CASE REPORT

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The effect of breastfeeding compared with formula milk on the growth of infants with congenital heart disease: Evidence-based case report

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ABSTRACT

Introduction: Children with Congenital Heart Disease are at high risk of feeding and growth problems. Nutrition practices for children with CHD still vary widely across institutions, including breastfeeding. This study aims to conduct a critical review to compare the effects of breastfeeding versus formula on the growth of infants with congenital heart disease.
Methods: The article search was conducted online using the PubMed, EBSCO, and ProQuest databases with the keywords "Congenital Heart Disease," "Human Milk," "Formula," and "Growth."
Result: Two articles were obtained in the form of systematic review studies. Results of the study stated that in infants with CHD with breastfeeding compared to formula milk Weight for age score is better with breastfeeding because breast milk is easier to digest
Conclusion: Breast milk has been shown to have significant benefits on the growth of infants with CHD compared to formula, especially in terms of weight-for-age z-score.

Keywords: *Congenital Heart Disease, Human Milk, Formula, Growth*.
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INTRODUCTION

Congenital Heart Disease (CHD) is the most common congenital disability, affecting nearly 1 in 100 infants. CHD is the leading cause of death in children due to congenital abnormalities.[1] Proper treatment can reduce mortality and morbidity and improve the quality of life of children after recovery. Children with CHD are at high risk for nutritional and growth problems. Most children with CHD are now expected to survive into adulthood, and more attention is now being paid to improving growth, development, and feeding.[2] The benefits of breast milk for premature and healthy infants have been widely studied, but there is limited data on the role of breast milk in improving outcomes for neonates and infants with CHD. Standard formulas typically contain intact proteins digested in the gastrointestinal tract, whereas breast milk is more easily digested and absorbed, especially in patients with impaired gastrointestinal function.[3] This distinction is crucial in children with CHD, where they are at increased risk for complications related to necrotizing enterocolitis (NEC), chylothorax, feeding difficulties, and growth failure. Given the growing evidence of improved outcomes associated with breast milk for critically ill infants, breast milk should be considered as a medical intervention for infants with CHD.[4] The purpose of this Evidence-Based Case Report focuses on determining the effect of breastfeeding versus formula feeding on the growth of infants with congenital heart disease based on a review of scientific evidence.

CASE DESCRIPTION

A 10-month-old girl came to the RSSA Emergency Room with complaints of worsening shortness of breath for 3 days, accompanied by fever. The patient was treated on the 20th day with a diagnosis of pneumonia, septic shock, heart failure, ROSS score IV significant PDA, acute liver failure, marasmus malnutrition, and acute diarrhea without signs of dehydration (improvement). Currently, shortness of breath has improved, and there is no fever or vomiting.

Table 1. Clinical questions according to the PICO method

Population (P)	Intervention (I)	Comparison (C)	Outcome (O)
Children with Congenital Heart Disease	Use of Breast Milk	Formula Giving	Growth

Table 2. Results of the study on the impact of human milk on outcomes for infants with congenital heart disease

Research	Groups	Parameter	Outcome
Yu et al.[5]	Breastmilk feeding vs formula	Average daily weight gain (g/kg/day)	19.0 (3.4) vs 14.4 (2.3) p = 0.041
Combs and Marino[6]	Breastfeeding (mother's milk) vs formula	>20% negative change in weight percentile from birth to 5 months	46% vs 83% p = 0.04
Kataria-Hale et al.[7]	Human milk (MOM/donor human milk) + HM-based fortifier (Prolacta) vs HM/formula + bovine-based fortifier.	Median weight velocity (g/kg/day).	3.62 vs 2.79 p = .04

Diarrhea (+) 3 times a day. The patient had a history of difficulty gaining weight since birth and had never been examined; therefore, there was no information about the patient's history of other illnesses. Physical examination in the regular inpatient room after being transferred from the PICU showed a heart rate was 134 times/minute, BP 100/40 mmHg, respiratory rate 38 times/minute, and temperature 37°C. There was no intercostal retraction, rhonchi (-/-), wheezing (-/-), and there was a continuous murmur in the left ICS 2 midsternal line. Pulse was strong, warm acral, CRT <2 seconds. BB/A 7 kg (-2SD to mean), TB/A 72 cm (mean to 2SD), BB/TB (-3SD to -2SD). From an echocardiography examination, the patient was found to have a large Patent Ductus Arteriosus (PDA). Currently, the patient is given breast milk alternately, Infantrini 8x60 cc (480cc, 480kcal). Monitoring and evaluation of nutritional provision include assessment of acceptability, tolerance, and effectiveness of nutritional provision.

CLINICAL QUESTIONS

Based on the case illustration above, a clinical question arises: Does the use of breast milk compared to formula milk provide better outcomes in pediatric patients with CHD?

LITERATURE SEARCH METHOD

The literature search procedure to answer the above questions was carried out by searching for references online through a search engine. Article searches were conducted online using the PubMed, EBSCO, and ProQuest databases. The keywords used included the keywords "Congenital Heart Disease," "Human Milk," "Formula," and "Growth." After the article was found, a selection was made based on the inclusion criteria, namely, the language of the article is English, Full-text, and publication within the last five years. Exclusion criteria included studies in the form of article reviews, similar articles, and articles without full text. After selection, two relevant articles were available and analyzed by considering their validity, relevance, and application to patients.

RESULTS

After a literature search, two articles were found that were relevant to the clinical question. A systematic review study (2022) by Elgersma et al.[4] comparing breastfeeding with intake other than breast milk in children (aged <1 year) with CHD, found 16 articles that met the inclusion criteria. Nine of them were cohort studies (seven retrospective and two prospective), four of them used a quasi-experimental design, two of them were Randomized-Controlled Trials (RCTs), and one was a retrospective case/control design. One RCT included multiple Sites, and two studies were secondary analyses of multisite datasets. These studies were most frequently conducted in the United States (n = 10), with Canada (n = 3), China (n = 1), Germany (n = 1), and Italy (n = 1), including seven studies measuring weight gain outcomes, four of which showed significant differences between groups, three positive trends for breastfeeding, and one study that was not statistically significant but showed a trend in favor of breastfeeding.

Systematic review study (2019) by Davis and Spatz[8], comparing breastfeeding with other formulas or no intervention with the outcome of reducing NEC rates, improving growth and development and reducing food intolerance, the results of two studies on infants with CHD with breastfeeding vs formula weight-for-age scores were better with breastfeeding, it was said that breast milk was easier to digest and breast milk had protein content, immunological factors and digestive enzymes that could increase gastric motility and reduce the possibility of digestive disorders.

DISCUSSION

There has been extensive research into the benefits of breast milk for premature and healthy infants. Still, limited data are available on the role of breast milk for neonates and infants with congenital heart disease (CHD). Infants with CHD are at higher risk for complications related to necrotizing enterocolitis (NEC), chylothorax, feeding difficulties, and growth failure.[4] Many contributing factors include poor feeding in CHD patients that separate in to medical factors (difficulty breathing, prolonged intubation, residual abnormalities, vocal cord dysfunction), psychological factors (poor endurance while feeding and reduce apetite, delayed oral motor skills, increase energy expenditure, hypermetabolism), and behaviour-environmental factors (delayed transition to oral feeding, ICU environments, parental experience, improper feeding behaviour).[9] Infants with heart defects are at the highest risk for morbidity and mortality related to feeding complications. Heart disease

Table 3. Search strategies, sources used, and search results

Search Portal	Keywords	Articles obtained	Articles used
Pubmed	("congenital heart disease"[Title/Abstract] AND ("human milk"[Title/Abstract] OR "breast milk"[Title/Abstract] OR "breastfeeding"[Title/Abstract] OR "breastfed"[Title/Abstract]) AND "formula"[Title/Abstract] AND "growth"[Title/Abstract	7	2
EBSCOhost	"Congenital heart disease" AND ("human milk" OR "breast milk" OR "breastfeeding" OR "breastfed") AND "formula" AND "growth"	0	0
ProQuest	noft(congenital heart disease) AND noft(human milk) AND formula AND growth	18	0
ScienceDirect	Title, abstract, keywords: "congenital heart disease" AND "human milk" AND growth	3	0

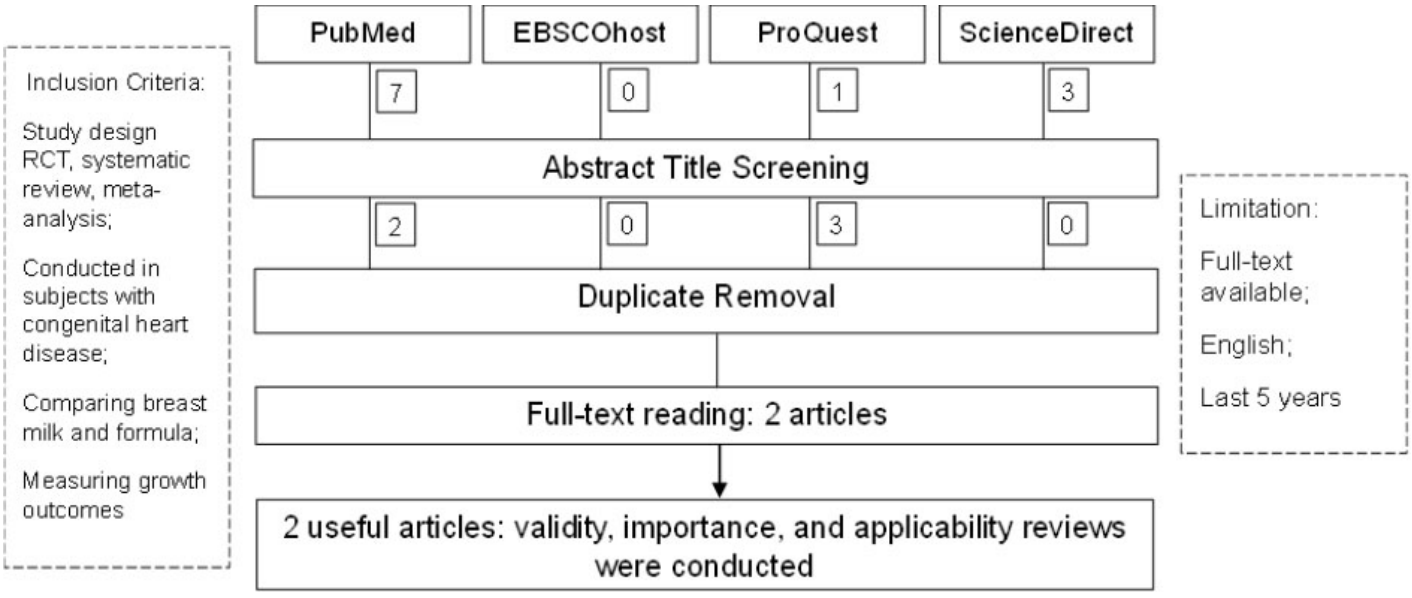

Figure 1. Literature selection flowchart.

Table 4. Critical assessment Systematic review

Article	Elgersma et al.[4]
Study design	Systematic review study
Level of Evidence	1
PICO	
P	Children with CHD
I	Breast Milk
C	In addition to breast milk intake
O	Intentionally not stated specifically
Introduction	This study clearly states its aim, namely, the impact of breastfeeding compared to other oral intakes on CHD.
Methods	Systematic review study Number of articles discussed: 16 articles
Results	This study sufficiently explains the essential data. The results obtained are in accordance with the analysis plan described in the method.
Discussion	This study's shortcomings are explained, namely, its use of varying criteria or unclear doses/responses to the results of babies who receive breast milk, formula milk, or cow's milk.

itself and the treatment process increase the metabolic needs of these infants. For infants with CHD, feeding is often delayed until the postoperative period.[4] This delay in feeding can increase the infant's risk of developing NEC and prolong the time needed to achieve the infant's feeding targets. If these complications occur, it will interfere with the child's weight gain and growth development. If these complications occur, it will interfere with the child's weight gain and growth development.[10]

Infants with heart disease who received a breast milk diet showed increased weight gain for age compared to infants who received formula. This may be related to the ease of digestion of breast milk.[11] Breast

Table 5. Critical assessment Systematic review

Article	David dan Spatz.[8]
Study design	Systematic review study
Level of Evidence	1
PICO	
P	Neonates and Children with CHD
I	Peptide-based formula
C	Standard Formula / Whole protein formula
O	Reduces the risk of NEC, improves growth and development, and reduces food intolerance
Introduction	This study clearly states the aim of this study, namely, to determine the impact of breastfeeding on children with CHD.
Methods	Systematic review study Number of articles discussed: 17 articles
Results	This study sufficiently explains the essential data. The results obtained are in accordance with the analysis plan described in the method.
Discussion	Although the studies appeared relevant in this study, the review lacked a rigorous quality assessment framework, which may affect the validity of the included evidence.

milk can improve digestion and help the development of the gastrointestinal tract because it has a concentration of proteins, immunological factors, and digestive enzymes that can increase gastric motility and reduce the possibility of digestive disorders. These benefits are significant for infants who often experience decreased systemic perfusion due to heart disease.[12]

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CONCLUSION

Breast milk has been shown to provide significant benefits on the growth of infants with CHD compared to formula, especially in terms of weight-for-age z-score. Further studies with better designs on breastfeeding in CHD are still an opportunity for further study. A breast milk-based approach, with consideration of formula, if necessary, needs to be prioritized for infants with CHD, especially in high-risk conditions such as malnutrition. Lactation support and maternal motivation are key to successful breastfeeding in infants with CHD. Optimizing breastfeeding in infants with CHD can improve growth and development outcomes. This strategy needs to be supported by a multidisciplinary approach and the availability of supporting facilities in health facilities.

DISCLOSURES

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The authors declare that the study received no funding.

Conflict of Interest

The authors declare that there is no conflict of interest to disclose.

Ethical Approval/Consent for Publication

Informed consent has been obtained and approved by the patient's parents.

Author Contribution

Study conception and design: M, PIP, SY, KTK, DK, AFR, MRF, MAM; data collection: M; literature search: M, PIP, SY, KTK, DK, AFR, MRF, MAM; analysis and interpretation of results: M, PIP, SY, KTK, DK, AFR, MRF, MAM; draft manuscript preparation: M, PIP, MRF. All authors prepare the manuscript and agree for this final version of manuscript to be submitted to this journal.

Ethical approval/consent for publication

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REFERENCES

1. Vervoort D, Jin H, Edwin F, Kumar RK, Malik M, Tapaua N, et al. Global Access to Comprehensive Care for Paediatric and Congenital Heart Disease. CJC Pediatric and Congenital Heart Disease. 2023;2(6):453–63.
2. Xu J, Li Q, Deng L, Xiong J, Cheng Z, Ye C. Global, regional, and national epidemiology of congenital heart disease in children from 1990 to 2021. Front Cardiovasc Med. 2025;12.
3. Elgersma KM, Wolfson J, Fulkerson JA, Georgieff MK, Looman WS, Spatz DL, et al. Human Milk Feeding and Direct Breastfeeding Improve Outcomes for Infants With Single Ventricle Congenital Heart Disease: Propensity Score-Matched Analysis of the NPC-QIC Registry. J Am Heart Assoc. 2023;12(17).
4. Elgersma KM, McKechnie AC, Gallagher T, Trebilcock AL, Pridham KF, Spatz DL. Feeding infants with complex congenital heart disease: A modified Delphi survey to examine potential research and practice gaps. Cardiol Young. 2021;31(4):577–88.
5. Yu XR, Xu N, Huang ST, et al. A Comparative Study on Breast Milk Feeding and Formula

Milk Feeding in Infants With Congenital Heart Disease After Surgery: A Retrospective Study. Heart Surg Forum. 2020;23(23):40–9.
6. Combs VL, Marino BL. A comparison of growth patterns in breast and bottle-fed infants with congenital heart disease. Pediatr Nurs. 1993;19:175–9.
7. Kataria-Hale J, Gollins L, Bonagurio K, Blanco C, Hair AB. Nutrition for Infants with Congenital Heart Disease. Clin Perinatol. 2023;50(3):699–713.
8. Davis JA, Spatz DL. Human Milk and Infants with Congenital Heart Disease: A Summary of Current Literature Supporting the Provision of Human Milk and Breastfeeding. Advances in Neonatal Care. 2019;19(3):212–8.
9. Liu HC, Chaou CH, Lo CW, Chung HT, Hwang MS. Factors Affecting Psychological and Health-Related Quality-of-Life Status in Children and Adolescents with Congenital Heart Diseases. Children. 2022;9(4).
10. Morgan J, Young L, Mcguire W. Delayed introduction of progressive enteral feeds to prevent necrotising enterocolitis in very low birth weight infants. Vol. 2014, Cochrane Database of Systematic Reviews. John Wiley and Sons Ltd; 2014.
11. Jangid V, Yadav DK, Bhatt DD. Weight gain in infants with congenital heart disease; breastfeeding alone versus supplemental spoon-feeding of expressed breast milk: an open-label, pilot, randomised control trial. 2024;34(7):1577–82.
12. Jakaitis BM, Denning PW. Human Breast Milk and the Gastrointestinal Innate Immune System. Vol. 41, Clinics in Perinatology. W.B. Saunders; 2014. p. 423–35.
13. Edmond Karen, Bahl Rajiv. Optimal feeding of low-birth-weight infants : technical review. World Health Organization; 2006. 121 p.