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REVIEW ARTICLE

Benefits of breastfeeding in reducing cardiovascular risk in children in the medium and long term: a systematic review

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Breast feeding,
Heart disease risk factors,
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Obesity.

Abstract

Objective: review the influence of breastfeeding with maternal milk on medium and long-term cardiovascular health. **Method:** A systematic literature search was conducted in English, Portuguese, and Spanish using the following databases: PubMed/MEDLINE, Embase, Cochrane, and Scopus. The main health science descriptors searched in Portuguese and English were "breastfeeding" and "risk cardiovascular." **Results:** This study reviewed 5936 patients who were evaluated for cardiovascular disease risk factors and the influence of breastfeeding with breast milk. Among the trials, a slight male prevalence was observed compared to females. The average age of the studies ranged from 13.2 to 71 years. **Conclusion:** Exclusive breastfeeding for at least 3-6 months with breast milk may be associated with a reduction in cardiovascular risk by decreasing risk factors such as endothelial response, medium-intimal thickness, likelihood of atherosclerotic plaque development, total cholesterol, blood pressure, and LDL/HDL ratio. A reduction in glycated hemoglobin was also observed in non-diabetic patients. Additionally, the sum of these variables may contribute to favorable cardiovascular health. However, no statistical difference was observed in relation to body mass index, triglycerides, and blood glucose.

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INTRODUCTION

Breast milk is a dynamic fluid that offers nutrition for infants. Its composition is abundant in bioactive and bioavailable growth factors, enzymes, antibodies, and stem cells, which enhance systemic and organ function[1].

It differs from infant formula in several aspects, including protein and fat content[2]. Breast milk contains less protein and is higher in fat than cow's milk. It is also richer in cholesterol than commercial infant formula[3]. Additionally, it contains essential hormones and growth factors that may be linked to the development of the cardiovascular system[4,5].

Breastfeeding has been linked to a reduction in cardiovascular risk factors in childhood. In developed nations, breastfed children tend to have a lower body weight during childhood and adolescence than those fed cow's milk or commercial infant formulas[6].

Some studies, including a randomized trial involving preterm infants, have demonstrated that breastfed children tend to have lower blood pressure, although other studies have not established this link[7]. Additionally, breastfed infants exhibit lower insulin levels compared to those fed formula[8].

It is important to note that although blood cholesterol levels may be higher in breastfed infants than those fed formula, this difference disappears when breastfeeding is stopped and may develop into more favorable lipid profiles during adolescence[9,10].

Some studies indicate that breastfeeding may improve glucose tolerance and lower the risk of developing diabetes mellitus[11]. However, recent research has shown a concerning link between extended breastfeeding duration and reduced artery distensibility in young adults[12].

This study aims to evaluate the effects of breastfeeding on cardiovascular health in the medium and long term.

MATERIALS AND METHODS

This systematic review complies with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.

Search strategy and selection criteria

A systematic search for English, Portuguese, and Spanish literature was conducted across the following databases: PubMed/MEDLINE, Embase, Cochrane, and Scopus. The primary health sciences descriptors searched in Portuguese and English were: "breastfeeding" and "cardiovascular risk." Boolean operators such as AND/and and OR/or were employed. Initially, all studies discussing breastfeeding and cardiovascular risk in children were screened and selected based on the criteria.

The inclusion criteria were: a) studies that correlated breastfeeding in children with changes in the risk of developing cardiovascular diseases; b) studies that assessed individuals who were exclusively breastfed for at least 3 to 6 months; c) studies that evaluated changes with follow-up during the first months of life and in adolescence or adulthood; d) articles that conducted case-control studies assessing additional variables such as diet and lifestyle habits in children, adolescents, and adults; e) studies that compared breastfeeding with breast milk against the use of supplementary food sources. The exclusion criteria were: a) systematic reviews; b) case reports; c) experimental trials; d) studies that did not describe additional factors and exclusively evaluated breastfeeding without considering other risk factors for cardiovascular disease; e) trials without a control group.

The articles were also chosen based on the Population, Intervention, Comparison, and Outcome (PICO) strategy.

- Population: individuals who were breastfed for at least 3-6 months and exhibited changes in cardiovascular risk.
- Intervention: analysis of statistical parameters regarding the incidence of obesity, lipid profiles, and hypertension in children, adolescents, and adults who were breastfed for at least six months.
- Comparison: Regarding cardiovascular risk indicators, individuals who did not receive breast milk were compared to those who did.
- Outcome: demonstrate a causal link between breastfeeding for at least 6 months and a reduced risk of cardiovascular risk in children, adolescents, and adults.

Data extraction

After assessing the abstracts against the criteria, relevant studies were selected for full reading and screening. The research team, composed of two independent reviewers, extracted the data. Disagreements between the reviewers regarding the inclusion or exclusion of a study were resolved by consensus, and a fifth reviewer was consulted when necessary. The variables collected included mean age, sex, follow-up time, interventions performed, and functional results obtained.

Quality assessment

The Newcastle-Ottawa scale was used to assess the quality of the studies. The scale considers eight items and

assigns a score of 0 to 9 points regarding the selection criteria, comparability, and outcomes of the control studies.

RESULTS

Literature search and study characteristics

The search yielded 387 studies. A total of 113 duplicates were excluded. In the second stage of the analysis, 262 studies were discarded based on the pre-established criteria: 168 for not meeting the inclusion criteria and 27 for focusing on maternal health. The remaining 63 studies were evaluated according to the inclusion criteria. Ultimately, four articles were deemed eligible for inclusion in this review.

Characteristics of the references

This review includes 5,936 patients who were evaluated for risk factors associated with the development of cardiovascular diseases and the impact of breastfeeding. Among the trials, a slight male predominance was noted compared to females. The mean age of participants ranged from 13.2 to 71 years, with all trials analyzing data from early childhood and later during adolescence or adulthood (Table 1). The most commonly assessed parameters were the lipid profile, glycemia, body mass index, and blood pressure. The studies prospectively followed the population, with a minimum follow-up period of two years during early childhood. Collected data included comparisons of laboratory parameters between those who were breastfed and those who received replacement foods.

DISCUSSION

The risk of developing cardiovascular disease is multifactorial, and breastfeeding seems to modulate these factors. Despite the limitations of longitudinal studies assessing the long-term effects of breastfeeding and other variables, several trials show a positive relationship with a reduced risk of developing cardiovascular disease.

When evaluating endothelial function in breastfed children compared to those who received formula, we found that acetylcholine responses were significantly related to the duration of breastfeeding[13]. Furthermore, in age- and sex-controlled models, breastfeeding was inversely associated with common carotid intima-media thickness (CIMT; difference -0.03 mm; 95% CI), bifurcation (difference -0.19 mm; 95% CI), carotid plaque (OR: 0.52; 95% CI), and femoral plaque (OR: 0.54; 95% CI)[14].

Additional factors such as lifestyle habits, physical activity, diet, smoking, and drinking are important in the assessment. Including fasting blood glucose, cholesterol, body mass index, waist/hip ratio, birth weight, Tanner stage, and physical activity did not change the significant relationship between ACh and breastfeeding[13]. Controlling for socioeconomic variables in childhood and adulthood, smoking, and drinking made little difference in estimating intima-media thickness[14].

Some studies differed regarding the lipid profile. An English cohort study that evaluated 405 individuals followed for 65 years showed little evidence of a difference in risk factors (adiposity, blood pressure, lipids, or insulin resistance). Another randomized study with 216 participants followed for 13 years found lower C-reactive protein (CRP) levels and LDL/HDL ratios (14% lower, 95% CI) in breastfed individuals compared to those who received formula for preterm infants[14,15].

Low birth weight was less common, and healthier eating habits were noted throughout life in individuals who were breastfed[16]. Breastfeeding was also linked to lower average blood glucose levels measured by hemoglobin A1c (HbA1c) in people without diabetes, along with a significant correlation between the duration of breastfeeding and reduced blood pressure and serum cholesterol levels[14,16].

Factors such as lower LDL/HDL levels and CRP may relate to a decreased likelihood of carotid and femoral plaques[15,16]. The differences in plaque prevalence associated with breastfeeding were comparable to those seen between smokers and non-smokers, as well as between individuals with and without evidence of coronary disease[14].

CONCLUSION

The risk of developing cardiovascular disease is multifactorial, primarily influenced by eating habits, genetics, physical activity, alcohol consumption, and smoking. Breastfeeding can impact the development of the cardiovascular system in children and lower the risk of disease. According to the studies reviewed, breastfeeding seems to have a modulating effect on the epithelium of large vessels, which reduces the incidence of atherosclerosis, lowers blood glucose levels in non-diabetics, and decreases blood pressure in adults. However, it is essential to emphasize the limitations of this study, as the trials were not randomized, making it impossible to conclude the benefits definitively. Furthermore, future trials must develop validated protocols that examine the relationship between breastfeeding and cardiovascular function while considering its multifactorial nature. Thus, this study suggests a possible influence of breastfeeding on the risk of cardiovascular diseases; however, new trials must be designed to clarify how breastfeeding affects cardiovascular development and additional factors like lipid profile and endothelial function.

Table 1. Comparison of cardiovascular risk factors between breastfed and formula-fed children, as found in the reviewed studies.

Study	Age (years)	Sex	LDL (mmol/l)	HDL (mmol/l)	Triglycerides (mmol/l)	Cholesterol (mmol/l)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)	Glucose (mmol/l)	BMI (kg/m²)	Birth weight (kg)
Khan F. *et al.* (2009)[13]	NB (13.3)	NB (12M:29F)	NB (2.19±0.66)	NB (1.53±0.32)	NB (0.72±0.23)	NB (4.01±0.68)	NB (100.2±7.2)	NB (62.7±7.8)	NB (4.75±0.58)	NB (20.2±2.5)	NB (3.41±0.41)
	B (13.2)	B (41M:61F)	B (2.15±0.55)	B (1.55±0.35)	B (0.77±0.36)	B (4.05±0.64)	B (97.1±8.8)	B (61.3±7.6)	B (4.94±0.78)	B (20.1±3.0)	B (3.42±0.43)
Martin *et al.* (2005)[14]	71	182M	NB (3.40±0.94)	NB (1.60±0.45)	NB (1.36±0.45)	NB (5.68±1.16)	NB (149.02±23.60)	NB (83.24±9.60)	NB (5.82±0.67)	NB (27.47±4.69)	-
		223F	N (3.52±1.08)	B (1.57±0.42)	B (1.32±0.42)	B (5.75±1.21)	B (147.78±21.79)	B (82.78±10.29)	B (5.74±0.58) **(HBAC1)	B (27.45±4.34)	
*Izadi V *et al.* (2004)[15]	NB (14.9±2.4)	2665M	NB (91.03±29.91)	NB (45.28±13.19)	NB (100.2±47.43)	NB(158.79±40.14)	NB (105.40±11.28)	NB (68.24±9.26)	NB (91.48±15.69)	NB (19.6±4.5)	NB (67.9% 2.5-4)
	B (14.5±2.4)	2593F	B (83.88±27.30) mg/dL	B (46.17±14.34) mg/dL	B (93.04±41.42) mg/dL	B(148.22±31.79) mg/dL	B (103.62±14.04)	B (66.07±10.67)	B (87.30±14.21) mg/dL	B (19.35±4.1)	B (77.95%2.5-4)
Singhal A *et al.* (2013)[16]	NB (15.1±1.0)	NB (32M:32F)	NB (2.7±0.7)	NB (1.2±0.3)	NB (1.1±0.8)	NB(4.1±0.8)	-	-	-	NB (21.1±3.9)	1.4-1.85
	B (15.2±0.9)	B (32M:34F)	B (2.5±0.6)	B (1.2±0.3)	B (0.9±0.5)	B(3.8±0.7)				B (20.8±3.9)	

B: breastfeeding; NB: not breastfeeding; BMI: Body mass index; LDL: Low-Density Lipoproteins; HDL: High-Density Lipoproteins.

* This study employed different units of measurement than others; to avoid approximations, we retained the data as reported.

** The study focused on glycated hemoglobin rather than glycemia.

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