

1 **Prevention of Type I Diabetes through Breastfeeding in Infants**

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6 **Abstract**

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8 Infant nutrition is especially critical within the first year of life. The nutrients provided can
9 protect against the risks of chronic diseases in the infant’s future. Insulin and protection against
10 enteric infections are qualities of breast milk that make it unique to other forms of infant
11 nutrition. This is why breastfeeding is strongly recommended for newborns—to provide the
12 infant with an optimal level of health. Among various chronic diseases, the risk for type I
13 diabetes has been shown to be reduced in infants who are breast fed in the beginning critical
14 months of life. Research supports the association between prevention of type I diabetes and
15 breast milk both positively and negatively. However, the most well-respected conclusion states
16 there is a correlation due to its physiological benefits, but more research should be conducted to
17 demonstrate breast milk’s effectiveness against type I diabetes.
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47 **INTRODUCTION**

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49 An infant's nutrient intake during the first year of life is critical to their current health
50 status and can ultimately influence their health and well-being throughout the rest of their life.
51 Infants are unable to communicate what their bodies need to reach their optimal health and
52 protect them from future complications. It is the parent's responsible to supply their baby with
53 adequate nutrients to promote the baby's grow and success during this early stage in life.
54 Without the parent's proper help and support, the risk of chronic disease increases dramatically.
55 One study conducted by Smith et al¹ found that premature weaning off breastfeeding or complete
56 lack of breastfeeding is related to a 30-200% increase risk in chronic diseases compared to those
57 who were breast fed for a period greater than six months.

58 With these risks present, optimal nutrition is the goal. The best way to achieve this goal is
59 through breastfeeding. Breastfeeding a newborn infant is strongly encouraged by most health
60 care professionals because of breast milk's unique composition and the positive outcomes that
61 follow for the infant as well as the mother. Breast milk has increased bioavailability of minerals,
62 appropriate levels of long-chain polyunsaturated fatty acids to support central nervous system
63 development, and the innate ability to protect against infection.² These qualities in maternal milk
64 set it apart from other infant nutritional alternatives, such as powder formula. While other
65 alternatives attempt to mimic these protective qualities, they lack the mechanisms that are
66 hypothesized to prevent type I diabetes and other chronic diseases in the years to come. All
67 forms of infant feeding are aimed to nurture the infant with the appropriate vitamins and
68 minerals; however, studies show only breast milk will produce a reduced risk in chronic diseases
69 and various other complications through the infant's life.²

70 While breast milk's protective qualities are believed to decrease the prevalence of type I
71 diabetes, research concerning the relationship of breast milk and type I diabetes in subsequent
72 years is conflicting. Type I diabetes is an autoimmune disease where the body is unable to
73 produce insulin, resulting in consistently high glucose levels. It has been assumed that
74 breastfeeding will reduce the risk of type I diabetes for the infant because of its ability to strength
75 the infant's immune system. However, other research has responded there is no correlation.

76 The main objective of this review is to evaluate current studies in order to determine the
77 most commonly recognized relationship between breastfeeding and the risk of type I diabetes for
78 the infant. Only peer-reviewed articles within the past 10 years are presented in this paper. They
79 demonstrate the current stance on the correlation between type I diabetes and breastfeeding.

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81 **METHODS**

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83 This research for this review article was conducted primarily through EBSCO, Academic
84 Search Primer database. A variety of key terms were searched such as: type I diabetes,
85 breastfeeding, infant nutrition, formula feeding, and chronic diseases. The key terms "type I
86 diabetes" and "breastfeeding" produced the best search results that were most applicable to this
87 review. Approximately 7,000 review articles were shown after the search was complete. This
88 number was reduced by selecting articles within the past twenty years and by only choosing peer
89 reviewed journals. There are nine articles cited in this paper along with one textbook resource.
90 Other databases were searched such as PubMed and nutrition related textbooks. These provided a
91 few more supporting details to this paper, but the majority of the information was gathered
92 through EBSCO.

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94 RESULTS/DISCUSSION

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96 The physiological make-up of breast milk compared to alternative forms of infant
97 nutrition is what allows it to potentially reduced type I diabetes occurrence in infants. Breast
98 milk has been found to have significant amounts of insulin in its composition based on analysis
99 of breast milk donations of breastfeeding mothers. Formula feeding, on the other hand, is unable
100 to provide infants with insulin based on its current formulation. This difference has been shown
101 to be one example why breastfeeding protects against type I diabetes.³ This idea that early
102 introduction to insulin reduces the risk of gaining type I diabetes, is based on the knowledge that
103 an individual with type I diabetes is lacking insulin production. A lack of early introduction
104 insulin in a newborn's diet can occur when an infant is introduced too early to cow's milk as
105 shown by research conducted by Shehadeh et al.³ In order to test this idea, insulin supplements
106 were given to infants who were weaned off breastfeeding prematurely and the results were as
107 predicted. They found when infants consume milk containing insulin their gut is able to properly
108 mature by decreasing its permeability to larger macromolecules that can cause potential upset.
109 The results showed that insulin, whether provided from breastfeeding or single supplements,
110 increased the infant's tolerance to insulin, which led to a lower risk in type I diabetes in the
111 future.³⁻⁴ Although this still remains a correlation and not necessarily a causation, there is
112 suggestive evidence that insulin found in breast milk allows the baby's body to protect itself
113 against a potential genetic susceptibility to type I diabetes.

114 Although some literature has found a protective effect of breast milk in preventing type I
115 diabetes, other studies have suggested that the presence of insulin in breast milk ultimately has
116 no effect on the prevalence of type I diabetes. For example, Savilahti et al.⁵ followed 6,209
117 healthy infants throughout their first year in order to gain information about their early infant
118 feeding and a possible later diagnosis of type I diabetes. They found no significant association
119 suggesting early introduction to cow's milk opposed to breastfeeding to be a risk factor in type I
120 diabetes through their collected information. Their findings weaken the association between
121 breast milk and decreased risk of type I diabetes; however, the association still exists.⁵

122 More research has resulted in similar findings. Cardwell et al.⁶ conducted a study to
123 search out the same question and found a negative association between type I diabetes and
124 breastfeeding for more than 2 weeks. The researchers initially hypothesized that breastfeeding
125 strongly reduces the prevalence of type I diabetes. They found that breastfeeding for more than 2
126 weeks was shown to be beneficial in reducing type I diabetes. However, when these same
127 women were tested for follow-up data, a weaker association was shown between type I diabetes
128 and breastfeeding when breastfeeding occurred for three months or more. This suggests that the
129 association between breast milk and a decreased risk of type I diabetes in infants may not be as
130 strong as previously predicted.⁶

131 However, the studies which focused primarily on the physiological components of milk
132 demonstrate milk's potential protective effect against type I diabetes. Physiologically, when an
133 infant's dietary intake is changed from breast milk to—historically—cow's milk the infant's
134 intestinal tract becomes more permeable to larger macromolecules such as bovine serum albumin
135 and casein.³ When done at the appropriate time in an infant's life, it results in no complication.
136 However, if given too early in life, this increased permeability has been shown to increase the
137 risk of autoimmunity and therefore, type I diabetes.^{3,7}

138 A study conducted by Couper⁸ supported the idea that the physiological components of
139 milk are what can protective infants from the risk of type I diabetes. He began his research
140 acknowledging that an individual can be genetically susceptible to type I diabetes, which is the
141 universally well-known cause of type I diabetes diagnosis. However, it is also known that
142 approximately only 10% of infants who are genetically susceptible to type I diabetes actually
143 acquire the disease.⁸ Therefore, it is known that under the appropriate circumstances, infants will
144 never fully develop the disease. If the environmental factors—such as early introduction of
145 cow’s milk—can be controlled, those who are genetically susceptible would never become type I
146 diabetics.⁸ Although the influence of breast milk protecting against type I diabetes is small, the
147 association still, undeniably, exist. This leads to the idea that feeding infants primarily breast
148 milk is one of the main environmental factors parents can control to help protect their baby from
149 future adverse health complications.

150 There is one more unique quality of breast milk that Couper⁸ believes to especially help
151 protect the body against type I diabetes and the overall health of the infant. He found that breast
152 milk has the ability to protect against enteric infections. Enteric infections could initiate
153 autoimmunity in the body or even lead to the final failure of the malfunctioning beta-cells in
154 individuals with type I diabetes.⁸ Research by Lonrot⁹ found similar findings. From their cohort
155 study looking at enterovirus presence in youth with type I diabetes, they found that enteric
156 infections are in fact related to the development of type I diabetes and to the initial destruction of
157 the beta-cells.⁹ If an individual experiences chronic enteric infections, especially early in life, it
158 will decrease the permeability of the intestines which will decrease the likelihood of
159 autoimmunity.⁹ This information on enteric infections could be a potential explanation why the
160 correlation between breastfeeding and type I diabetes are not as strong as predicted because of
161 the potential of enteric infections resulting in the underlying cause.

162 Debates have gone back and forth throughout the past years whether or not to promote
163 breastfeeding as a means to reduce the risk in type I diabetes among infants. When looking at the
164 direct physiological benefits, it leads to a clear understanding how breastfeeding is beneficial and
165 to more information about its unique properties. However, researchers who have studied the
166 outright correlation have not found a strong enough relationship to promote its effect. The most
167 appropriate summary between the relationship of breastfeeding and type I diabetes is best stated
168 through the research conducted by Malcova et al.¹⁰ These researchers recognized that the
169 apparent effect of environmental factors influencing the risk of type I diabetes has been
170 increasing over time, just as others had assumed before. The purpose of their study was to find
171 more about this association in hopes of uncovering more evidence. Through questionnaires
172 completed by parents about their experience with breastfeeding and any later diagnosis with
173 diabetes, they found that there was, in fact, a positive association between breastfeeding and the
174 risk of type I diabetes. They noted that breastfeeding over 12 months was associated as the
175 strongest protection against diabetes. However, the researchers concluded that other confounding
176 factors, such as perinatal stress factors, birth size and weight, and prenatal infectious, need to be
177 further researched before a conclusive correlation between these two factors can be made.

178 In conclusion, the majority of research suggests there is an association between
179 breastfeeding an infant and a reduced risk of type I diabetes when assessing the components in
180 breast milk verses other nutrition alternatives. However, more research is needed to eliminate
181 potential confounding factors relating to this matter. Even though breastfeeding has numerous
182 qualities that make it unique and protective against other forms of chronic diseases, its
183 possibilities of decreasing the risk of type I diabetes still remains questionable.

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