

Relationship Between Duration of Exclusive Breastfeeding and Cognitive Development in Children: A Systematic Study

Ruth Olivia Widiyanto*, Johannes Cancius Prihadi, Ellen Wijaya, Laurentius Aswin
Pramono

Universitas Katolik Indonesia Atma Jaya, Indonesia

Email: oliviawidiyanto11@gmail.com*

ABSTRACT

Cognitive development is a crucial aspect of a child's overall growth. This process refers to the stages in which the child undergoes changes that help them remember, understand, process information, and solve problems. One of the key factors in enhancing cognitive development in children is exclusive breastfeeding, defined as breastfeeding without any complementary foods since birth. This systematic review aims to determine the optimal duration of exclusive breastfeeding for cognitive development in children. This research is a systematic review focusing on journals published between 2012 and 2022, using the keywords ("duration" OR "month" OR "months") AND ("exclusive breastfeeding" OR "exclusive breastmilk feeding") AND ("cognitive development" OR "intelligence quotient" OR "cognitive abilities") in the PubMed, ScienceDirect, and ProQuest databases. The review was conducted based on the PRISMA guidelines and evaluated using the JBI Critical Appraisal tools. The results identified three relevant journals. Research by Jedrychowski et al. (2012) and Cando reported that exclusive breastfeeding for six months led to greater cognitive development improvements in children compared to durations of less than six months. In contrast, Choi et al. (2018) found that exclusive breastfeeding for less than six months resulted in higher cognitive development gains compared to six months. This systematic review indicates a relationship between exclusive breastfeeding and improvements in cognitive development in children. This association is likely attributed to the nutrients found in mother's milk, such as omega-3, which are beneficial for supporting children's cognitive development.

KEYWORDS

Duration; Exclusive breastfeeding; cognitive enhancement; intelligence quotient



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INTRODUCTION

Cognitive development is one of the most important aspects of a child's growth, referring to the stages at which the child undergoes changes that help him remember, understand, process information, and solve problems (Black et al., 2017). This cognitive development can be divided into four stages: the sensorimotor stage (0–24 months), the preoperational stage (2–7 years), the concrete operational stage (7–11 years), and the formal operational stage (11–15 years) (Sanghvi, 2020; Tosolini et al., 2025). Cognitive development in children is influenced by both external and internal factors, one of the key external factors being nutrition (Cusick & Georgieff, 2016; Roberts et al., 2022; Dulal et al., 2021).

Exclusive breast milk is considered an ideal nutritional intake for babies because it offers numerous benefits, such as supporting brain and physical development (Horta et al., 2015; Victora et al., 2016), preventing disease (Alotiby, 2023; Lokossou et al., 2022), promoting ideal weight gain (Prasanna Kumar & Lukman, 2019), and meeting all nutritional needs (Hopkins Medicine, 2023). This is due to the fact that breast milk contains abundant nutrients—including fats, carbohydrates, proteins, minerals, and vitamins—that are adequate for infants (MDPI, 2023). Additionally, breast milk contains antibodies that strengthen the baby's immune system to fight viruses and bacteria (Verhasselt, 2024; Atyeo et al., 2021).

Exclusive breastfeeding rates in Indonesia remain relatively low. Based on data from the International Baby Food Action Network (IBFAN) in 2014, Indonesia ranked third lowest among 51 countries assessed for infant and child feeding policies and programs. According to Gayatri (2021), although many Indonesian women breastfeed, only 42% provide exclusive breastfeeding to their babies.

The Indonesian Ministry of Health and WHO recommend that babies aged 0–6 months be given breast milk without supplementation or replacement with other foods or drinks (WHO, 2019). However, some studies suggest that providing exclusive breastfeeding for six months can reduce vitamin B12 intake, which plays an important role in a child's cognitive development (Dağ et al., 2020). These studies advocate exclusive breastfeeding for only 3–4 months, as vitamin B12 levels in breast milk may decrease during this period (Henjum et al., 2020). These differing opinions have led to debates about the optimal duration of exclusive breastfeeding (Williams et al., 2023).

Research on the relationship between breastfeeding duration and cognitive development has produced mixed findings. For example, Mohammed et al. (2022) found that longer exclusive breastfeeding is associated with improved cognitive development and academic performance later in life, underscoring its long-term benefits. In contrast, Chade et al. (2024) suggested that extended exclusive breastfeeding could limit the intake of certain nutrients, such as vitamin B12, which plays a crucial role in early brain development. While these studies provide valuable insights into the role of breastfeeding in cognitive development, they do not conclusively determine the optimal duration of exclusive breastfeeding—a critical issue in infant nutrition and cognitive development.

Previous studies have generally explored breastfeeding duration and its effect on cognitive development in infants, but specific discussions on exclusive breastfeeding duration remain limited. Moreover, these studies have not examined in detail the distinction between exclusive breastfeeding for less than six months and for a full six months. The objective of this research is to investigate the impact of exclusive breastfeeding duration on cognitive development in infants, with a focus on comparing those breastfed exclusively for less than six months and those breastfed for six months. This research could aid medical professionals—particularly pediatricians and midwives—in enhancing their understanding of exclusive breastfeeding and its relationship to cognitive development in children, enabling them to better educate parents about its importance. Accordingly, this study will further examine the relationship between exclusive breastfeeding and cognitive development in infants, specifically during the periods of less than six months and six months.

METHOD

The systematic review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines¹⁷. The search was conducted using the keywords “duration” OR “month” OR “months” AND “exclusive breastfeeding” OR “exclusive breastmilk feeding” AND “cognitive development” OR “intelligence quotient” OR “cognitive abilities” across the PubMed, ScienceDirect, and ProQuest databases.

The inclusion criteria were studies discussing the relationship between the duration of exclusive breastfeeding and cognitive development in children, published within the last 10

years, in either Indonesian or English, and employing a cohort or cross-sectional design. The exclusion criteria included literature limited to titles and abstracts, as well as studies that did not provide sufficient data for analysis.

The selected studies were assessed and evaluated using The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Cross-Sectional Studies and The JBI Critical Appraisal Checklist for Cohort Studies.

RESULT AND DISCUSSION

The databases used are PubMed, Science Direct and ProQuest where there are 1371 journals found using these databases. The journals will then be selected based on inclusion and exclusion criteria. Of the journals that were created, as many as 3 journals can be used for this systematic review because they have met all the inclusion and exclusion criteria

Based on the summary of data in Table 1, research by Jedrychowski states that there is a relationship between the duration of breastfeeding and cognitive development in children. This study used the Bayley Mental Scales of Infant Development – II (BSID – II) and to analyze the data, this study used the General Estimation Equation (GEE). From the results obtained, exclusive breastfeeding for more than 6 months was associated with an average increase in IQ scores 3.8 points higher than those who did not give exclusive breastfeeding. In addition, breastfeeding for 4-6 months had a higher IQ of 2.6 points and breastfeeding for less than 4 months had a higher IQ of 2.1 points than those who were not given exclusive breastfeeding. This suggests that the duration of exclusive breastfeeding is important for a child's cognitive development. In line with the research of Jedrychowski, research by Cando also shows that with a longer duration of breast milk consumption, a child's Intelligence Quotient (IQ) and cognitive will be higher. This can be seen in children who receive Exclusive Breastfeeding for 6 months have a total IQ of 94.50 ± 11.89 , for those who are 4-6 months they have a total IQ of 90.33 ± 11.64 and for those who are less than 6 months have a total IQ of 84.86 ± 5.05 .

Research conducted by Choi showed that although there was a cognitive improvement in infants who were given exclusive breastfeeding compared to those who did not, exclusive breastfeeding at 4 months and then continued by mixed-feeding had better cognitive outcomes than those who were given exclusive breastfeeding for 6 months. This study uses the Korean Developmental Screening Test (K-DST)18 which assesses gross motor, fine motor, cognition, communication, social interaction, and self-control. From the results seen at the age of 6 months, babies who were given exclusive breastfeeding for 4 months and then continued by mixed-feeding had a cognitive assessment of 4.71 while those who were given exclusive breastfeeding for 6 months had a cognitive assessment of 2.71. Not only that, when assessed when the baby is 12 months old, babies who are given exclusive breastfeeding for 4 months and then continued by mixed-feeding have a cognitive assessment of 7.50, while those who are given exclusive breastfeeding for 6 months have a cognitive assessment of 4.31.

Breast milk serves as the main food in a baby's development.^{9,10,11} Breast milk has a lot of nutrients that are good for babies such as vitamin B12, protein, and fat. Nutrients obtained from breast milk help increase the baby's appetite and also improve cognitive development in children. ^{9,10} According to WHO, exclusive breastfeeding to children is recommended to be given for 6 months.^{8,12} There are also other studies that state that exclusive breastfeeding is

enough to be given for 4 months, especially in areas that are still developing because there is insufficient nutrition in the mother, so that breast milk is often deficient in vitamin B12 which plays an important role in cognitive development in children.¹¹ This causes differences of opinion so that some give exclusive breastfeeding more from 6 months or less than 6 months. In this discussion, the researcher will discuss the difference in the duration of exclusive breastfeeding and its role on cognitive in children.¹³ This research was conducted so that readers can find out the optimal duration of exclusive breastfeeding and its effect on children's cognition. This study shows that there is an increase in cognitive in children when given exclusive breastfeeding, but there are also other factors that can also affect the cognitive development such as the IQ of the mother, the environment and others.

Research by Jedrychowski, et al. (2012) ¹⁴ assesses cognitive development in 1-year-old children. This study states that babies who are given exclusive breastfeeding for 6 months have higher cognitive development compared to those who are less than 6 months. This study states that this is due to differences in the development of brain electrical activity during infancy in children who are exclusively breastfed and not. This difference refers to the unsaturated fatty acids (omega-3s) found in breast milk and also other bioactive components that are important for development. Although this study was conducted for 7 years, to reduce the bias factor in this study, the researchers began to study children from the age of 1 year when maternal education and other factors such as environment and education were still considered insignificant. Not only that, observations from the research of Jedrychowski, ¹⁴ suggest that exclusive breastfeeding in infants can regulate the cognitive development trajectory of children at a higher level, and may also affect cognitive abilities in adolescence and adulthood as well so that a longer duration of exclusive breastfeeding can further improve children's cognitive abilities. The study had a sufficient sample size (study strength = 90%, at alpha = 0.05) that made it possible to limit measurement errors in assessing exclusive breastfeeding and mixed feeding practices with regular interviews with mothers at three-month intervals during infancy. After the child moves from infancy to preschool age, a longitudinal statistical analysis (GEE model) of intelligence test scores is carried out to see the cognitive development of preschool-age children related to exclusive breastfeeding. The analysis conducted by this study has also assessed other factors that have the potential to be related to children's cognitive development, such as chronic diseases of the mother or active smokers of tobacco mothers so that late mothers who have this condition are eliminated through inclusion criteria.¹⁴

Similar findings were also obtained from the research of Cando, namely that babies who were given exclusive breastfeeding for 6 months or more had higher cognitive development compared to those who were less than 6 months. However, unlike the research conducted by Jedrychowski, et al. who assessed all cognitf in children, this study assessed cognitive only from the IQ aspect. Babies who consumed breast milk for longer showed a higher amount of deep graymatter and higher brain volume and white matter. The polyunsaturated fatty acids n-3 and arachidonic acid found in colostrum and breast milk have been shown to be positively associated with the cognition of children aged 5 to 6 years. When breastfeeding too, the mother's touch of affection indirectly contributes to cognitive development in the baby. These things show that breastfeeding is undernourished. ¹⁵

Exclusivity can improve cognition in children. The research researched by Cando was conducted in Riobamba, Ecuador which is a developing area, and many people there work as farmers. Many mothers in the area give breast milk for more than 6 months because of poverty factors that make it difficult for parents to buy formula milk or other foods. This can also be an important point because foods that are not sufficiently nutritious can hinder cognitive improvement in children, so exclusive breastfeeding is very important to do there.¹⁵

In contrast to the research conducted by Jedrychowski, et al. (2012) and Cando, the research conducted by Choi, et al. (2018) ¹⁶ assessed that babies who were given exclusive breastfeeding for less than 6 months had higher cognitive development compared to those who were 6 months or more. Research conducted by Choi agrees that exclusive breastfeeding to babies can improve cognitive development in children because breast milk contains long-chain polyunsaturated fatty acids, especially docosahexaenoic acid (DHA) which is good for brain development. Not only that, this study¹⁶ agrees that the relationship between parents and children during breastfeeding can improve emotional relationships in children so that it can help in their cognitive development. The difference between this study and other studies may be due to the small number of samples taken, so this study suggests taking more samples.

CONCLUSION

This systematic study shows that there is a relationship between the duration of consuming exclusive breast milk and increased cognitive development in infants. This is due to the nutrients found in breast milk that are good for helping children's cognitive development, such as omega-3s. The researcher hopes that there will be further research on the topic of exclusive breastfeeding and its relationship with cognitive development in children, so that it can add knowledge to parents and health workers. Researchers hope that studies like this can be conducted in Indonesia or in different regions to be able to see the characteristics and whether exclusive breastfeeding can help cognitive development in children around the world, especially Indonesia. This study also recommends that other research that will be carried out in the future can use a larger and broader database so that it can examine more data and better results.

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