

Noviembre 2021

ART2_A1_2022_2

N° de serie

Artículo Científico

Kangaroo mother care had a protective effect on the volume of brain structures in young adults born preterm

Autores

Nathalie Charpak

Rejean Tessier

Juan Ruiz

Felipe Uriza

José Hernández

Darwin Cortes

Adriana Montealegre



ALIANZA EFI
Economía Formal e Inclusiva

ORIGINAL ARTICLE

Kangaroo mother care had a protective effect on the volume of brain structures in young adults born preterm

Nathalie Charpak¹  | Rejean Tessier² | Juan Gabriel Ruiz³ | Felipe Uriza⁴ | José Tiberio Hernandez⁵ | Darwin Cortes⁶ | Adriana Montealegre-Pomar^{1,4}

¹Fundación Canguro/Kangaroo Foundation, Bogota, Colombia

²School of psychology, Université Laval, Québec, Canada

³Department of Medical and Population Health Sciences Research, Herber Wertheim, Florida International University, Miami, Florida, USA

⁴Hospital San Ignacio, Universidad Javeriana, Bogota, Colombia

⁵IMAGINE Team, Systems & Computing Engineering, Universidad de los Andes, Bogota, Colombia

⁶Economics Department, Universidad del Rosario, Bogota, Colombia

Correspondence

Nathalie Charpak, Fundación Canguro/Kangaroo Foundation, Bogota, Colombia
Carrera 7 No 46-20, Bogotá, Colombia.
Email: ncharpak@gmail.com

Funding information

Grand Challenge Canada.

Abstract

Aim: The protective effects of Kangaroo mother care (KMC) on the neurodevelopment of preterm infants are well established, but we do not know whether the benefits persist beyond infancy. Our aim was to determine whether providing KMC in infancy affected brain volumes in young adulthood.

Method: Standardised cognitive, memory and motor skills tests were used to determine the brain volumes of 20-year-old adults who had formed part of a randomised controlled trial of KMC versus incubator care. Multivariate analysis of brain volumes was conducted according to KMC exposure.

Results: The study comprised 178 adults born preterm: 97 had received KMC and 81 were incubator care controls. Bivariate analysis showed larger volumes of total grey matter, basal nuclei and cerebellum in those who had received KMC, and the white matter was better organised. This means that the volumes of the main brain structures associated with intelligence, attention, memory and coordination were larger in the KMC group. Multivariate lineal regression analysis demonstrated the direct relationship between brain volumes and duration of KMC, after controlling for potential confounders.

Conclusion: Our findings suggest that the neuroprotective effects of KMC for preterm infants persisted beyond childhood and improved their lifetime functionality and quality of life.

KEYWORDS

grey matter, Kangaroo mother care, magnetic resonance imaging, premature infants, white matter

Abbreviations: IQ, intelligence quotient; KMC, Kangaroo mother care; MRI, magnetic resonance imaging; NHPT, Nine-hole Peg Test; RCT, randomised controlled trial; WASI-II, Wechsler Abbreviated Scale of Intelligence, Second Edition.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2022 The Authors. *Acta Paediatrica* published by John Wiley & Sons Ltd on behalf of Foundation Acta Paediatrica.

1 | BACKGROUND

High rates of premature birth, and the increased survival of extremely preterm infants, have brought together clinicians, researchers and policy-makers to identify priorities. Authors such as McCormick and Litt,¹ Saigal² and Zolkowitz³ have realistically assessed the difficulties of studying this population and identified research priorities for prematurity.

One of the most serious problems that affects preterm infants is the impact on neurodevelopment and anterior central nervous system functioning and performance. The central nervous system grows rapidly during the third trimester, and brain volume increases by almost five times between 26 and 40 weeks of gestation.⁴ Critical neurodevelopmental processes take place during the second and third trimesters of gestation and continue beyond birth. These include neuronal migration, synaptogenesis, organisational development of cortical layers and circuitry. Prematurity disrupts key phases of brain growth, development and organisation, even when there are no specific injuries to the perinatal central nervous system.⁵ Decreased brain volumes do not recover during childhood and have been associated with decreased measures of intelligence and executive functioning.⁶

Kangaroo mother care (KMC) is evidence-based technology that centres on the mother as the primary provider of heat and stimulation. It involves skin-to-skin contact in the Kangaroo position, Kangaroo nutrition in the form of maternal breast milk and close monitoring after early hospital discharge.⁷ A growing body of evidence indicates that KMC decreases mortality and morbidity rates among preterm infants,⁸ promotes breastfeeding^{8,9} and increases mother-infant bonding and attachment.¹⁰ It also has lasting neuroprotective effects, at least during childhood.¹¹ Most of the limited number of studies that have been conducted on the long-term impact of KMC on neurodevelopmental outcomes in preterm infants have been conducted by our research group.¹¹

The aim of this study was to assess the long-term impact of KMC on brain volume and its association with cognitive development. The study comprised 20-year-old adults who had been born preterm and had taken part in a randomised controlled trial (RCT) of KMC versus incubator care. We hypothesised that KMC would encourage better brain tissue growth, maturation and pathway formation. These have been associated with better cognitive and motor functioning in infants who received KMC after their normal in utero brain growth and development was disrupted by preterm delivery.

2 | PATIENTS AND METHODS

2.1 | Population and sample

This was a long-term follow-up study of an RCT that was conducted in Bogota, Colombia, between 1993 and 1996. The RCT studied 746 preterm and full-term infants who were born weighing less than 2000 g. Participants were stratified into 4 categories, according to their birthweight: <1200 g, 1200–1500 g, 1501–1800 g and

Key Notes

- We investigated whether the protective effects of Kangaroo mother care (KMC) on the neurodevelopment of preterm infants persisted beyond infancy.
- Brain scans and cognitive, memory and motor skills tests were performed on 20-year-old adults who had participated in a randomised controlled trial of KMC versus incubator care.
- The volumes of the main brain structures associated with intelligence, attention, memory and coordination were larger in infants who had received KMC.

1801–2000 g. Subjects in each group were randomly allocated to either KMC or the control group. The present follow-up study involved the 433 subjects born weighing up to 1800 g, 412 of these survived up to one year of age, and 264 were traced and re-enrolled in this study between 2012 and 2014.

In 1995, we assembled and followed a cohort of full-term, healthy newborn infants born at the same hospital where the original RCT was performed. We traced 37 of them between 2012 and 2014, and they underwent the same neuroimaging tests as the RCT participants, in order to provide reference values for the present study.

2.2 | Interventions in the original RCT

At the time of the initial study, KMC began once the infant could suck and swallow properly, without treatment. The KMC intervention had three components: exclusive or nearly exclusive breastfeeding, prolonged, continuous skin-to-skin contact in the Kangaroo position and early home discharge in KMC with daily follow-up visits at an outpatient KMC clinic. These daily visits continued until the appropriate weight gain had been documented, and then, they took place weekly until the infant had reached 40 weeks of gestational age.

The preterm infants who received traditional care were kept in incubators until they achieved temperature regulation and were discharged according to hospital practice, when they weighed around 1700 g. They received the usual outpatient care that was available under social security insurance.

Both groups received standardised follow-up care, with periodic evaluations until 1 year of corrected age. The details of the RCT have previously been published.^{10,12,13}

2.3 | Variables of interest at 20 years of age

The outcomes of interest at 20 years of age were the cerebral volumes of grey and white matter and organisation of white matter, as determined by fractional anisotropy. Expert neuroradiologists