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The kangaroo mother care method at the teaching hospital of Treichville (Côte d'Ivoire): how effective is it five years after implementation?

Abstract

Kangaroo Mother Care (KMC) is a high-impact practice for reducing infant mortality. It was recently implemented in our paediatric department at Treichville Teaching Hospital. The aim of this study is to analyse mother-kangaroo care activity at Treichville Teaching Hospital after five years of practice.

Patients and method: Cross-sectional, analytical study of data on low birthweight babies who stayed in the 'mother-kangaroo' subunit of the paediatrics department at the Teaching Hospital of Treicville from 1 March 2019 to 28 February 2024 (i.e. 5 years). The data were analysed using SPSS software version 25, and the chi-square test was used for proportions at the 95% significance level.

Results: 55.1% of low birthweight babies (LBW), i.e. 737 LBW admitted to the paediatric ward, were able to benefit from Kangaroo Mother Care. The average age of the mothers of these LBWs was 28.9 years and most were unemployed (42.9%). These newborns were born in a teaching hospital in 34.7% of cases. The transfer of these newborns to Treichville Teaching Hospital was medicalised in 23.3% of cases. They were very premature (GA between 28 and 32 weeks of amenorrhoea) in 59.1% of cases, with an average birth weight of 1535g and a low birth weight of 815g. Only 4.9% of these babies were exclusively breastfed. The average length of stay was 14 days and the average daily weight gain was 29 ±82g. We noted that maternal age ($p<0.001$), mother's level of education ($p<0.001$), type of pregnancy ($p<0.001$) and the weight of the newborn on admission to the KMC ($P=0.01$) could influence the mean daily weight gain.

Conclusion: The kangaroo method is still effective in our practice, with a success rate of over 99%. However, there are a number of difficulties to be noted, in particular quasi-non-exclusive breastfeeding, inadequate nutrition and the fact that mothers are more or less unavailable. Multidisciplinary follow-up would therefore be invaluable, and all these factors constitute the challenges to be met.

Keywords: Kangaroo Mother Care, assessment, low birth weight, effectiveness, challenges, Côte d'Ivoire

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Introduction

The Kangaroo Mother Method' is defined as 'early, prolonged and continuous skin-to-skin contact between a mother and her low-birth-weight baby, in hospital and after early discharge, with (ideally) exclusive breastfeeding and appropriate follow-up'. This method of caring for low-birth-weight babies was initiated in Bogotá in 1978 by Rey and Martinez, to compensate for the lack of material resources, such as incubators, and to try to reverse the high rates of neonatal infection and mortality. One in three deaths of children under the age of five worldwide occurs during the neonatal period, i.e. before the 28th day of life. Prematurity and birth asphyxia each account for eleven per cent (11%) of under-five mortality.[1]

In Côte d'Ivoire, mortality among newborns is still high, although there has been a marked reduction in mortality among children in general. Prematurity remains the leading cause of death among newborns (31.6%), according to the ENAP 2018-2020 plan.[2] As part of the drive to reduce neonatal mortality linked to prematurity, the Ministry of Health and Public Hygiene (MHPH) is committed to implementing Kangaroo Mother Care (KMC) as a high-impact practice for reducing this mortality. Because of its simplicity, KMC can be applied almost anywhere and contribute to the humanisation of neonatal care and the creation of a better bond between mother and baby in both poor and rich countries.[3] The first KMC unit in Côte d'Ivoire opened in February 2019, designed to care for small, stable birthweights admitted to the Paediatrics Department at Treichville Teaching Hospital. After five years of operation, and as a prelude to the opening of a new, larger 20-bed unit, it seemed appropriate to evaluate the activity, giving the results obtained, while noting the difficulties encountered, in order to define new challenges. The aim of this study was to analyse the activity of the KMCs and the immediate outcome of low birth weight babies hospitalised in the Kangaroo Mother Care Unit at Treichville Teaching Hospital.

Patients and method

This cross-sectional, analytical study was conducted over five years, from 1 March 2019 to 29 February 2024, in the 'mother kangaroo' subunit of the paediatrics department at Treichville Teaching Hospital in Abidjan, Côte d'Ivoire. The unit, which was established in 2019, began admitting low birth weight (LBW) infants on 1 February 2019. The study included an exhaustive sample of all LBW infants who stayed in the Mother Kangaroo Care unit during the study period. To be eligible, infants had to meet specific inclusion criteria. Specifically, all LBW babies admitted to the unit were included if they fulfilled the admission criteria for Kangaroo Mother Care (KMC). This meant

they had to be stable, weighing less than 2500g, with or without difficulties in sucking and swallowing, and potentially experiencing issues with thermal regulation. Furthermore, only those who were followed up until 40 weeks corrected age were considered. However, cases with inadequately completed medical records, where less than 50% of the clinical information and course were documented, were excluded from the study.

Several key variables were examined, including sociodemographic characteristics of the mothers, obstetric history, delivery parameters, and both anthropometric and clinical parameters of the newborns. Additionally, follow-up data and newborn outcomes were analyzed to provide a comprehensive assessment. To gather this information, data were extracted from medical records, mother-child health booklets, and the registers of the kangaroo subunit. Furthermore, information systematically recorded in computer systems was utilized. The data were directly entered into Excel and analyzed using SPSS version 25. Statistical analysis involved the Chi-square test, with the odds ratio calculated at a 95% confidence interval. In assessing factors influencing weight gain, a p-value of less than 0.05 was considered statistically significant Quantitative variables were expressed as mean and standard deviation. Qualitative variables were presented as proportions. The odds ratio or associations were assessed using the calculation of odds ratios with a 95% confidence interval.

The dependent variable was the average weight gain per kilogram per day during hospitalization (calculated as the difference between the admission weight and the discharge weight, divided by the average weight between these two periods and the number of hospitalization days). The categories were: weight gain ≥ 15 g/kg/day and < 15 g/kg/day.[4] Independent variables included various socio-demographic, clinical, and evolutionary characteristics. Some quantitative variables were grouped into ranges for univariate or multivariate analysis. This categorization was based on epidemiological data.

Ethical issues Ethics approval and consent to participate: Approval from the Head of Departmentwas obtained, as well as from the Ministry of Health, Public Hygiene, and UniversalHealth Coverage, under the supervision of the institution : Medical and Scientific Directorate. This study was carried out in accordance with the ethical standards of the Declaration of Helsinki.

Results

The collection of data from different sources and the analysis of these data enabled us to note the following epidemiological data: During the study period, five thousand seven hundred and thirty-five (5735) newborns were hospitalised, including 1505 (26.24%) low birth weight (LBW) in the neonatology unit of Treichville Teaching Hospital. Of these LBWs, 737 were admitted to the kangaroo subunit, i.e. 55.1% of LBWs admitted to the paediatric ward during the 5-year study period, with a peak in 2022 (185 LBWs) (Figure 1).

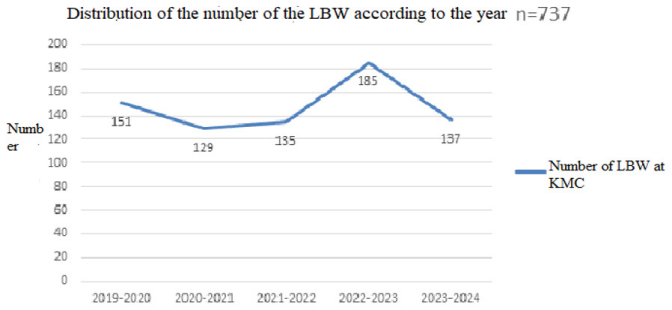

Figure 1 Distribution of the number of LBWs newborn admitted to KMC by year.

Sociodemographic and obstetric characteristics of the mothers (Table 1)

Table 1 Distribution according to the socio-demographic and obstetrical characteristics of mothers n=683 (due to multiple pregnancies)

	Number (n=683)	Percentage (%)
Mothers age	Average= 28±5,89 years	
<18 years	14	2,1%
18-34 years	576	84,3%
≥35 years	93	13,6%
Education level		
none	264	38,7%
primary	141	20,6%
secondary	195	28,6%
Higher	83	12,1%
Mothers occupation		
Without occupation (housewives)	293	42,9%
Informal sector	205	30%
Corporate/public sector	185	27,1%
Parity of mothers		
Primiparous	259	37,9%
Pauciparous (2 -3 parities)	344	50,4%
Multiparous (> 4 parities)	80	11,7%
Number of ANCs completed		
0	37	5%
3-Jan	405	55%
≥4	241	40%
Delivery route		
Vaginal birth	512	75%
High birth	171	25%
Place of delivery		
Domicile	12	1,8%
Level I	134	19,6%
Level II	152	23,2%
Level III	237	34,7 %
Private facility	141	20,7%
Type of pregnancy		
Unique	636	93,12%
Double	40	5,86%
Triple	7	1,02%
Gestational Age at birth (GA)		
<28GA	13	1,9%
[28-33]	403	59%
[33-36]	248	36,3%
≥37 GA	19	2,8%

Characteristics of low birthweight babies admitted to the KMC (Table 2)

Table 2 Distribution of LBW according to weight interval at admission in KMC unit n=737

	Number (n)	Percentage (%)
Weight at to admission(g)	Average weight=1455±302,55g	
<1000	40	5,5%
1000-1499	373	50,6%
1500-1999	292	39,6%

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Table 2 Continued....

≥2000	32	4,3%
Gender	Sex ratio = 0,92	
female	384	52,1%
male	353	47,9%
Average weight gain (g)	Average=29± 82g	
< 100	49	6,7%
100 to 300	247	33,5%
301 to 500	234	31,7%
501 to 800	139	18,9%
> 1000	27	3,7%
Weight at discharge (g)	Average= 1862 ± 26g	
< 1500	63	8,5%
1500 to 2000	503	68,3%
> 2000	171	23,2%
Corrected age at discharge (Weeks of amenorrhea)	35,6 ±23	
[31-34[	55	7,5%
[34-37[	401	54,4%
≥ 37	281	38,1%
Type of milk consumed	n= 732	
Exclusive breast milk	36	4,9%
Premature formula	45	6,1%
Breast milk + formula for premature infants	L 656	89%
Length of hospitalization (D)	average=14,3 ± 8,4 days	
7-Mar	103	14%
[7-15[	368	49,9%
[15-21[	117	15,9%
[21-30[	103	14%
≥30	46	6,2%
At 40 weeks corrected age		
Living	732	99,3%
Deceased	5	0,7%
Lost to sight	0	0%
First vaccines at 40 weeks corrected age	n=732	
none	632	86,3%
BCG + polio O	100	13,7%

No deaths were recorded during hospitalisation in the mother-kangaroo care unit, however 5 cases of death were recorded after a return to neonatology. These deaths were due to various incidents, including 3 cases of reflux of gastric contents followed by respiratory distress, one case of decompensated anaemia (immediate unavailability of blood products) and one case of strong suspicion of sepsis in the context of Enterocolitis ulcerative necrosis (ECUN). At 40 weeks corrected age, 53.5% (392) of low-birth-weight infants had received BCG vaccinations and a dose of oral polio. No infant was lost to follow-up at 40 weeks corrected age. (Table 3)

Table 3 Distribution of newborns according to the frequency of incidents recorded during hospitalization in KMC n=737

Incidents	Number	Percentage
Apnea	85	11,5 %
Hypothermia	75	10,2%
Hyperthermia	19	2,6%
Digestive disorders (GERD/constipation)	492	66,7%
Anemia (transfusion)	47	6,4%
Weight loss	19	2,6%

Parameters influencing daily weight gain

The factors influencing the weight gain of low birth weight babies were the mothers' low level of education, the primiparity of the mothers, the weight of the low birth weight baby above 1500 g on admission to kangaroo mother care. (Table 4)

Table 4 Factors associated with weight gain during kangaroo mother care (univariate and multivariate analysis)

	Average weight gain<15 g/kg/d	Average weight gain ≥ 15 g/kg/d	P value	OR $CI_{95\%}$
Mother age				
< 18 years	9	5	0,001	25,3(8,16-78,49)
≥ 18 years	48	675		
Education level of the mother				
< Secondary	180	225	P<0,001	8,68(5,71-13,76)
≥ Secondary	27	299		
Parity of the mother				
Primiparous	178	81	P<0,001	27,8(18 ,04-42,85)
Pauci et multiparous	35	443		
Type of pregnancy				
Unique	147	489	P<0,001	0,16(0,10-0,25)
Multiple	66	35		
Gender of LBW				
Female	102	282	P=0,144	0,79(0,57-1,09)
Male	111	242		
Weight at LBW admission				
<1500 g	76	337	P=0,001	0,31(0,22-0,43)
≥1500g	137	187		
Type of feeding at discharge				
Breast milk only	16	20	P=0,066	1,87(0,95-3,68)
Other	207	484		

Discussion

The retrospective nature of the data collection, the lack of suitable tools and the irregular contact with these children for the evaluation of acquisitions and the absence of multidisciplinary follow-up of these children (ENT, ophthalmology, neurology, psychomotricity, etc.) constitute limitations to this study, however the results obtained give rise to discussion.

Socio-demographic and epidemiological: Our results showed that the frequency of LBW was higher in the 21-35 age group of mothers (72.2%). This high proportion of mothers in this age group had been reported by Beddeck and Demmouche in their study.[5] Unlike findings in industrialized countries, where extreme maternal ages (under 18 and over 35 years) are associated with different outcomes.[6]

The high prevalence of LBW in this age group could be explained by the fact that this is the ideal age for childbearing, but the difficulties of everyday life, professional activities and various pathologies during

pregnancy could also explain these high rates of LBW. In addition, the fact that the study took place in a referral facility could also explain these high figures. There was a high proportion of mothers with no schooling (39.8%), as in Senegal in a similar study, where they represented 37.9% of the study population.[7] The figure was even higher in Niamey, Niger, where Kamaye and al. reported that 44.1% of mothers did not attend school.[8] A case-control study carried out in Senegal showed that a low level of schooling (primary level) was a predictive factor (p=0.015) of low birth weight.[9] On the other hand, O. Ndiaye and al, in Senegal, in their search for aetiological factors for prematurity, concluded that the mother's level of education was not linked to the risk of prematurity.[10]

Like the results found by Kamaye and al in Niger, where the mothers had an average parity of 2.9 and were pauci pares (51.5%),[8] we found practically the same results. Additionally, in 60% of cases, pregnancies were monitored with fewer than four prenatal consultations, as recommended by the WHO, based on the average gestational age at birth. The first contact typically occurred at 12 weeks of gestation, followed by visits at 20, 26, 30, 34, 36, 38, and 40 weeks of gestation.[11]

In our study, more than half of these LBWs were not born in referral facilities, while the majority were very premature. Multiple births occurred in 6.9% of cases, lower than the rate found by Tchagbele and al in Togo which was 15.6% of cases[12] but slightly higher than the result of O. Ndiaye in Senegal which found 3.6%.[9]

Ndiaye in Senegal, who found 3.6%.[9] The rate of multiple pregnancies varies from region to region and from country to country,[13] and these multiple pregnancies, like the other risk factors for preterm delivery, make imminent delivery and therefore in utero transfers (to referral facilities) difficult. With the advent of medically assisted reproduction (MAP) and the increase in maternal age at first pregnancy, the incidence of twin pregnancies has risen sharply.[14,15]

The caesarean section rate in our series was 25.8%. Our figures are higher than those of Faye and al in Senegal who found 12.6% and Roba and al in Ethiopia who found 19.21% of cases.[11,16] On the other hand, Charpak in Colombia, Lebane in Algeria and Tchagbele in Togo found 68%, 48.74% and 27.8% respectively.[12,15,17] The national average for caesarean sections was 3.5%, and the WHO recommended standard is between 5 and 15%.[2]

Although prematurity is not an indication for caesarean section, this high rate could be justified by the fact that certain causes of prematurity, such as pre-eclampsia and placenta previa, usually require an elective caesarean section.[18] Another explanation could be the location of our study, which is a referral facility.

Clinically: Characteristics of low birth weight infants admitted to the KMC

In our study, the population was recruited after a stay in the neonatal unit of the hospital's paediatrics department for conditions representing the typical complications of prematurity. Female LBWs were the majority in our cohort (sex ratio: 0.92), similar to the findings of Charpak in Colombia and Faye in Senegal, with 52% and a sex ratio of 0.78, respectively.[7,17] However, this differed from the results of Roba and al. in Ethiopia, who observed a male predominance. The average weight of LBWs at admission to kangaroo mother care was 1454 ± 302.55g. In Senegal, the average admission weight reported by Faye and al. was 1445g, compared to 1209g in Niger in the study by Kamaye and al.[7,8]

This difference could be attributed to the fact that each country adapts the eligibility criteria for kangaroo mother care (KMC) to its own realities, taking into account the availability of incubators, accommodation facilities for mothers, and the type of feeding for these LBWs. These same challenges could explain the relatively significant proportion of very Low Birth Weight (6.1% of LBWs had a weight below 1,000 grams) admitted to KMC. Our findings are comparable to those of Faye and al. in Senegal, who reported 5.9% of newborns weighing less than 1,000 grams,[7] but are significantly lower than those of Kamaye and al. in Niger, who found a rate of 18.5%.[8]

The average length of stay in KMC in our study was 14.3 ± 8.4 days. The literature shows that the length of stay varies by country. Mohammadzadeh and al. in Algeria found an average stay of 16.52 days in their study, with a minimum of 5 days and a maximum of 49 days.[18] In Niger, Kamaye M and al. reported an average of 13.4 ± 8.9 days.[8] In Senegal, the stay was shorter, averaging ten days with a range of three to 24 days.[7] This variability in the duration of stay by region could reflect the influence of sociocultural factors and acceptability, as noted by Chan and al. in their study.[20]

Moreover, the criteria for discharge from kangaroo mother care units are well established, including consistent weight gain, mastery of care by mothers, and the community's acceptance of the method.[21]

Furthermore, one of the goals of kangaroo mother care (KMC) is to reduce the length of hospitalisation for low birth weight (LBWs). This has been corroborated by several studies that demonstrated KMC effectively reduces the hospital stay of LBWs.[15,18,19]

The average weight at discharge from the unit in our study was estimated at 1862 ± 26g. In Niger, Kamaye and al. reported an average discharge weight of 1836.8g,[8] whereas in Senegal, the average discharge weight was lower, at 1761g.[7] While there is no significant difference between the average discharge weights, it is worth noting that in all studies, it remained above 1500g. However, average discharge weight cannot be the sole criterion for returning home. Other factors such as the clinical stability of the LBW, digestive tolerance, the mother's confidence and support from the community, as well as daily weight gain, are critical considerations in the discharge decision.

In our series, we observed an average daily weight gain of 29 ± 82g. In Niger, Kamaye and al. recorded an average daily weight gain of 24.4g. Several studies demonstrated the beneficial effect of KMC on daily weight gain,[19,22] which helps achieve one of the goals of kangaroo nutrition strategy: a weight gain of 15 to 30 grams per kilogram per day until 40 weeks postmenstrual age.[23]

In our study, 85.8% of LBWs were discharged from the unit between 34 and 40 weeks corrected age, with an average of 35.6 ± 2.3 weeks. One of the conditions for discharge was the acquisition of proper coordination of sucking, swallowing, and breathing, which is generally achieved at this age.[24] Exclusive breastfeeding should be prioritised and encouraged during KMC. However, in our series, none of the LBWs were exclusively breastfed at admission. This could be attributed to delayed milk production, likely due to the psychological and emotional distress experienced by mothers who had given birth to a LBW.

One challenge stemmed from the fact that most LBWs admitted to the KMC unit were born outside the Treichville Teaching Hospital. Their mothers were hospitalised either in the gynaecology-obstetrics department or in other healthcare facilities. As a result, there was a separation between the lbws and their mothers at birth due to prematurity or adaptation difficulties. These situations could cause stress for both the mother and the newborn.

Another difficulty was the lack of adequate accommodation facilities for mothers whose newborns were hospitalised in incubators prior to admission to the KMC unit, which further prolonged the separation. It is therefore crucial to encourage the expression of breast milk within the first hours following delivery, even if the newborn is not with the mother. To achieve this, other factors must be addressed, including hygiene during breast expression and the safe transfer of milk to the infant.

The low birth weight (LBW) would only remain in constant contact with its mother during its stay in the KMC unit. Another difficulty faced by mothers in the unit was access to daily meals. The hospital did not provide meals for the mothers of hospitalised newborns, forcing them to leave the unit to purchase food (which was not always suitable for breastfeeding mothers) or wait for meals to be brought from home, depending on the availability of a family member and the traffic conditions in this large city. Under such circumstances, it would be challenging for these breastfeeding mothers to meet their daily nutritional needs and nurse their newborns adequately.

Despite these difficulties, the mother's constant presence alongside her child in the KMC unit resulted in 36 newborns being exclusively breastfed (raising the exclusive breastfeeding rate from zero to 4.9%) by the end of their stay. However, our rates remained very low compared to other countries, such as Senegal and Niger, where exclusive breastfeeding rates were 56% and 98.5%, respectively.[7,8]

Exclusive breastfeeding remains a significant challenge for our low-birth-weight newborns. The immaturity of preterm newborns often prevents them from effectively stimulating lactogenesis, leading to insufficient milk production, which is a major cause of breastfeeding failure.[23]

The main incidents observed during the stay in the KMC unit were gastroesophageal reflux (31.9%), apnoea (5.5%), and hypothermia (4.9%). In Senegal, Faye's study reported hypothermia in 18.5% of cases and gastroesophageal reflux in 16.4%.[7] These are common complications observed in low birth weight, primarily due to their immaturity. The hypothermia observed should be the subject of more in-depth research to determine its timing, frequency, and probable causes.

In our study, we recorded only one case of infection during hospitalisation in the KMC unit. This finding is consistent with Lebane's results in Algiers.[18] In contrast, Faye in Dakar reported infections in 20.2% of cases.[7]

The near absence of infection in our study could be explained by several factors. First, the geographic separation between the neonatal unit and the KMC unit likely limited cross-contamination. Second, the staff dedicated to KMC care were entirely separate from those working in the neonatal unit. Furthermore, the hygiene measures taught to and practised by mothers, combined with the limited non-essential contact between healthcare staff and the mother-child pair, may have contributed to this near absence of infections.

Immediate outcomes of newborns

We did not record any cases of loss to follow-up at 40 weeks of corrected age. This could be explained by the fact that the vast majority (87.2%) of our study population resides in the city of Abidjan. However, experience teaches us that it is essential to consider the actual distance separating the parents' place of residence from the hospital where the child is being monitored. Additionally, the inexperience of mothers in managing these Low Birth Weight (LBWs), as well as the environment and operation of the KMC unit, may explain this absence of loss to follow-up in the immediate aftermath of hospitalisation.

Furthermore, the short duration of follow-up (corrected age of 40 weeks' gestational age) allowed us to maintain contact with all families. During this follow-up, it was found that only 13.7% of LBWs had received the BCG vaccine and the first dose of oral polio vaccine. This very low rate could be explained, on the one hand, by the age at which the mother brought the LBW to the vaccination service after hospitalisation (on average, after 29 days) and, on the other hand, by the child's weight. Indeed, most healthcare facilities require a minimum weight of 2,500g for the administration of the BCG vaccine, in line with the recommendations provided to these facilities.

The study of maternal and neonatal factors that could influence the average daily weight gain revealed several findings. The type of feeding had no impact; however, the mother's age, level of education, and parity could influence the average daily weight gain. Additionally, the birth weight of the low-birth-weight infant was associated with daily weight gain. Among the factors identified, it could be hypothesised that the experience gained by mothers, either due to their age or from previous deliveries, could be determining factors in weight gain. However, a prospective or even randomised study could better explain the relationships between these various factors and daily weight gain.

Limitations

The limitations are related to the retrospective nature of data collection, which may be a source of error. Additionally, the study was conducted in a single center. In reality, this is the first and reference center, from which others are gradually being established. The results obtained are actually encouraging, highlighting potential difficulties that new centers might face, thus allowing for the development of sustainable solutions.

Conclusion

The KMC (Kangaroo Mother Care) approach represents an essential component in the management of LBW in our context. Its introduction under our working conditions has highlighted its benefits in terms of weight gain and neonatal survival. However, challenges remain in its implementation. Prospects such as home visits and longer-term multidisciplinary follow-up could further improve the prognosis for these LBWs.

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Conflict of interest

The authors declare that they have no conflicts of interest in relation to the content of this article.

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