted during the 12 months of life. In patients, the correlation coefficient between Coordination development quotient (CDQ) and birth weight was r = 0.15 with a p = 0.026. There was an association between CDQ and birth weight. Very low birth weight patients had worse coordination development than low birth weight patients (Figure 3). There was no association between perinatal asphyxia and CDQ.

- **Postural development quotient (PDQ) of patients at 12 months of life**

There was no association between developmental quotient and maternal parameters, nor with infant pathologies contacted during the 12 months of life. In patients with perinatal asphyxia at birth, the postural development quotient

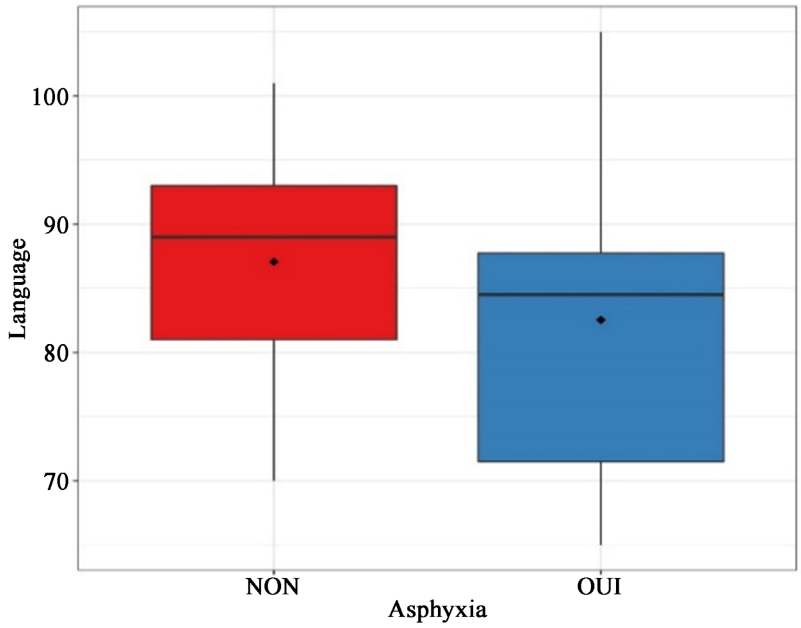

Figure 1. LDQ and perinatal asphyxia.

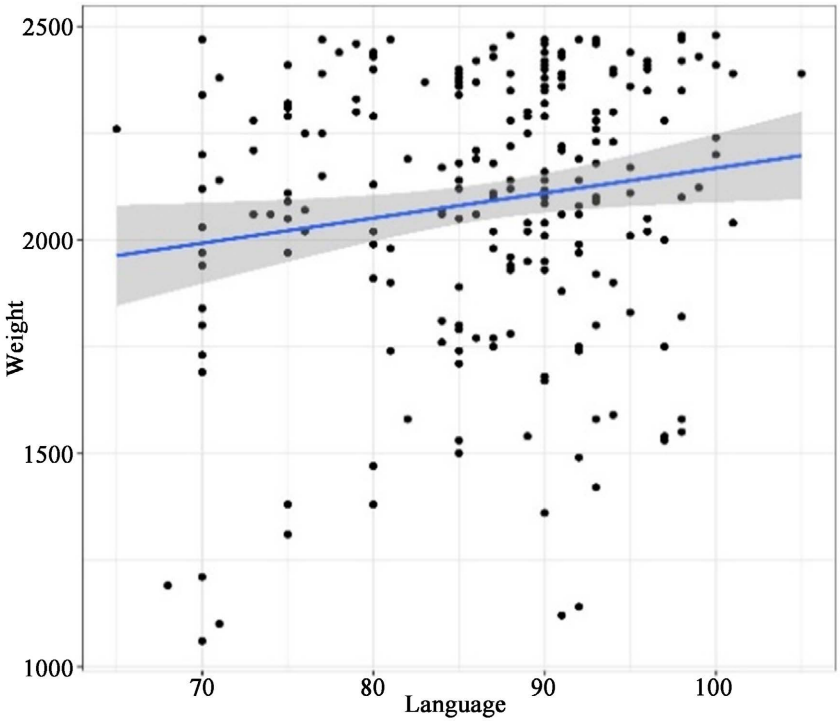

Figure 2. LDQ and birth weight.

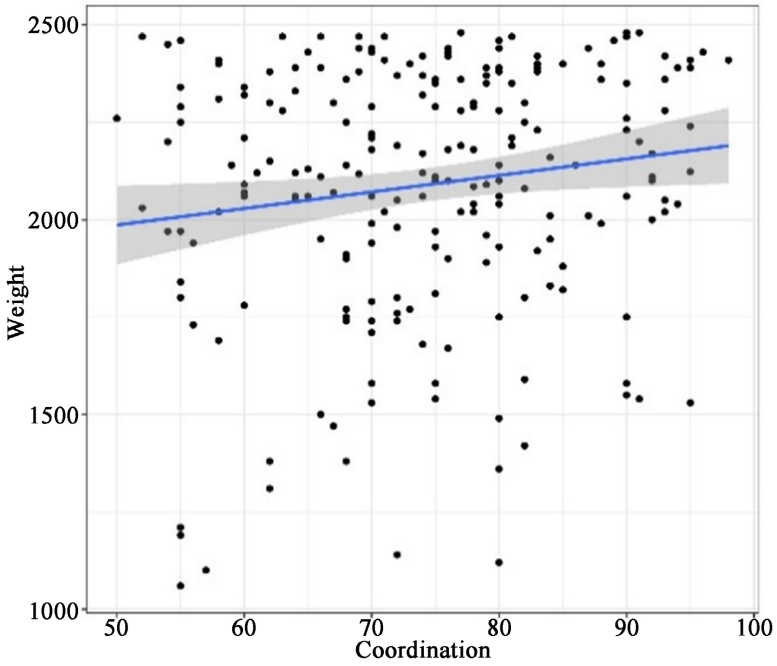

Figure 3. CDQ and birth weight.

(PDQ) averaged 71.5 (±17.8). In those without perinatal asphyxia, the average was 79.7 ± 11.8 with a p = 0.026. There was an association between Postural development quotient (PDQ) and perinatal asphyxia (**Figure 4**). The correlation coefficient between PDQ and birth weight was r = 0.15 with a p = 0.015. There was an association between postural development quotient and birth weight.

Very low birth weight patients had worse postural development than low birth weight patients (Figure 5).

4. Discussion

4.1. Study Limitation

The context of COVID-19 pandemic as well as the health measures taken has created certain obstacles to the optimal conduct of this survey, in particular the

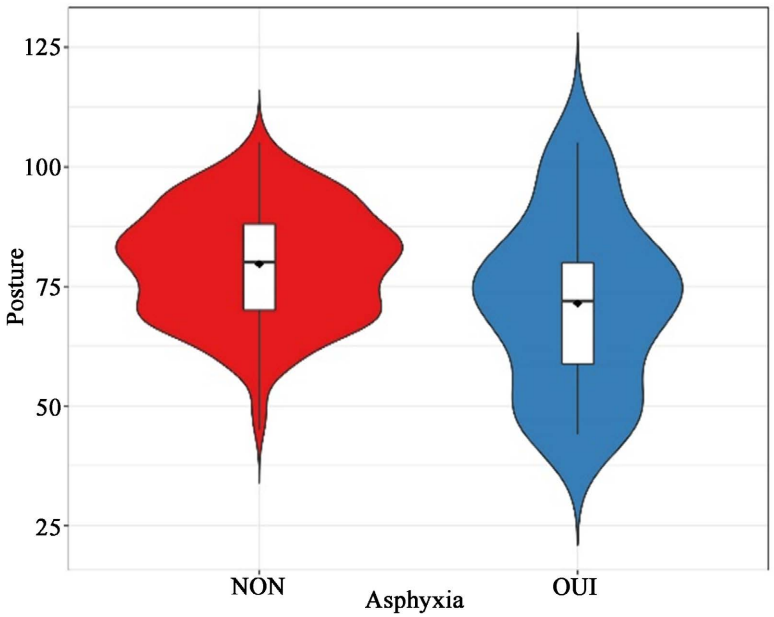

Figure 4. PDQ and perinatal asphyxia.

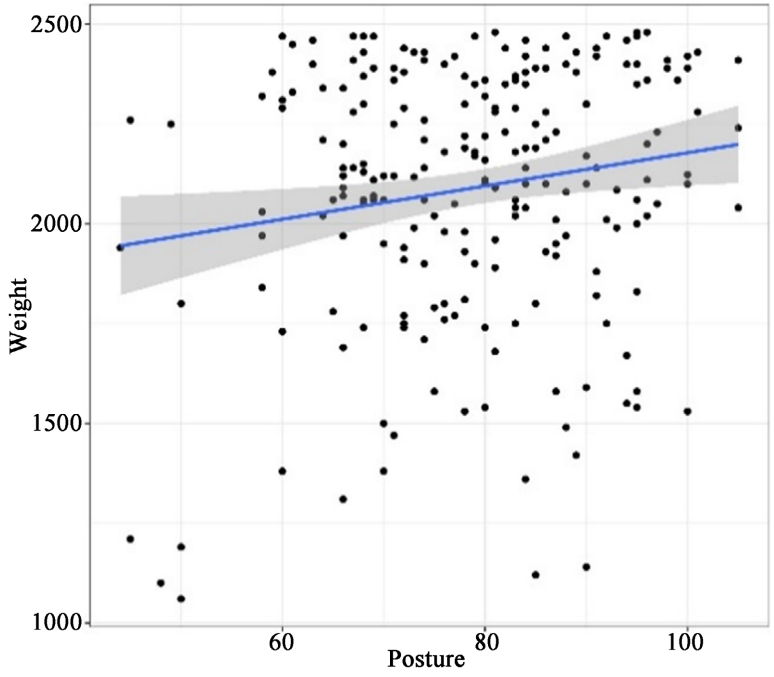

Figure 5. PDQ and birth weight.

unique nature, the lack of patient attendance during outpatient follow-up, and the low adherence of parents to the study. Nevertheless, the results obtained have made it possible to identify useful data, which can contribute to the improvement of the management of newborns of low birth weight in our health centers.

4.2. Frequency of Low Birth Weight

The frequency of low birth weight at UHCME-JEF during the study period was 14.0%. This frequency is superposable on that observed in Gabon globally in 2004 (14.0%) [13], close to that estimated in sub-Saharan Africa (13.0%) [10] and those reported by Faye in Dakar, Bwana Kangulu in Kamina, Tshinzobe in Kinshasa and Muchemi in Olkalouqui are respectively 14.8%, 14.3%, 13.3% and 12.3% [14] [15] [16] [17]. It is lower than those found by Alemu in Ethiopia (18.0%) [18] and Chiabi in Cameroon (20.7%) [19]. These different prevalences of low birth weight all remain high. This finding may be because the UHCME-JEF is a reference facility for the management of pathological pregnancies and sick newborns and on the other hand by the high rate of intercurrent pathologies in pregnancy (56.4%), dominated by infectious and vascular pathologies that are known as providers of low birth weight [10]. These intercurrent pathologies in pregnancy have also been reported in the studies of Faye and Chiabi [14] [19]. Also, it is well established that it is in developing countries that the rate of low birth weight is most found [20]. This is probably due to the high prevalence of prematurity and intercurrent pathology to pregnancy that they record.

4.3. Characteristics of Newborns of Low Birth Weight

The sex ratio was 0.8. This result is identical to those of Faye. *et al.* in Senegal, Bwana Kangulu *et al.* in DRC, Chiabi *et al.* in Cameroon, and Hassoune *et al.* in Morocco, which find a female predominance [14] [15] [19] [21]. Bandyopadhyay *et al.* in India find a male predominance (54.2%) with no impact on the fate of newborns of LBW [22]. The average age of newborns and the proportion of preterm newborns in our study are superimposed on those found by Faye, Chiabi and Bandyopadhyay who found a rate of preterm newborns of 85.6%, 79.6% and 78.2% respectively with an average gestational age of 34 weeks and a higher proportion of average prematurity [14] [19] [22]. This is not surprising because prematurity is one of the main causes of low birth weight [7] [10]. This high rate of average prematurity also explains the fact that the average birth weight in our study was 2008.6 ± 215.2 g with a higher proportion of newborns with LBW. This observation is also made by Faye, Chiabi and Bandyopadhyay [14] [19] [22].

4.4. Psychomotor Development at 12 Months

At 12 months of age, in general, the majority of low birth weight infants had normal developmental quotients, between 70 - 110 for PDQ (75.3%), (68.0%) for

DCQ and (99.1%) the development quotient of language. These results are similar to those of Sylla M *et al.* who found 71.2% and 90% respectively for language and motor skills [23]. We also observed that there is an association between psychomotor development and birth weight. Indeed, there is a significant difference in the different partial development quotients (posture, language and coordination) between very low birth weight and low birth weight newborns with a $p = 0.015$, $p = 0.024$ and $p = 0.026$ respectively. This is similar to the results of Savadogo LGB *et al.* who observed that the psychomotor development of low birth weight infants was significantly slower than that of very low birth weight infants [24]. This may be explained by the fact that the majority of low birth weight newborns are preterm and nutritional status has been shown to have a significant impact on the psychomotor development of the infant [25].

4.5. Asphyxia and Psychomotor Development

Perinatal asphyxia was the main factor of poor development in posture and language in our study. It is well established that one of the most severe complications of perinatal asphyxia is brain damage and therefore explains this observation. This observation was also made by Stacey *et Al* in Canada where asphyxia was the cause of global developmental retardation in 55% of cases [26]. Similarly, Kedy Koum in Cameroon observed in a population of children with neonatal asphyxia behavioral abnormalities (8.2%), prehension abnormalities (8.2%), gestural/motor abnormalities (14.3%) and language abnormalities (26.5%), ass well as tone disorders (10.2%) and delays in language acquisition (27.0%), and walking (14.0%) [27].

5. Conclusion

In our study, the frequency of low birth weight is 14% and the mortality rate is 27%. This is a major problem in our context. All patients had a psychomotor development quotient > 110 at 12 months of life. But the very low birth weight and the presence of perinatal asphyxia were the factors of the poor psychomotor development that we found. It is therefore important to take all the necessary measures to limit the occurrence of very low birth weight and asphyxia in order to minimize the risk of the appearance of psychomotor development disorders in newborns with Low birth weight. Also, a study with a larger number of people will help to better understand this question.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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