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Child Development and Types of Birth in a Colombian Population: Are Cesarean Sections Beneficial?

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Abstract

Birth is a physiologically and emotionally impactful event. It has been observed that negative biological circumstances during childbirth can influence neurodevelopment. The objective of this study was to determine whether variables such as the type of delivery (vaginal, cesarean), the age and educational level of the mother, as well as the number of children, may be associated with child development. This is a quantitative cross-sectional correlational study. A purposive sample of 100 children, born at full term through vaginal or cesarean delivery, attending the growth and development consultation, underwent the EAD-3 assessment. A descriptive-correlational analysis of the data was conducted using the SPSS.25 statistical package. It was found that a higher maternal educational level correlates with better development in a baby's motor and language areas. Similarly, it was observed that having siblings promotes child development in language and personal-social skills. Children born by cesarean section showed better development in fine motor skills and language, whereas children born through vaginal delivery exhibited better development in gross motor skills. The results support certain theoretical postulates; however, there are also conflicting results. Thus, the relationship between cesarean birth and all areas of child development remains inconclusive.

Keywords: child development; EAD-3, early childhood, cesarean section; vaginal delivery

Introduction

Perinatal conditions can influence child development during the first five years of life, potentially leading to setbacks or impairments that, in severe cases, become a social burden.

These situations may perpetuate scenarios of violence, socio-economic lag, and a loss of opportunities in the social integration of children (Vélez van Meerbeke et al., 2007; Sarmiento et al., 2017).

Birth, a physiologically impactful event, has been identified as a crucial factor in child neurodevelopment. Negative biological situations during childbirth, whether vaginal, preterm, or by cesarean section, can compromise neurodevelopment and even the mental health of the mother-infant dyad and their family (Olza, 2017; Davies et al., 2020).

Fear of childbirth, lack of information and education about natural childbirth, and a preference for cesarean section due to perceived safety reasons can cause distress in the mother, psychologically affecting the fetus (Hopkins, 2000; Manrique et al., 2017; Silió, 2011). Risks to the health of the mother-child dyad related to cesarean sections, including potential alterations in neurodevelopment, have been documented (Daniel et al., n.d.; Rocha et al., 2020).

In Latin America, social factors such as teenage motherhood and school dropout exacerbate the situation, affecting the neurocognitive development of children (Neal et al., 2018; Morales et al., 2020). The choice of delivery type has led to a current perspective in public health focused on promoting vaginal delivery from the beginning of prenatal care (Olza et al., 2017; CLAP, 2021; WHO, 2016).

Although reducing cesarean sections is controversial due to potential risks for the mother and fetus, some scientific groups advocate for less medical intervention during childbirth to improve maternal and child health (Fraile, 2015; Silió, 2011; Rocha, 2020). Scientific evidence supports that natural childbirth activates beneficial proteins for brain development compared to cesarean section (Fraile, 2015).

The relationship between cesarean section and normal brain development, and its repercussions in adolescence and adulthood, has been evaluated in the first three years of life, focusing particularly on events of central nervous system injury due to hypoxia (Ardila, 2005; Fernandez-Carrocera, 2011; Gialloreti, 2014).

It is crucial to explore the relationship between perinatal and postnatal aspects associated with neurodevelopment, especially in non-industrialized countries, where the delay in neurodevelopment in children has been less frequently measured (Vélez van Meerbeke et al., 2007).

To contribute empirical evidence, data from growth and development programs in Colombia were analyzed using the *Abbreviated Development Scale* (EAD-3 by its acronym in Spanish), an instrument validated since 1999. The goal was to determine if variables such as the type of delivery, mother's age and education level, and the number of children the mother previously had are associated with child development, answering the question of which variables are related to better neurodevelopment.

Method

The study was descriptive, cross-sectional, and correlational. A single measurement was taken during growth and development monitoring, collecting sociodemographic data about the mother and family, as well as birth and other perinatal situations.

Sociodemographic data included the mother's age and level of education, type of delivery, and number of children. Scores for the individual total and transformed assessments of each child regarding their neurodevelopment were obtained for gross motor skills, fine motor skills, hearing and language, along with the personal-social scale. This allowed for establishing the level of development in each area by comparing it with national benchmarks provided by the EAD-3 test used in Colombia. A correlational statistical analysis with SPSS was performed between the two groups and each of the variables analyzed.

Sample

A purposive sample of 100 full-term children was taken, statistically representative of the total population, with 70 born vaginally and 30 born by cesarean section. The age of all children was less than 25 months. Children born through instrumental delivery or preterm birth, or with very low birth weight, were not considered to avoid selection bias related to pathologies identified as at risk of developmental alterations.

Parents signed informed consent for a neurodevelopment assessment according to the EAD-3, which was conducted during the growth and development consultation. The exact cause of cesarean section was not indicated, but all were recorded as performed due to clinical conditions in full-term pregnancies.

Instruments

Abbreviated Development Scale-3 (EAD-3): The EAD-3 (Luna Moreno, 2016), designed and validated in Colombia after measuring outcomes of previous scales (EAD1 and EAD 2), was adopted as a strategy and state policy in public health named *"De Cero a Siempre."* It includes scales to identify social and language skills along with fine motor, gross motor, and personal-social adaptive skills.

Gross Motor Skills (MG) Area: It measures systematic proprioceptive changes in the body from the head to the limbs, reflexes, and physical characteristics related to balance control, posture, and bipedal movement progression.

Fine Motor Skills (MF) Area: It measures how the child acquires skills to relate individual movements of limbs, trunk, and hand with sensory organs in a cephalo-caudal or proximal-distal manner.

Language and Auditory Evaluation (LGJE) Area: It observes how the child acquires different types of language from preverbal and gestural to verbal and written language. It checks visual pathways from birth, auditory pathways in more elaborate language from 1 to 5 years, and reading and writing from 5 to 7 years, verifying the integrity of vision, hearing, phonatory processes, breathing, resonance and articulation, and the maturity of the nervous system.

Personal-Social (PS) Area: It evaluates the infant's ability to recognize oneself as different from others, as well as the ability to respond to social interactions with their primary caregiver and others in their context.

Results

The study involved an urban population in Tunja city with a birth rate of 10.8 per 1000 inhabitants, comprising 2035 births (1036 girls and 999 boys) over a 60-month period, identifying cesarean sections, usual vaginal deliveries, instrumental deliveries, and dystocic deliveries. The representative sample consisted of 100 children, 56% girls and 44% boys, aged between 1 and 24 months, with 31 born by cesarean section and 69 by vaginal delivery. The ages of the mothers were distributed as follows: 15 to 17 years (9%), 18 to 22 years (29%), 23 to 28 years (35%), and 29 to 41 years (27%).

In terms of the education level of the mothers, it was found that 9% had primary education, 25% had incomplete high school, 41% were high school graduates, 16% had technical studies, 6% had a professional degree, and 3% had postgraduate studies. Concerning the number

of children in the household, it was evident that 41% had a single child, 37% had two children, and 18% had three or more children. To verify if the data exhibited a normal distribution, the Kolmogorov-Smirnov test for independent samples was conducted, confirming that it did not meet the criteria for such distribution. In any case, the p-values were less than 0.05 (Kim, 2013). Therefore, non-parametric tests were used to analyze the data. To establish any association between the type of delivery and the development areas evaluated with the EAD-3 (MG, MF, LGJE, PS), the Mann-Whitney U test was employed (see Table 1).

Table 1.

Differences in the scores of development areas (EAD-3) according to the type of delivery.

Area of development	Type of birth	W	p
Gross motor skills	Vaginal	0.984	0.509
	Cesarean section	0.905	**0.010**
Fine motor skills	Vaginal	0.965	**0.049**
	Cesarean section	0.971	0.543
Hearing and language	Vaginal	0.972	0.126
	Cesarean section	0.907	**0.011**
Personal-social skills	Vaginal	0.974	0.158
	Cesarean section	0.977	0.722

Note: Elaborated by the authors

Statistically significant differences were observed in the scores of the gross motor skills (p: 0.010) and hearing and language (p: 0.011) areas in favour of children born by cesarean section. Additionally, a significant difference was found in the fine motor skills area (p: 0.049) in favour of children born by vaginal delivery. No significant differences were identified in the other areas.

Regarding the association between variables such as the mother's level of education, age, and the number of children, the information is presented in Table 2.

Table 2.

Areas of Development and Associated Variables

Area	Variables	W	p
Gross motor skills	Mother's age	0.984	0.009
	Academic level	0.905	0.010
	Number of children	0.983	0,508
Fine motor skills	Mother's age	0.965	0.049
	Academic level	0.971	0.543
	Number of children	0,985	0,000
Language	Mother's age	0.972	0.126
	Academic level	0.907	0.011
	Number of children	0.950	0.009
Personal-social skills	Mother's age	0.974	0.158
	Academic level	0.977	0.722
	Number of children	0.953	0.019

Note: Elaborated by the authors

Table 2 shows that the better development of fine motor skills and language is associated with the mother's higher academic level, and gross motor skills are associated with the mother's older age. As for the personal-social area, differences were found in favor of children with more siblings.

Discussion

The choice of delivery method, whether cesarean or vaginal, has been a subject of discussion regarding various aspects such as attachment, emotion (Velasco, 2000), and the neurocognitive development of the newborn and the mother. While cesarean delivery is commonly accepted and, in certain high-risk cases, may be an alternative for a successful birth, its implications for maternal and child health are subjects of debate. Although some studies (Hopkins, 2000; Manrique-Abril et al., 2017) suggest that children born by cesarean section may exhibit alterations in psychomotor and language development, a causal association still lacks robust evidence.

In this regard, contributing empirically to this understanding, our results are consistent with those found by Velázquez et al. (2014), who reported that children born by cesarean section presented alterations in psychomotor and language development. The latter was also reported in the studies by Fraile (2015). The authors suggest that this is because a cesarean section itself is a surgical risk not only due to the risk of decreased fetal oxygenation but also due to the release of stress-related hormones in the maternal-fetal dyad that favors neuronal connections at the time of birth.

Other authors also propose that, while not always a healthy natural birth produces social and neuroendocrine attachment mechanisms, a cesarean section may inhibit some natural responses (Glardina et al., 2008 as cited in Simón-Areces et al., 2012). However, in their research, Curran et al. (2017); Khadem and Khadivzadeh (2010); Blake et al. (2021) found no association between cesarean birth and impairments in child development. The above, as suggested by Blake et al. (2021) in their systematic review, highlights that there is still limited evidence to support a causal association between cesarean birth and decreased cognitive and physical development. This underscores the need for further research on this association.

Concerning the relationship between the mother's level of education and child development measured with the EAD-3, the results suggest that children with mothers with a higher level of education have better developments in the language area. Jiménez et al. (2018) suggest that when mothers have a higher level of schooling, they know more about how to stimulate their children, and they also speak more to their children, which favours and stimulates language development (Bornstein and Bradley, 2014). Similarly, according to Hoff (2003a, as cited in Jiménez et al., 2021), parents with a higher level of education create more stimulating environments, thus contributing to better child development.

Regarding the mother's age, studies show that the children of very young mothers tend to have lesser early child development. Hubert et al. (2021) present data that align with our findings where the children of older mothers had better scores in fine and gross motor skills, as well as in language. This is probably because older mothers have more knowledge and experience in child development, either through their own learning or vicarious learning, and as a result, they understand the importance of stimulating their children's development.

With respect to the association between the number of children and child development, our data show that there is a relation between these two variables, meaning that having more siblings can foster language and personal-social development. In this regard, Santi-León (2019) suggests that when infants interact with others and peers consistently, they are forced to develop language and social skills earlier to interact with them, resolve conflicts, and make decisions. Edwards (2014) also found in their research that mothers raising more than two children provided greater emotional support.

Thus, we can say that, the influence of the environment (socio-emotional and affective interaction, parental attention, caregivers' academic background) has not only been associated with better language development (Vázquez-Salas, et al., 2020) but also with higher psychomotor development (Lerma et al., 2019) and better overall cognitive performance. Similarly, it is crucial to ensure that children receive adequate stimulation in the early years (Hanley-Cook, et al., 2020).

Conclusion

In relation to the mother's age, level of education, and the number of children, these factors have also shown to influence child development. It has been observed that children of younger mothers tend to have lower early development, while those with older mothers exhibit better scores in areas such as fine and gross motor skills, as well as language. Mothers with a higher level of education tend to stimulate their children more, thus fostering advanced development in these areas. This phenomenon is attributed to the greater experience and knowledge that older mothers have about child development.

Although there are indications of possible adverse effects associated with cesarean delivery, the evidence is still inconclusive. The positive influence of the socio-emotional and affective environment, parental attention, and caregivers' academic background is also highlighted as crucial for comprehensive development in the early years of life. These findings emphasize the need for further research so as to deepen the understanding of these complex interrelationships.

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