

## REVIEW

# Breastfeeding and its gamut of benefits

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## ABSTRACT

Maternal milk is recommended as the optimal and exclusive source of early nutrition for all infants from birth and until at least their sixth month of age. Their nutritional virtues are due to potent immune factors and a unique composition which evolves in tandem with the infant's growth and developmental needs. Breast milk promotes sensory and cognitive development, and protects the infant against infectious and chronic diseases. Exclusive breastfeeding reduces infant mortality due to common childhood illnesses such as diarrhea or pneumonia, and improves recovery time during illness. Breastfeeding provides numerous short- and long-term health benefits for both the baby and its mother. Beyond the immediate benefits for infants, breastfeeding also contributes to a lifetime of good health. In this review we describe the influence of breastfeeding on mental and psychomotor development, on the risk of endocrine disorders, pediatric cancers and allergic diseases for the breastfed child. More prospective studies with comparable methodologies and longer periods of follow-up are necessary to allow firm conclusions on the effects of breastfeeding in some of these aspects.

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**B**reastfeeding leads to improved infant and maternal health outcomes in both industrialized and developing countries and is recommended as the conventional and unequalled method for feeding infants.<sup>1</sup>

Breast milk is the most suitable form of nutrition for the newborn infant, a finding recognised by the world's leading scientific organizations, nutrition committees and international pediatrics societies, all of which recommend exclusive breastfeeding for the first six months and partial breastfeeding until 12 months of age.<sup>2, 3</sup> The American Academy of Pediatrics strongly recommends breastfeeding for the first year of life<sup>4</sup>. Breastfeeding provides substantial health benefits for children and moth-

ers that include a lower risk of infection rates, obesity, and post-neonatal death among children and a lower risk of breast and ovarian cancer among mothers.<sup>5, 6</sup>

Feedings should be initiated as soon after birth as possible, depending on the infant's ability to tolerate enteral nutrition. Human milk is uniquely adapted to the infant's needs and is the most appropriate milk for the infant. Breastfeeding also has practical and psychological advantages, thus all mothers should be encouraged to breast-feed their babies. Ideally, the established schedule should be based on reasonable "self-regulation" by the infant. However, this "self-regulation" is not established immediately; considerable variation in

the time between feedings and in the amount taken per feeding is to be expected during the first few weeks of life. Feeding can be considered to have progressed satisfactorily if the infant is no longer losing weight by the end of the first week of life and is gaining weight by the end of the second week.

Breastfeeding is associated with fewer feeding difficulties incident to allergy and/or intolerance to bovine milk. These include diarrhea, intestinal bleeding, occult melena, colic and atopic eczema. Breastfed infants also appear, in some studies, to have a lower frequency of certain allergic and chronic diseases in later life than formula fed infants. Human milk contains bacterial and viral antibodies, including relatively high concentrations of secretory immunoglobulin A, that prevent microorganisms from adhering to the intestinal mucosa. It also contains substances that inhibit the growth of many common viruses as well as specific antibodies that are thought to provide local gastrointestinal immunity against organisms entering the body via this route. This factor probably accounts, at least partially, for the lower prevalence of diarrhea, otitis media, pneumonia, bacteremia and meningitis during the first year of life in infants who are breastfed exclusively compared with those who are formula-fed for the first four months of life. Macrophages in human milk may synthesize complement, lysozyme, and lactoferrin. Additionally, the lower pH of the stool of breastfed infants is thought to contribute to the favorable intestinal flora of infants fed human milk compared with formula (more bifidobacteria and lactobacilli, fewer *Escherichia coli*), and this helps protect against infections caused by some species of *E. coli*. Human milk also contains bile salt-stimulated lipase, which kills *Giardia lamblia* and *Entamoeba histolytica*.

Milk from mothers whose diet is sufficient and properly balanced will supply all the necessary nutrients except vitamin D; whose intake should be 400 IU/day for all breastfed infants. The iron content of human milk is low, but most full term infants have sufficient iron stores for the first 4-6 months of life. The vitamin K content of human milk also is low and

may contribute to hemorrhagic disease of the newborn. Parenteral administration of 1 mg vitamin K<sub>1</sub> at birth is recommended for all infants, and this is especially important for those who will be breastfed. The psychological advantages of breastfeeding for both mother and infant are well recognized. The mother is personally involved in nurturing her infant, and this results in both a feeling of being essential and a sense of accomplishment. At the same time, the infant develops a close and comfortable physical relationship with the mother.<sup>7</sup>

Breastfeeding provides numerous short and long term health benefits for both baby and mother. In this review we briefly illustrate that breast milk is associated with substantial benefits to the health and development of both premature and full term infants and we describe the influence of breastfeeding on mental and psychomotor development, on the risk of endocrine disorders, pediatric cancers and allergic diseases for the breastfed child.

#### Maternal milk and the preterm infant

Preterm birth, defined as birth occurring prior to 37 weeks gestation, persists as a leading perinatal health problem facing women and children.<sup>8</sup> The preterm birth rate is currently reported at 12.8% of all births in the USA and affects as many as 15 million infants worldwide.<sup>9</sup> The implications of preterm birth on human health have been well documented. One of the leading causes of morbidity and mortality among infants born preterm is infection (bacteremia, pneumonia, meningitis) during the early neonatal period, occurring approximately in one in six infants. A disproportionate number of fetal infections occur in the smallest and most premature infants<sup>10, 11</sup> who require invasive interventions disrupting the protective mucosal and epithelial barriers in the face of inadequate innate immunity.

Human milk provides a unique composition of bioactive factors that have the ability to overcome the immature immune response and thus may prevent inflammatory diseases such as necrotizing enterocolitis (NEC) in the short term, resulting in optimal growth and

neurodevelopment in the long term. NEC remains the most catastrophic gastrointestinal disease among preterm infants. The mechanisms underpinning NEC are multifactorial and remain poorly understood. The only consistently identified protective strategy against NEC is exposure to human milk.<sup>12, 13</sup> Preterm infants who are breastfed have been shown to be at a six- to ten-fold lower risk of NEC when compared to formula-fed infants.<sup>14</sup> The protective mechanisms provided by human milk against this disease are likely associated with optimal intestinal colonization, which helps to prevent inflammation and infection by pathogenic bacteria. In addition, preterm infants fed with human milk have the advantage of an innate immune system that is programmed by the powerful immunological factors found in maternal milk. As a result, these children are better equipped to mount an appropriate inflammatory response that may prevent the disease pathogenesis common to NEC. In summary, providing maternal milk to preterm infants is of paramount importance to enhance both short- and long-term health outcomes as a result of the unique immunologic properties found in this optimal source of infant nutrition.<sup>15</sup>

### Short and long term effects of breastfeeding

Current evidence, mostly from high-income countries, suggests that the occurrence of non-communicable diseases may be programmed by exposures occurring during gestation or in the first years of life.<sup>16-18</sup> Several studies have reviewed recent scientific data on the short and long term health effects of breastfeeding (duration of both, partial and exclusive breastfeeding) and introduction of foods other than breast milk. The level of evidence was classified as convincing, probable, limited-suggestive and limited-no conclusion (Figure 1).<sup>19</sup> Evidence was convincing for a protective dose/duration of breastfeeding against excessive weight gain and obesity in childhood and adolescence, overall infections, acute otitis media and gas-

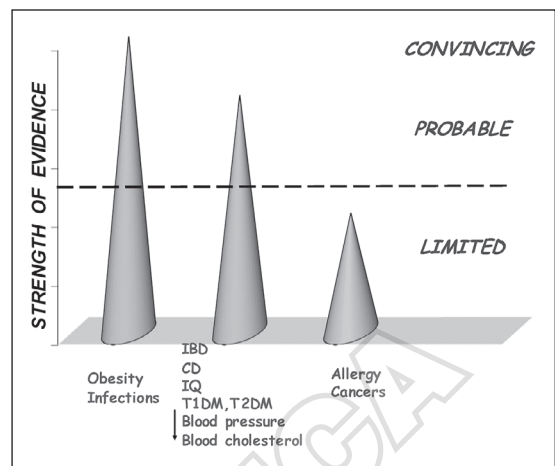


Figure 1.—Strength of scientific evidence on short and long term effects of breastfeeding. IBD: inflammatory bowel disease; CD: celiac disease; IQ: intelligence quotient; T1DM: type 1 diabetes mellitus; T2DM: type 2 diabetes mellitus.

trointestinal and respiratory tract infections (Figure 1). The evidence was probable that exclusive breastfeeding for longer than four months is associated with slower weight gain during the second half of the first year which could explain the reduced risk for later excess weight gain or obesity.

As mentioned above the evidence is convincing that breastfeeding protects infants against overall infections, acute otitis media, gastrointestinal and respiratory tract infections. These benefits have been reported in low and middle income and in high-income countries.

In spite of recent progress, diarrhea remains one of the leading causes of death among children <5 years. In 2010, diarrhea was estimated to have caused about 800,000 child deaths globally.<sup>20</sup>

In 1984, a comprehensive review indicated that promotion of breastfeeding was one of the most important interventions for controlling diarrhea among children.<sup>21</sup> Several mechanisms for the possible protective effects of breastfeeding against gastrointestinal infections have been proposed, these include the presence of substances with antimicrobial or immunological properties, avoidance of contamination (as in artificial formula or baby

bottles), and the general improved nutritional status of breastfed infants.

Respiratory infections continue to be the leading cause of death among children <5 years, worldwide. In 2010, it was estimated that 1384 million deaths among children under 5 years were caused by pneumonia. Promotion of breastfeeding has been considered one of the most cost-effective interventions against such deaths.<sup>22</sup> Breast milk contains immune cells, antibodies, immune modulators and growth modulators that protect the child against respiratory infection.<sup>23, 24</sup>

There is also probable evidence that breastfeeding provides protection against inflammatory bowel disease (IBD), coeliac disease, and diabetes (type 1 and 2); and has a beneficial effect on IQ (intelligence quotient) and developmental scores of children, as well as, a small reductive effect on blood pressure and blood cholesterol levels in adulthood (Figure 1).<sup>19</sup>

Some studies<sup>19, 25</sup> judge there to be probable evidence that breastfeeding provides protection against IBD. However, there is insufficient evidence to give exact estimates of the risk reduction. Considering metabolic diseases well-performed prospective studies with reliable, well-defined breastfeeding data are needed. There is however evidence that breastfeeding is a protective factor for coeliac disease, if gluten is introduced in small amounts while still breastfeeding, although it is unclear whether the protection only delays the onset of coeliac disease or if it provides permanent protection. Longer duration of breastfeeding may also contribute to risk reduction in the development of type 1 diabetes mellitus (T1DM) more than short-term breastfeeding. Breastfeeding may also be considered a modifiable risk factor for the development of type 2 diabetes mellitus (T2DM). The evidence for a stronger protective effect in relationship with a longer duration of breastfeeding is still limited but suggestive. Moreover, it is unclear whether the positive effects attributed to breastfeeding depend on the breast milk itself, on the avoidance of other foods given to infants, or on other factors that have been suggested in the literature such as lower prevalence of infections in the breastfed child.

There is also evidence that breastfeeding provides a small but significant normalizing effect on blood pressure and on blood cholesterol later in life. Whether this has any effect on the risk of cardiovascular disease is however unclear.<sup>19</sup>

In confirmation, several meta-analyses and reviews have found that exclusive breastfeeding remains the best option during the first six months of life. As a result, the World Health Organization (WHO) and UNICEF recommend exclusive breastfeeding until six months of age, with continued breastfeeding up to two years of age or beyond along with appropriate introduction of complementary foods.<sup>26</sup>

### **Influence of breastfeeding on mental and psychomotor development**

The possible influence of breastfeeding on cognitive development is of great scientific interest. From the first study in 1929<sup>27</sup> to the most recently published works, the subject has not ceased to provoke considerable debate due to the substantial disparity of reported results. Several studies have shown a positive correlation between breastfeeding and cognitive development in children. However, a number of confounders represent problems in these studies. Mothers who breast feed tend to be older, have a better education, and a higher socioeconomic status, than mothers who breastfeed their children for a limited time or not at all.<sup>28</sup> However, some recent meta-analyses conclude that breastfeeding is associated with significantly higher scores for cognitive development than formula feeding, after adjustment for confounding factors.<sup>28, 29</sup>

While language development in humans is under substantial genetic control,<sup>30</sup> there is accumulating evidence that environmental factors can alter the expression of the genome and lead to enduring phenotypic changes. Breastfeeding is one environmental factor known to confer a range of nutritional and immunological advantages upon infants,<sup>31</sup> and there has been considerable interest in whether breast milk may also benefit language development in children.

The actual mechanisms linking improved cognitive development with breastfeeding remain unknown; however, since 1990 it has been suggested that long-chain polyunsaturated fatty acids (LCPUFA), such as arachidonic (AA) and docosahexaenoic (DHA) acids, present in human milk, may account for this effect due to their role as nutrients in brain and retina development.<sup>32, 33</sup>

However, human milk contains other biological factors that may be beneficial for mental development, including biologically active peptides such as neural growth factors and insulin like growth factors, which may influence brain growth.

A recent study showed that there is an association between breastfeeding duration and language ability in middle childhood. A multivariable linear regression analysis adjusted for covariates found that children who were predominantly breastfed for >6 months had a mean PPVT-R score (Peabody Picture Vocabulary Test-Revised) that was 4.04 points higher than children who were never breastfed. The authors also concluded that breastfeeding for longer periods in early life has a positive and statistically-independent effect on language development in middle childhood.<sup>34</sup>

Another recent study characterized the developmental status (mental, motor and language) of breastfed, milk-based formula-fed or soy protein-based formula-fed infants during the first year of life. It showed that all scores on developmental testing were within established normal ranges and that milk-based formula fed and soy protein-based formula-fed did not differ significantly. Furthermore, this study demonstrated a slight advantage of breastfed infants in cognitive development compared with formula-fed infants.<sup>35</sup>

Human brain maturation is incomplete at birth. Behavioral, neurophysiological and anatomical development is fastest during the first three months of life. Cognitive development, physical growth and school achievement are also known to be positively associated with the head circumference, a value that reflects cellular growth patterns in the brain.<sup>36</sup> One study found that at the sixth month, head circumfer-

ence for age values of infants in mixed-fed and formula-fed groups were well below those of the breastfed group<sup>36</sup>. These data support the theory that greater head circumference values may be associated with more positive psychomotor and mental development of infants who enjoy prolonged breastfeeding. This result suggests that exclusive breastfeeding of infants is the best feeding method and is sufficient to sustain normal growth for the first six months of life.<sup>36</sup>

### Breastfeeding and endocrine disorders

Diabetes mellitus is among the leading causes of morbidity and mortality, and its worldwide prevalence has increased rapidly especially in developing countries.<sup>37</sup> It should be noted, however, that an increased incidence of the disease is observed worldwide. There were 371 million diabetics worldwide in 2012. It is estimated that in 2030, approximately 552 million individuals will have diabetes. Diabetics are at increased risk of developing cardiovascular disease, neuropathies, and nephropathies, with decreased quality of life and survival. Due to the magnitude of the disease and its impact on public health, identifying measures to prevent its occurrence is of great interest. It is believed that breast milk has a positive impact on health by preventing the manifestation of diseases such as diabetes mellitus.<sup>38</sup>

In T1DM, the autoimmune destruction of pancreatic  $\beta$ -cells is genetically transmitted. However, it appears that not all individuals that have the gene develop the disease. This fact suggests the existence of environmental factors that control its manifestation. It is believed that the early use of cow's milk, a highly allergenic food, and the absence of breastfeeding are responsible for triggering the above mentioned autoimmune process.<sup>39</sup> The protective effect of human milk has been linked to its anti-infective properties and because its use prevents early exposure to other infectious agents present in other types of milk.

Another study highlighted that individuals who were breastfed have lower rates of obe-

sity and T2DM than those fed infant formula. The investigated benefits were proportional to the duration of breastfeeding. Although there is no consensus in the scientific community yet, evidence available to date show that lack of breastfeeding is a possible modifiable risk factor for the manifestation of both T1DM and T2DM. The benefits of breastfeeding have been attributed to bioactive substances, which promote the maturation of the immune system, reduce insulin resistance, and prevent excessive weight gain during childhood.<sup>40</sup>

Celiac disease (CD), also known as gluten sensitive enteropathy, is a chronic autoimmune disease that affects the small intestine in genetically predisposed individuals. The disease is multifactorial due to a combination of adaptive and innate immune responses to gluten.<sup>41</sup>

The only currently available treatment is a lifelong gluten-free diet. Possible prevention strategies for CD focus on early infant feeding practices, namely breastfeeding and the time and mode of gluten introduction to the infant's diet. A systematic review of available data suggested that the risk of developing CD may be decreased by breastfeeding and continued breastfeeding at the time of gluten introduction. However, it is not clear whether this strategy prevents the disease or only delays the onset of symptoms. Gluten should not be introduced earlier than four months of age and not later than seven months of age since both early and late introduction of gluten have been shown to increase the risk of CD.<sup>42</sup>

Using estimates of the association between food types and infant health, a study provides quantified estimates of the relationship between different feeding practices and reported infant health outcomes. For example, for an infant younger than six months following current guidelines and exclusively breastfed instead of supplementing with solid foods, may grow 0.75 cm longer. These results confirm previous findings that exclusive breastfeeding remains the best option for children up to six months of age.<sup>43</sup>

Screening newborns for congenital hypothyroidism allows for earlier hormone replacement than was previously possible with clinical

diagnosis. However, even with the earliest screening programs, there is still a delay before treatment is initiated and euthyroidism is achieved. Because breast milk contains small quantities of thyroid hormones not found in commercial formula preparations, breastfeeding may provide protective benefits to the hypothyroid infant before treatment can be started, and euthyroidism ultimately achieved. To evaluate this hypothesis many studies have been performed with conflicting results. Rovet's study<sup>44</sup> provided minimal support for the hypothesis; they found that even though breastfeeding was associated with higher T<sub>4</sub> levels during the first two months of life, this did not translate into improved cognitive function later. This study showed a benefit of breastfeeding in children with ectopic glands, but the effect did not persist past three years of age. Although the issue of the appropriate starting dose is still a matter of controversy, one practical implication of their findings was that a higher dose may have to be considered for children who are formula fed to normalize their T<sub>4</sub> levels at a faster rate. Moreover, until the longer term effects of early breastfeeding have been established, pediatricians should encourage mothers of hypothyroid children who do choose to breast feed to continue as long as possible, at least until hormone levels have normalized, especially if the gland is ectopic.<sup>44</sup>

### Breastfeeding and pediatric cancer

The positive effects that breastfeeding has on the prevention of infectious diseases and in strengthening the immune system are well known. Antineoplastic protection has also been suggested as an additional advantage for both mother and child. Previous published studies have focused on the long term effects of breastfeeding on cancer protection in both children and mothers. The low prevalence of pediatric cancer, long latency periods and the difficulty of epidemiological research design encourage use of observational case control studies to investigate the risk factors implicated with pediatric cancer.<sup>45</sup>

Breastfeeding has been found to reduce the

risk of pediatric cancer in most of recent studies<sup>46-52</sup> but not in few others.<sup>53, 54</sup>

Human milk contains an extensive array of anti-microbial agents and appears to stimulate early development of the infant's immune system. Artificially-fed infants negotiate exposure to infectious agents without the benefits of this immunologic armament and do not do as well as breastfed infants in resisting infection. This concept has been extended to include better negotiation against future carcinogenic insults by modulating the interaction between infectious agents and the developing infant immune system or by directly affecting the long-term development of the infant's immune system. Further research is needed to confirm the association between infant feeding and pediatric cancer in large, population-based, case-control studies. Improved measurement of infant feeding should also be addressed if future studies are to advance the understanding of this association. In addition, studies on specific measures of immunity, particularly cellular immune responses, should be conducted in populations of breastfed and non-breastfed young children.<sup>46</sup>

Ortega-Garcia *et al.*<sup>45</sup> demonstrated that the protective effect of breastfeeding may start to show from the first eight weeks of breastfeeding and increase progressively from then on, at least, during the first six months of age. Previous research has demonstrated that this effect continues into the second year of life. Studies report a diminished risk for children to develop acute leukemia, predominantly acute lymphoblastic leukemia, as well as acute myeloid leukemia, non-Hodgkin lymphoma, Hodgkin's lymphoma, Wilms' tumor and tumors of the sympathetic nervous system in exclusively breastfed infants. The protective action of breastfeeding therefore seems to be important not only in one subtype but also in different histological subtypes.<sup>46-52</sup>

Hornel *et al.* affirm that there is limited but suggestive evidence for a risk reduction of breastfeeding against childhood leukemia and possibly other childhood cancers. Moreover the effect on childhood leukemia seems greater with longer breastfeeding duration (> six months). However, as childhood cancers are

relatively rare, the public health importance of these associations may be small. Research and evidence is too scarce and weak to judge associations between breastfeeding and cancers in adulthood (Figure 1).<sup>19</sup>

In conclusion breastfeeding seems inversely associated with pediatric cancer incidence, and the protection increases with the duration of breastfeeding. Additional research on possible mechanisms of this association may be warranted, meanwhile, breastfeeding should be encouraged.

### Human milk and allergic diseases

With the rising prevalence of atopic disease, primary prevention may play a role in reducing its burden, especially in high-risk infants.<sup>55</sup> However, existing scientific evidence is very limited and no conclusions can be drawn for any preventive effects of breastfeeding on atopic disease in children (Figure 1). Longitudinal studies in cohorts of newborn infants could help clarify the relationship of exclusive and/or duration of breastfeeding, as well as introduction of solid foods, and atopic disease.<sup>19</sup>

Regarding the effect of breastfeeding on atopic dermatitis in a meta-analysis, exclusive breastfeeding for three months appeared to reduce the incidence of atopic dermatitis in children compared with conventional formula feeding.<sup>56</sup> However, this effect was lost when a controversial study was removed from a more recent systematic review and meta-analysis.<sup>57</sup> In conclusion, reports are conflicting about whether exclusive breastfeeding longer than three months decreases, increases, or has no effect on the incidence of atopic dermatitis in children.<sup>58-67</sup>

Regarding the effect of breastfeeding on asthma, some studies describe that exclusive breastfeeding for three to four months reduces the number of early upper respiratory infection-associated wheezing episodes before the age of four years.<sup>67-70</sup> Wheezing in later childhood (> six years of age) is more likely to represent atopic asthma, and the associations between breastfeeding and this type of wheezing are currently unclear, because data from

various studies have drawn conflicting conclusions.<sup>70-73</sup> Some studies suggest that exclusive breastfeeding increases the incidence of asthma after the age of 14 years.<sup>74-76</sup>

Even the effect of breastfeeding on food allergy is not clear. A systematic review found an association in high risk infants between exclusive breastfeeding for at least four months and a lowered risk of cow's milk allergy (but not food allergy in general) in infants, compared with infants given intact cow's milk protein formula.<sup>77, 78</sup> However, evidence is insufficient to draw more general conclusions, with no clear benefit in unselected populations.<sup>79-85</sup>

The effect of breastfeeding on allergic rhinitis in children was evaluated in a meta-analysis of prospective studies and found a protective effect of breastfeeding for three months,<sup>86</sup> but the effect was of borderline statistical significance. More recent studies have found a reduced risk of allergic rhinitis in children with breastfeeding, but only one study was a prospective study, and the reduced risk was only found in the African American subpopulation.<sup>87</sup> More prospective studies with comparable methodologies and longer periods of follow-up are necessary to allow firm conclusions on the effect of breastfeeding on the development of allergic rhinitis in children.

Despite some studies that showed an increased risk of allergic diseases with exclusive breastfeeding the overall benefits of breastfeeding on the general health of the child are likely to outweigh the potential drawbacks, regardless of the allergic status of mother or child.

### **World Health Organization: 10 facts on breastfeeding**

The World Health Organization (WHO) emphasizes that breastfeeding is one of the most effective ways to ensure children's health and survival. If every child were breastfed within an hour of birth, given only breast milk for their first six months of life, and continued breastfeeding up to the age of two years, about 800,000 child lives would be saved every year. Globally, less than 40% of infants under six

months of age are exclusively breastfed. Adequate breastfeeding counselling and support are essential for mothers and families to initiate and maintain optimal breastfeeding practices.

#### *WHO recommendations*

The WHO recommends exclusive breastfeeding for the first six months of life. At six months, solid foods, such as mashed fruits and vegetables, should be introduced to complement breastfeeding for up to two years or more. In addition:

- breastfeeding should begin within one hour of birth;
- breastfeeding should be provided "on demand", as often as the child wants day and night;
- bottles or pacifiers should be avoided.

#### *Health benefits for infants*

Breast milk is the ideal food for newborns and infants. It gives infants all the nutrients they need for healthy development. It is safe and contains antibodies that help protect infants from common childhood illnesses such as diarrhea and pneumonia, the two primary causes of child mortality worldwide. Breast milk is readily available and affordable, which helps to ensure that infants get adequate nutrition.

#### *Benefits for mothers*

Breastfeeding also benefits mothers. Exclusive breastfeeding is associated with a natural (though not fail-safe) method of birth control (98% protection in the first six months after birth). It reduces the risks of breast and ovarian cancer later in life, helps women return to their pre-pregnancy weight faster, and lowers rates of obesity.

#### *Long-term benefits for children*

Beyond the immediate benefits for children, breastfeeding contributes to a lifetime of



good health. Adolescents and adults who were breastfed as babies are less likely to be overweight or obese. They are less likely to have type-2 diabetes and perform better on intelligence tests.

### *Why not infant formula?*

Infant formula does not contain the antibodies found in breast milk. When infant formula is not properly prepared, there are risks arising from the use of unsafe water and unsterilized equipment or the potential presence of bacteria in powdered formula. Malnutrition can result from over-diluting formula to “stretch” supplies. While frequent feeding maintains breast milk supply, if formula is used but becomes unavailable, a return to breastfeeding may not be an option due to diminished breast milk production.

### *HIV and breastfeeding*

An HIV-infected mother can pass the infection to her infant during pregnancy, delivery and through breastfeeding. Antiretroviral (ARV) drugs given to either the mother or HIV-exposed infant reduces the risk of transmission. Together, breastfeeding and ARVs have the potential to significantly improve the infants' chances of surviving while remaining HIV uninfected. WHO recommends that when HIV-infected mothers breastfeed, they should receive ARVs and follow WHO guidance for infant feeding.

### *Regulating breast-milk substitutes*

An international code to regulate the marketing of breast-milk substitutes was adopted in 1981. It calls for:

- all formula labels and information to state the benefits of breastfeeding and the health risks of substitutes;
- no promotion of breast milk substitutes;
- no free samples of substitutes to be given to pregnant women, mothers or their families;
- no distribution of free or subsidized substitutes to health workers or facilities.

### *Support for mothers is essential*

Breastfeeding has to be learned and many women encounter difficulties at the beginning. Nipple pain, and fear that there is not enough milk to sustain the baby are common. Health facilities that support breastfeeding — by making trained breastfeeding counsellors available to new mothers — encourage higher rates of the practice. To provide this support and improve care for mothers and newborns, there are “baby-friendly” facilities in about 152 countries thanks to the WHO-UNICEF Baby-friendly Hospital initiative.

### *Work and breastfeeding*

Many mothers who return to work abandon breastfeeding partially or completely because they do not have sufficient time, or a place to breastfeed, express and store their milk. Mothers need a safe, clean and private place in or near their workplace to continue breastfeeding. Enabling conditions at work, such as paid maternity leave, part-time work arrangements, on-site crèches, facilities for expressing and storing breast milk, and breastfeeding breaks, can help.

### *The next step: phasing in solid foods*

To meet the growing needs of babies at six months of age, mashed solid foods should be introduced as a complement to continued breastfeeding. Foods for the baby can be specially prepared or modified from family meals. The WHO notes that:

- breastfeeding should not be decreased when starting on solids;
- food should be given with a spoon or cup, not in a bottle;
- food should be clean, safe and locally available;
- ample time is needed for young children to learn to eat solid foods.<sup>88</sup>

## **Conclusions**

In closing, we conclude that there is convincing scientific evidence that breastfeeding

is a protective factor for infections and reduces the risk of obesity and excessive weight gain in childhood and adolescence.

Regarding the reduction of the risk of developing inflammatory bowel disease, celiac disease, and diabetes mellitus types 1 and 2 the scientific evidence is probable. Even for the beneficial effects on IQ and the reduction of blood pressure and blood cholesterol levels, the scientific evidence is probable. There is limited but suggestive evidence for a risk reduction of breastfeeding against childhood cancers.

For allergic diseases there is limited scientific evidence on the beneficial effects of breastfeeding due to conflicting results of several studies. Despite some studies that showed an increased risk of allergic diseases with exclusive breastfeeding the overall benefits of breastfeeding on the general health of the child are likely to outweigh the potential drawbacks, regardless of the allergic status of mother or child.

More prospective studies with comparable methodologies and longer periods of follow-up are necessary to allow firm conclusions on the effects of breastfeeding in some of these aspects.

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