

Increased risk of cardiovascular disease

This UK study looked at the cholesterol levels of 1500 - 13 to 16 year olds and determined that breastfeeding may contribute to long term protection from cardiovascular disease by reducing total cholesterol and low-density lipid cholesterol. The research suggests that early exposure to breastmilk may program fat metabolism in later life, resulting in lower blood cholesterol levels and therefore a lower risk of cardiovascular disease.

Owen GC, Whipcup PH, Odoki JA, Cook DG. Infant feeding and blood cholesterol: a study in adolescents and systematic review. Pediatrics 110: 597-608, 2002

To confirm links between infant nutrition and health risks in later life, British researchers measured blood pressure at 13 to 16 years of age of 216 children who had been born prematurely. For those who had received preterm infant formula or routine infant formula, blood pressure was higher than for those who had received breastmilk during infancy. The authors concluded that for children born prematurely, breastfeeding lowers blood pressure in later life and that this conclusion can be extended to term infants as well.

Singhal A, Cole TJ, Lucas A. Early nutrition in preterm infants and later blood pressure: two cohorts after randomized trials. The Lancet 357: 413-419, 2001

Increased risk of obesity

To determine the impact of infant feeding on childhood obesity, this large Scottish study looked at body-mass index of 32,200 children aged 39 to 42 months. After elimination of confounding factors, socioeconomic status, birthweight and sex, the prevalence of obesity was significantly higher in the formula fed children; leading to the conclusion that formula feeding is associated with an increase in childhood obesity.

Armstrong, J. et al. Breastfeeding and lowering the risk of childhood obesity. Lancet 359:2003-04, 2002

German researchers collected height and weight data of 9375 school children to determine the



impact of early childhood feeding on the development of obesity. The prevalence of obesity was found to be 4.5 per cent - nearly 40 per cent higher - in those who had never been breastfed compared to 2.8 per cent for those who had been exclusively breastfed.

Von Kries R. Breastfeeding and obesity: cross sectional study. BMJ 319: 147-150, 1999

Increased risk of gastrointestinal infections

A comparison between infants who received primarily breastmilk during the first 12 months of life to infants who were exclusively formula-fed or who were breastfed for three months or less found that diarrheal disease was twice as high for the formula-fed infants then for those who were breastfed.

Dewey KG, Heinig MJ, Nommsen-Rivers LA. Differences in morbidity between breast-fed and formula-fed infants. J Pediatr 126: 696-702, 1995

Breastfeeding promotion in Belarus significantly reduced the incidence of gastrointestinal infections by 40 per cent.

Kramer MS, Chalmers B, Hodnett ED, et al. Promotion of Breastfeeding Intervention Trial (PROBIT): A randomized trial in the Republic of Belarus. JAMA 285: 413-420, 2001

Increased risk of mortality

Compared with exclusive breastfeeding, children who were partially breastfed had a 4.2 times increased risk of death due to diarrheal disease. Not breastfeeding was associated with a 14.2 times increased risk for death due to diarrheal disease in Brazilian children.

Victoria CG, Smith PG, Patrick J, et al. Infant feeding and deaths due to diarrhea: A case-controlled study. Amer J Epidemiol 129: 1032-1041, 1989

Infants in Bangladesh who were partially breastfed or not breastfed had a risk of acute respiratory infection death 2.4 times greater than exclusively breastfed infants. If children were predominantly breastfed the risk of death due to acute respiratory infection was similar to that of exclusively breastfed children.

Arifeen S, Black RE, Atbeknab G, Baqui A, Caulfield L, Becker S. Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. Pediatrics 108: e67, 2001

The authors of this review discuss the impact of breastfeeding on child spacing and estimate that exclusive breastfeeding can decrease mortality up to 20 per cent when infants are spaced at least two years apart.

Thapa S, Short RV, Potts M. Breast feeding, birth spacing and their effect on child survival. Nature 335: 679-682, 1988

Increased risk of otitis media and ear infections

The number of episodes of acute otitis media increased significantly with decreased duration of and exclusivity of breastfeeding. US infants who were exclusively breastfed for four months or more had a 50 per cent reduction of episodes compared to infants who were not breastfed. A 40 per cent reduction of episodes was reported for breastfeeding infants who were supplemented before four months of age.

Duncan B, Ey J, Holberg CJ, Wright AL, Martines F, Taussig LM. Exclusive breastfeeding for at least 4 months protects against otitis media. Pediatrics 91: 867-872, 1993

Between six and 12 months of age the incidence of first episodes of otitis media increased from 25 per cent to 51 per cent in infants exclusively breastfed. In infants that were exclusively formula fed the incidence rose from 54 per cent to 76 per cent during the second half of the first year. The authors concluded that breastfeeding even for a short period (three months) would significantly reduce the episodes of otitis media during infancy.

Duffy LC, Faden H, Wasielewski R, Wolf J, Krystofik D. Exclusive breastfeeding protects against bacterial colonization and day care exposure to otitis media. Pediatrics 100: E7, 1997

Increased risk of side effects of environmental contaminants

A Dutch study showed that at six years of age, cognitive development is affected by prenatal exposure to PCBs and dioxins. An adverse effect of prenatal exposure on neurological outcome was also demonstrated in the formula fed group but not in the breastfed group. Despite higher PCB exposures from breastmilk, the study found that at 18 months, 42 months, and six years of age there was a beneficial effect of breastfeeding on the quality of movements, in terms of fluency, and in cognitive development tests.

The data gives evidence that prenatal exposure to PCBs has subtle negative effects on neurological and cognitive development of children up to school age. The study also gives evidence that breastfeeding counteracts the adverse developmental effects of PCBs and dioxins.

Boersma ER, Lanting CI. Environmental exposure to polychlorinated biphenyls (PCBs) and dioxins. Consequences for longterm neurological and cognitive development of the child. Adv Exp Med Biol 478:271-87, 2000

Fourteen Risks of Formula Feeding

A brief annotated bibliography

Prepared by INFANCT Canada, November 2002

Risks of Formula Feeding

When breastfeeding is not fully practiced, infant formulas are generally used. The World Health Organization International Code of Marketing of Breast-milk Substitutes requires that parents be informed about the health hazards of unnecessary or improper use of infant formula. This brief annotated bibliography gives some examples from the extensive body of research documenting the importance of breastfeeding and in turn the associated risks of formula feeding.

The World Health Organization recommends exclusive breastfeeding for six months, the introduction of nutritious complementary foods at six months and continued breastfeeding for two years and beyond.

Increased risk of asthma

A study of 2184 children done by the Hospital for Sick Children in Toronto determined that the risk of asthma and wheezing was approximately 50 per cent higher when infants were formula fed compared to infants who were breastfed for nine months or longer.

Dell S, To T. Breastfeeding and Asthma in Young Children. Arch Pediatr Adolesc Med 155: 1261-1265, 2001

Researchers in West Australia studied 2602 children to determine the development of asthma and wheezing at six years of age. Not breastfeeding increased the risk of asthma and wheezing by 40 per cent compared to infants who were exclusively breastfed for four months. The authors recommend exclusive breastfeeding for at least four months to reduce the risk of asthma.

Oddy WH, Peat JK, de Klerk NH. Maternal asthma, infant feeding, and the risk for asthma in childhood. J. Allergy Clin Immunol. 110: 65-67, 2002

Increased risk of allergy

Children in Finland who had been breastfed the longest had the lowest incidence of atopy, eczema, food allergy and respiratory allergy. At 17 years of age, the incidence of respiratory allergy for those who had little breastfeeding was 65 per cent and for those who were breastfed the longest it was 42 per cent.

Saarienen UM, Kajosarri M. Breastfeeding as a prophylactic against atopic disease: Prospective follow-up study until 17 years old. Lancet 346: 1065-1069, 1995

A longitudinal prospective study of 1246 healthy infants in Arizona, USA, aimed to determine the relationship between breastfeeding and recurrent wheezing. The results showed that non-atopic children

at the age of six years who had not been breastfed were three times more likely to have recurrent wheezing.

Wright AL, Holberg CJ, Taussig LM, Martinez FD. Relationship of infant feeding to recurrent wheezing at age 6 years. Arch Pediatr Adolesc Med 149: 758-763, 1995

Reduced cognitive development

A total of 3880 Australian children were followed from birth to determine breastfeeding patterns and later cognitive development. Those breastfed for six months or more had an 8.2 point higher for females and a 5.8 point higher for males in vocabulary tests over those who had never been breastfed.

Quinn PJ, O'Callagan M, Williams GM, Najman JM, Anderson MJ, Bo W. The effect of breastfeeding on child development at 5 years: a cohort study. J Paediatr Child Health 37: 465-469, 2001

To determine the impact of exclusive breastfeeding on cognitive development for infants born small for gestational age, this US based study evaluated 220 infants, using the Bayley Scale of Infant Development at 13 months and the Wechsler Preschool and Primary Scales of Intelligence at five years. The researchers concluded that exclusively breastfed (without supplements) small for gestational age infants had a significant advantage in cognitive development without compromising growth.

Rao MR, Hediger ML, Levine RJ, Naficy AB, Vik T. Effect of breastfeeding on cognitive development of infants born small for gestational age. Arch Pediatr Adolesc 156: 651-655, 2002

The benefits of breastfeeding have long term potential on a person's life through its influence on childhood cognitive and educational development, concludes this UK study. Regression analysis was used to determine that breastfeeding was significantly and positively associated with educational levels obtained by age 26 as well as cognitive abilities at age 53 years.

Richards M, Hardy R, Wadsworth ME. Long-term effects of breastfeeding in a national cohort: educational attainment and midlife cognition function. Public Health Nutr 5: 631-635, 2002

Increased risk of acute respiratory disease

Brazilian children not breastfed were 16.7 times more likely to be diagnosed with pneumonia than children who had received breastmilk only as infants.

Cesar JA, Victora CG, Barros FC, et al. Impact of breastfeeding on admission for pneumonia during postneonatal period in Brazil: Nested case-controlled study. BMJ 318: 1316-1320, 1999

To determine the modifiable risk factors for acute lower respiratory infection in young children, this

Indian hospital - based study compared 201 cases to 311 controls. Lack of breastfeeding was one of the key modifiable risk factors for lower respiratory infection in children under five years of age.

Broor S, Pandey RM, Ghosh M, Maitreyi RS, Lodha R, Singhal T, Kabra SK. Risk factors for severe acute lower respiratory tract infection in under-five children. Indian Pediatr 38: 1361-1369, 2001

Increased risk for infection from contaminated formula

This case report from a recent US based outbreak of *Enterobacter sakazakii* in a neonatal intensive care unit documents the death of a 20 day old infant who developed fever, tachycardia, decreased vascular profusions and seizures at 11 days. The infant died at day 20. *E. sakazakii* cultures were identified from the spinal fluid and traced to contaminated powdered infant formula used in the NICU.

Weir E. Powdered infant formula and fatal infection with Enterobacter sakazakii. CMAJ 166, 2002

A Belgian based outbreak of necrotizing enterocolitis (NEC) is traced back to infant formula contaminated with *Enterobacter sakazakii*. A total of 12 infants developed NEC during the outbreak and two infants (twin brothers) died.

Van Acker J, de Smet F, Muylderms G, Bougateg A, Naessens A, Lauwers S. Outbreak of necrotizing enterocolitis associated with Enterobacter sakazakii in powdered infant formulas. J Clin Microbiol 39: 293-297, 2001

Increased risk of childhood cancers

The UK Childhood Cancer Study analyzed 3500 childhood cancer cases and the relationship to breastfeeding. Results showed a small reduction for leukemia and for all cancers combined when infants had "ever been breastfed".

UK Childhood Cancer Investigators. Breastfeeding and Childhood Cancer. Br J Cancer 85: 1685-1694, 2001

A case controlled study, in the United Arab Emirates looked at 117 cases of acute lymphocytic leukemia and 117 controls. They found that the breastfeeding duration of those with leukemia was significantly shorter than the breastfeeding duration of the controls. They concluded that breastfeeding duration of six months or longer may protect against childhood acute leukaemia and lymphomas.

Bener A, Denic S, Galadari S. Longer breastfeeding and protection against childhood leukaemia and lymphomas. Eur J Cancer 37: 234-238, 2001

Increased risk of chronic diseases

A review of infant feeding practices and childhood chronic diseases shows increased risk for Type I diabetes, celiac disease, some childhood cancers, and inflammatory bowel disease associated with artificial infant feeding.

Davis MK. Breastfeeding and chronic diseases in childhood and adolescence. Pediatr Clin North Amer 48: 125-141, 2001

Celiac disease may be triggered by an autoimmune response when an infant is exposed to a food containing gluten proteins. In order to investigate the impact of breastfeeding on this response, Ivarsson and her team of researchers looked at the breastfeeding patterns of 627 children with celiac disease and at 1254 healthy children to determine the effect of breastfeeding during the time of introduction of gluten containing foods on the outcome of the development of celiac disease.

An astounding 40 per cent risk reduction was reported for the development of celiac disease in children at two years of age or younger for those who were breastfed when dietary gluten was introduced. And the effect was even more pronounced in infants who continued to be breastfed after dietary gluten was introduced, the authors noted.

Ivarsson, A. et al. Breast-Feeding May Protect Against Celiac Disease. Am J Clin Nutr 75:914-21, 2002

Increased risk of diabetes

To determine the link between cow's milk consumption (cow's milk based infant formula) and the development of antibody response to cow's milk protein, Italian researchers measured the antibody response of 16 breastfed and 12 cow's milk fed infants under four months of age. Cow's milk fed infants had elevated levels of beta-casein antibodies when compared to breastfed infants. They concluded that breastfeeding for the first four months prevented the production of antibodies and could have a preventive effect on the development of Type 1 diabetes.

Monetini L, Cavallo MG, Stefanini L, Ferrazzoli F, Bizzarri C, Marietti G, Curro V, Cervoni M, Pozzilli P, IMDIAB Group. Bovine beta-casein antibodies in breast-and bottle-fed infants: their relevance in Type 1 diabetes. Hormone Metab Res 34: 455-459, 2002

In this case-controlled study, 46 native Canadian Type II diabetes patients were matched with 92 controls. Pre and postnatal risk factors were compared. Breastfeeding was found to reduce the risk of Type II diabetes.

Young TK, Martens PJ, Taback SP, Sellers EA, Dean HJ,