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POLICY STATEMENT

Breastfeeding and the Use of Human Milk

SECTION ON BREASTFEEDING

KEY WORDS

breastfeeding, complementary foods, infant nutrition, lactation, human milk, nursing

ABBREVIATIONS

AAP—American Academy of Pediatrics
AHRQ—Agency for Healthcare Research and Quality
CDC—Centers for Disease Control and Prevention
CI—confidence interval
CMV—cytomegalovirus
DHA—docosahexaenoic acid
NEC—necrotizing enterocolitis
OR—odds ratio
SIDS—sudden infant death syndrome
WHO—World Health Organization

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abstract

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Breastfeeding and human milk are the normative standards for infant feeding and nutrition. Given the documented short- and long-term medical and neurodevelopmental advantages of breastfeeding, infant nutrition should be considered a public health issue and not only a lifestyle choice. The American Academy of Pediatrics reaffirms its recommendation of exclusive breastfeeding for about 6 months, followed by continued breastfeeding as complementary foods are introduced, with continuation of breastfeeding for 1 year or longer as mutually desired by mother and infant. Medical contraindications to breastfeeding are rare. Infant growth should be monitored with the World Health Organization (WHO) Growth Curve Standards to avoid mislabeling infants as underweight or failing to thrive. Hospital routines to encourage and support the initiation and sustaining of exclusive breastfeeding should be based on the American Academy of Pediatrics-endorsed WHO/UNICEF "Ten Steps to Successful Breastfeeding." National strategies supported by the US Surgeon General's Call to Action, the Centers for Disease Control and Prevention, and The Joint Commission are involved to facilitate breastfeeding practices in US hospitals and communities. Pediatricians play a critical role in their practices and communities as advocates of breastfeeding and thus should be knowledgeable about the health risks of not breastfeeding, the economic benefits to society of breastfeeding, and the techniques for managing and supporting the breastfeeding dyad. The "Business Case for Breastfeeding" details how mothers can maintain lactation in the workplace and the benefits to employers who facilitate this practice. *Pediatrics* 2012;129:e827–e841

INTRODUCTION

Six years have transpired since publication of the last policy statement of the American Academy of Pediatrics (AAP) regarding breastfeeding.[1] Recently published research and systematic reviews have reinforced the conclusion that breastfeeding and human milk are the reference normative standards for infant feeding and nutrition. The current statement updates the evidence for this conclusion and serves as a basis for AAP publications that detail breastfeeding management and infant nutrition, including the *AAP Breastfeeding Handbook for Physicians*,[2] *AAP Sample Hospital Breastfeeding Policy for Newborns*,[3] *AAP Breastfeeding Residency Curriculum*,[4] and the *AAP Safe and Healthy Beginnings Toolkit*.[5] The AAP reaffirms its recommendation of exclusive breastfeeding for about 6 months, followed by continued breastfeeding as complementary foods are introduced, with continuation

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of breastfeeding for 1 year or longer as mutually desired by mother and infant.

EPIDEMIOLOGY

Information regarding breastfeeding rates and practices in the United States is available from a variety of government data sets, including the Centers for Disease Control and Prevention (CDC) National Immunization Survey,[6] the NHANES,[7] and Maternity Practices and Infant Nutrition and Care.[8] Drawing on these data and others, the CDC has published the "Breastfeeding Report Card," which highlights the degree of progress in achieving the breastfeeding goals of the Healthy People 2010 targets as well as the 2020 targets (Table 1).[9–11]

The rate of initiation of breastfeeding for the total US population based on the latest National Immunization Survey data are 75%.[11] This overall rate, however, obscures clinically significant sociodemographic and cultural differences. For example, the breastfeeding initiation rate for the Hispanic or Latino population was 80.6%, but for the non-Hispanic black or African American population, it was 58.1%. Among low-income mothers (participants in the Special Supplemental Nutrition Program for Women, Infants, and Children [WIC]), the breastfeeding initiation rate was 67.5%, but in those with a higher income ineligible for WIC, it was 84.6%.[12] Breastfeeding initiation rate was 37% for low-income non-Hispanic black mothers.[7] Similar disparities are age-related; mothers younger than 20 years initiated breastfeeding at a rate of 59.7% compared with the rate of 79.3% in mothers older than 30 years. The lowest rates of initiation were seen among non-Hispanic black mothers younger than 20 years, in whom the breastfeeding initiation rate was 30%.[7]

Although over the past decade, there has been a modest increase in the rate of "any breastfeeding" at 3 and 6 months, in none of the subgroups have the Healthy People 2010 targets been reached. For example, the 6-month "any breastfeeding" rate for the total US population was 43%, the rate for the Hispanic or Latino subgroup was 46%, and the rate for the non-Hispanic black or African American subgroup was only 27.5%. Rates of exclusive breastfeeding are further from Healthy People 2010 targets, with only 13% of the US population meeting the recommendation to breastfeed exclusively for 6 months. Thus, it appears that although the breastfeeding initiation rates have approached the 2010 Healthy People targets, the targets for duration of any breastfeeding and exclusive breastfeeding have not been met.

Furthermore, 24% of maternity services provide supplements of commercial infant formula as a general practice in the first 48 hours after birth. These observations have led to the conclusion that the disparities in breastfeeding rates are also associated with variations in hospital routines, independent of the populations served. As such, it is clear that greater emphasis needs to be placed on improving and standardizing hospital-based practices to realize the newer 2020 targets (Table 1).

TABLE 1 Healthy People Targets 2010 and 2020(%)

	2007[a]	2010 Target	2020 Target
Any breastfeeding			
Ever	75.0	75	81.9
6 mo	43.8	50	60.5
1 y	22.4	25	34.1
Exclusive breastfeeding			
To 3 mo	33.5	40	44.3
To 6 mo	13.8	17	23.7
Worksite lactation support	25	—	38.0
Formula use in first 2 d	25.6	—	15.6

[a] 2007 data reported in 2011.[10]

INFANT OUTCOMES

Methodologic Issues

Breastfeeding results in improved infant and maternal health outcomes in both the industrialized and developing world. Major methodologic issues have been raised as to the quality of some of these studies, especially as to the size of the study populations, quality of the data set, inadequate adjustment for confounders, absence of distinguishing between "any" or "exclusive" breastfeeding, and lack of a defined causal relationship between breastfeeding and the specific outcome. In addition, there are inherent practical and ethical issues that have precluded prospective randomized interventional trials of different feeding regimens. As such, the majority of published reports are observational cohort studies and systematic reviews/meta-analyses.

To date, the most comprehensive publication that reviews and analyzes the published scientific literature that compares breastfeeding and commercial infant formula feeding as to health outcomes is the report prepared by the Evidence-based Practice Centers of the Agency for Healthcare Research and Quality (AHRQ) of the US Department of Health Human Services titled *Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries*.[13] The following sections summarize and update the AHRQ meta-analyses and provide an expanded analysis regarding health outcomes. Table 2 summarizes the dose-response relationship between the duration of breastfeeding and its protective effect.

Respiratory Tract Infections and Otitis Media

The risk of hospitalization for lower respiratory tract infections in the first year is reduced 72% if infants breastfed exclusively for more than 4 months.[13,14] Infants who exclusively breastfed for 4

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TABLE 2 Dose-Response Benefits of Breastfeeding[a]

Condition	% Lower Risk[b]	Breastfeeding	Comments	OR[c]	95% CI
Otitis media[13]	23	Any	—	0.77	0.64–0.91
Otitis media[13]	50	≥3 or 6 mo	Exclusive BF	0.50	0.36–0.70
Recurrent otitis media[15]	77	Exclusive BF ≥6 mo[d]	Compared with BF 4 to <6 mo[d]	1.95	1.06–3.59
Upper respiratory tract infection[17]	63	>6 mo	Exclusive BF	0.30	0.18–0.74
Lower respiratory tract infection[13]	72	≥4 mo	Exclusive BF	0.28	0.14–0.54
Lower respiratory tract infection[15]	77	Exclusive BF ≥6 mo[d]	Compared with BF 4 to <6 mo[d]	4.27	1.27–14.35
Asthma[13]	40	≥3 mo	Atopic family history	0.60	0.43–0.82
Asthma[13]	26	≥3 mo	No atopic family history	0.74	0.6–0.92
RSV bronchiolitis[16]	74	>4 mo	—	0.26	0.074–0.9
NEC[19]	77	NICU stay	Preterm infants Exclusive HM	0.23	0.51–0.94
Atopic dermatitis[27]	27	>3 mo	Exclusive BFnegative family history	0.84	0.59–1.19
Atopic dermatitis[27]	42	>3 mo	Exclusive BFpositive family history	0.58	0.41–0.92
Gastroenteritis[13,14]	64	Any	—	0.36	0.32–0.40
Inflammatory bowel disease[32]	31	Any	—	0.69	0.51–0.94
Obesity[13]	24	Any	—	0.76	0.67–0.86
Celiac disease[31]	52	>2 mo	Gluten exposure when BF	0.48	0.40–0.89
Type 1 diabetes[13,42]	30	>3 mo	Exclusive BF	0.71	0.54–0.93
Type 2 diabetes[13,43]	40	Any	—	0.61	0.44–0.85
Leukemia (ALL)[13,46]	20	>6 mo	—	0.80	0.71–0.91
Leukemia (AML)[13,45]	15	>6 mo	—	0.85	0.73–0.98
SIDS[13]	36	Any >1 mo	—	0.64	0.57–0.81

ALL, acute lymphocytic leukemia; AML, acute myelogenous leukemia; BF, breastfeeding; HM, human milk; RSV, respiratory syncytial virus.

[a] Pooled data.

[b] % lower risk refers to lower risk while BF compared with feeding commercial infant formula or referent group specified.

[c] OR expressed as increase risk for commercial formula feeding.

[d] Referent group is exclusive BF ≥6 months.

to 6 months had a fourfold increase in the risk of pneumonia compared with infants who exclusively breastfed for more than 6 months.[15] The severity (duration of hospitalization and oxygen requirements) of respiratory syncytial virus bronchiolitis is reduced by 74% in infants who breastfed exclusively for 4 months compared with infants who never or only partially breastfed.[16]

Any breastfeeding compared with exclusive commercial infant formula feeding will reduce the incidence of otitis media (OM) by 23%.[13] Exclusive breastfeeding for more than 3 months reduces the risk of otitis media by 50%. Serious colds and ear and throat infections were reduced by 63% in infants who exclusively breastfed for 6 months.[17]

Gastrointestinal Tract Infections

Any breastfeeding is associated with a 64% reduction in the incidence of nonspecific gastrointestinal tract infections, and this effect lasts for 2 months after cessation of breastfeeding.[13,14,17,18]

Necrotizing Enterocolitis

Meta-analyses of 4 randomized clinical trials performed over the period 1983 to 2005 support the conclusion that feeding preterm infants human milk is associated with a significant reduction (58%) in the incidence of necrotizing enterocolitis (NEC).[13] A more recent study of preterm infants fed an exclusive human milk diet compared with those fed human milk supplemented with cow-milk-based infant formula products noted a 77% reduction in NEC.[19] One case of NEC could be prevented if 10 infants received an exclusive human milk diet, and 1 case of NEC requiring surgery or resulting in death could be prevented if 8 infants received an exclusive human milk diet.[19]

Sudden Infant Death Syndrome and Infant Mortality

Meta-analyses with a clear definition of degree of breastfeeding and adjusted for confounders and other known risks for sudden infant death syndrome (SIDS) note that breastfeeding is associated with a 36% reduced risk of SIDS.[13] Latest data comparing any versus exclusive breastfeeding reveal that for any breastfeeding, the multivariate odds ratio (OR) is 0.55 (95% confidence interval [CI], 0.44–0.69). When computed for exclusive breastfeeding, the OR is 0.27 (95% CI, 0.27–0.31).[20] A proportion (21%) of the US infant mortality has been attributed, in part, to the increased rate of SIDS in infants who were never breastfed.[21] That the positive effect of breastfeeding on SIDS rates is independent of sleep position was confirmed in a large case-control study of supine-sleeping infants.[22,23]

It has been calculated that more than 900 infant lives per year may be saved in the United States if 90% of mothers exclusively breastfed for 6 months.[24] In the 42 developing countries in which 90% of the world's childhood deaths occur, exclusive breastfeeding for 6 months and weaning after 1 year is the most effective intervention, with the potential of preventing more than 1 million infant deaths per year, equal to preventing 13% of the world's childhood mortality.[25]

Allergic Disease

There is a protective effect of exclusive breastfeeding for 3 to 4 months in

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reducing the incidence of clinical asthma, atopic dermatitis, and eczema by 27% in a low-risk population and up to 42% in infants with positive family history.[13,26] There are conflicting studies that examine the timing of adding complementary foods after 4 months and the risk of allergy, including food allergies, atopic dermatitis, and asthma, in either the allergy-prone or nonatopic individual.[26] Similarly, there are no convincing data that delaying introduction of potentially allergenic foods after 6 months has any protective effect.[27–30] One problem in analyzing this research is the low prevalence of exclusive breastfeeding at 6 months in the study populations. Thus, research outcomes in studies that examine the development of atopy and the timing of introducing solid foods in partially breastfed infants may not be applicable to exclusively breastfed infants.

Celiac Disease

There is a reduction of 52% in the risk of developing celiac disease in infants who were breastfed at the time of gluten exposure.[31] Overall, there is an association between increased duration of breastfeeding and reduced risk of celiac disease when measured as the presence of celiac antibodies. The critical protective factor appears to be not the timing of the gluten exposure but the overlap of breastfeeding at the time of the initial gluten ingestion. Thus, gluten-containing foods should be introduced while the infant is receiving only breast milk and not infant formula or other bovine milk products.

Inflammatory Bowel Disease

Breastfeeding is associated with a 31% reduction in the risk of childhood inflammatory bowel disease.[32] The protective effect is hypothesized to result from the interaction of the immunomodulating effect of human milk and the underlying genetic susceptibility of the infant. Different patterns of intestinal colonization in breastfed versus commercial infant formula–fed infants may add to the preventive effect of human milk.[33]

Obesity

Because rates of obesity are significantly lower in breastfed infants, national campaigns to prevent obesity begin with breastfeeding support.[34,35] Although complex factors confound studies of obesity, there is a 15% to 30% reduction in adolescent and adult obesity rates if any breastfeeding occurred in infancy compared with no breastfeeding.[13,36] The Framingham Offspring study noted a relationship of breastfeeding and a lower BMI and higher high-density lipoprotein concentration in adults.[37] A sibling difference model study noted that the breastfed sibling weighed 14 pounds less than the sibling fed commercial infant formula and was less likely to reach BMI obesity threshold.[38] The duration of breastfeeding also is inversely related to the risk of overweight; each month of breastfeeding being associated with a 4% reduction in risk.[14]

The interpretation of these data is confounded by the lack of a definition in many studies of whether human milk was given by breastfeeding or by bottle. This is of particular importance, because breastfed infants self-regulate intake volume irrespective of maneuvers that increase available milk volume, and the early programming of self-regulation, in turn, affects adult weight gain.[39] This concept is further supported by the observations that infants who are fed by bottle, formula, or expressed breast milk will have increased bottle emptying, poorer self-regulation, and excessive weight gain in late infancy (older than 6 months) compared with infants who only nurse from the breast.[40,41]

Diabetes

Up to a 30% reduction in the incidence of type 1 diabetes mellitus is reported for infants who exclusively breastfed for at least 3 months, thus avoiding exposure to cow milk protein.[13,42] It has been postulated that the putative mechanism in the development of type 1 diabetes mellitus is the infant's exposure to cow milk β-lactoglobulin, which stimulates an immune-mediated process cross-reacting with pancreatic β cells. A reduction of 40% in the incidence of type 2 diabetes mellitus is reported, possibly reflecting the long-term positive effect of breastfeeding on weight control and feeding self-regulation.[43]

Childhood Leukemia and Lymphoma

There is a reduction in leukemia that is correlated with the duration of breastfeeding.[14,44] A reduction of 20% in the risk of acute lymphocytic leukemia and 15% in the risk of acute myeloid leukemia in infants breastfed for 6 months or longer.[45,46] Breastfeeding for less than 6 months is protective but of less magnitude (approximately 12% and 10%, respectively). The question of whether the protective effect of breastfeeding is a direct mechanism of human milk on malignancies or secondarily mediated by its reduction of early childhood infections has yet to be answered.

Neurodevelopmental Outcomes

Consistent differences in neurodevelopmental outcome between breastfed and commercial infant formula–fed infants have been reported, but the outcomes are confounded by differences in parental education, intelligence, home environment, and socioeconomic status.[13,47] The large, randomized Promotion of Breastfeeding Intervention Trial provided evidence that adjusted outcomes of intelligence scores and teacher's ratings are significantly greater in breastfed infants.[48–50] In

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addition, higher intelligence scores are noted in infants who exclusively breastfed for 3 months or longer, and higher teacher ratings were observed if exclusive breastfeeding was practiced for 3 months or longer. Significantly positive effects of human milk feeding on long-term neurodevelopment are observed in preterm infants, the population more at risk for these adverse neurodevelopmental outcomes.[51–54]

PRETERM INFANTS

There are several significant short- and long-term beneficial effects of feeding preterm infants human milk. Lower rates of sepsis and NEC indicate that human milk contributes to the development of the preterm infant's immature host defense.[19,55–59] The benefits of feeding human milk to preterm infants are realized not only in the NICU but also in the fewer hospital readmissions for illness in the year after NICU discharge.[51,52] Furthermore, the implications for a reduction in incidence of NEC include not only lower mortality rates but also lower long-term growth failure and neurodevelopmental disabilities.[60,61] Clinical feeding tolerance is improved, and the attainment of full enteral feeding is hastened by a diet of human milk.[51,52,59]

Neurodevelopmental outcomes are improved by the feeding of human milk. Long-term studies at 8 years of age through adolescence suggest that intelligence test results and white matter and total brain volumes are greater in subjects who had received human milk as infants in the NICU.[53,54] Extremely preterm infants receiving the greatest proportion of human milk in the NICU had significantly greater scores for mental, motor, and behavior ratings at ages 18 months and 30 months.[51,52] These data remain significant after adjustment for confounding factors, such as maternal age, education, marital status, race, and infant morbidities. These neurodevelopmental outcomes are associated with predominant and not necessarily exclusive human milk feeding. Human milk feeding in the NICU also is associated with lower rates of severe retinopathy of prematurity.[62,63] Long-term studies of preterm infants also suggest that human milk feeding is associated with lower rates of metabolic syndrome, and in adolescents, it is associated with lower blood pressures and low-density lipoprotein concentrations and improved leptin and insulin metabolism.[64,65]

The potent benefits of human milk are such that all preterm infants should receive human milk (Table 3). Mother's own milk, fresh or frozen, should be the primary diet, and it should be fortified appropriately for the infant born weighing less than 1.5 kg. If mother's own milk is unavailable despite significant lactation support, pasteurized donor milk should be used.[19,66] Quality control of pasteurized donor milk is important and should be monitored. New data suggest that mother's own milk can be stored at refrigerator temperature (4°C) in the NICU for as long as 96 hours.[67] Data on thawing, warming, and prolonged storage need updating. Practices should involve protocols that prevent misadministration of milk.

TABLE 3 Recommendations on Breastfeeding Management for Preterm Infants

1. All preterm infants should receive human milk.
   - Human milk should be fortified, with protein, minerals, and vitamins to ensure optimal nutrient intake for infants weighing <1500 g at birth.
   - Pasteurized donor human milk, appropriately fortified, should be used if mother's own milk is unavailable or its use is contraindicated.
2. Methods and training protocols for manual and mechanical milk expression must be available to mothers.
3. Neonatal intensive care units should possess evidence-based protocols for collection, storage, and labeling of human milk.[150]
4. Neonatal intensive care units should prevent the misadministration of human milk (http://www.cdc.gov/breastfeeding/recommendations/other_mothers_milk.htm).
5. There are no data to support routinely culturing human milk for bacterial or other organisms.[151]

MATERNAL OUTCOMES

Both short- and long-term health benefits accrue to mothers who breastfeed. Such mothers have decreased postpartum blood loss and more rapid involution of the uterus. Continued breastfeeding leads to increased child spacing secondary to lactational amenorrhea. Prospective cohort studies have noted an increase in postpartum depression in mothers who do not breastfeed or who wean early.[68] A large prospective study on child abuse and neglect perpetuated by mothers found, after correcting for potential confounders, that the rate of abuse/neglect was significantly increased for mothers who did not breastfeed as opposed to those who did (OR: 2.6; 95% CI: 1.7–3.9).[69]

Studies of the overall effect of breastfeeding on the return of the mothers to their pre-pregnancy weight are inconclusive, given the large numbers of confounding factors on weight loss (diet, activity, baseline BMI, ethnicity).[13] In a covariate-adjusted study of more than 14 000 women postpartum, mothers who exclusively breastfed for longer than 6 months weighed 1.38 kg less than those who did not breastfeed.[70] In mothers without a history of gestational diabetes, breastfeeding duration was associated with a decreased risk of type 2 diabetes mellitus; for each year of breastfeeding, there was a decreased risk of 4% to 12%.[71,72] No beneficial effect for breastfeeding was noted in mothers who were diagnosed with gestational diabetes.

The longitudinal Nurses Health Study noted an inverse relationship between the cumulative lifetime duration of breastfeeding and the development of rheumatoid arthritis.[73] If cumulative duration of breastfeeding exceeded 12

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months, the relative risk of rheumatoid arthritis was 0.8 (95% CI: 0.8–1.0), and if the cumulative duration of breastfeeding was longer than 24 months, the relative risk of rheumatoid arthritis was 0.5 (95% CI: 0.3–0.8).[73] An association between cumulative lactation experience and the incidence of adult cardiovascular disease was reported by the Women's Health Initiative in a longitudinal study of more than 139 000 postmenopausal women.[74] Women with a cumulative lactation history of 12 to 23 months had a significant reduction in hypertension (OR: 0.89; 95% CI: 0.84–0.93), hyperlipidemia (OR: 0.81; 95% CI: 0.76–0.87), cardiovascular disease (OR: 0.90; 95% CI: 0.85–0.96), and diabetes (OR: 0.74; 95% CI: 0.65–0.84).

Cumulative lactation experience also correlates with a reduction in both breast (primarily premenopausal) and ovarian cancer.[13,14,75] Cumulative duration of breastfeeding of longer than 12 months is associated with a 28% decrease in breast cancer (OR: 0.72; 95% CI: 0.65–0.8) and ovarian cancer (OR: 0.72; 95% CI: 0.54–0.97).[76] Each year of breastfeeding has been calculated to result in a 4.3% reduction in breast cancer.[76,77]

ECONOMIC BENEFITS

A detailed pediatric cost analysis based on the AHRQ report concluded that if 90% of US mothers would comply with the recommendation to breastfeed exclusively for 6 months, there would be a savings of $13 billion per year.[24] The savings do not include those related to a reduction in parental absenteeism from work or adult deaths from diseases acquired in childhood, such as asthma, type 1 diabetes mellitus, or obesity-related conditions. Strategies that increase the number of mothers who breastfeed exclusively for about 6 months would be of great economic benefit on a national level.

DURATION OF EXCLUSIVE BREASTFEEDING

The AAP recommends exclusive breastfeeding for about 6 months, with continuation of breastfeeding for 1 year or longer as mutually desired by mother and infant, a recommendation concurred to by the WHO[78] and the Institute of Medicine.[79]

Support for this recommendation of exclusive breastfeeding is found in the differences in health outcomes of infants breastfed exclusively for 4 vs 6 months, for gastrointestinal disease, otitis media, respiratory illnesses, and atopic disease, as well as differences in maternal outcomes of delayed menses and postpartum weight loss.[15,18,80]

Compared with infants who never breastfed, infants who were exclusively breastfed for 4 months had significantly greater incidence of lower respiratory tract illnesses, otitis media, and diarrheal disease than infants exclusively breastfed for 6 months or longer.[15,18] When compared with infants who exclusively breastfed for longer than 6 months, those exclusively breastfed for 4 to 6 months had a fourfold increase in the risk of pneumonia.[15] Furthermore, exclusively breastfeeding for 6 months extends the period of lactational amenorrhea and thus improves child spacing, which reduces the risk of birth of a preterm infant.[81]

The AAP is cognizant that for some infants, because of family and medical history, individual developmental status, and/or social and cultural dynamics, complementary feeding, including gluten-containing grains, begins earlier than 6 months of age.[82,83] Because breastfeeding is immunoprotective, when such complementary foods are introduced, it is advised that this be done while the infant is feeding only breastmilk.[82] Mothers should be encouraged to continue breastfeeding through the first year and beyond as more and varied complementary foods are introduced.

CONTRAINDICATIONS TO BREASTFEEDING

There are a limited number of medical conditions in which breastfeeding is contraindicated, including an infant with the metabolic disorder of classic galactosemia. Alternating breastfeeding with special protein-free or modified formulas can be used in feeding infants with other metabolic diseases (such as phenylketonuria), provided that appropriate blood monitoring is available. Mothers who are positive for human T-cell lymphotrophic virus type I or II[84] or untreated brucellosis[85] should not breastfeed nor provide expressed milk to their infants Breastfeeding should not occur if the mother has active (infectious) untreated tuberculosis or has active herpes simplex lesions on her breast; however, expressed milk can be used because there is no concern about these infectious organisms passing through the milk. Breastfeeding can be resumed when a mother with tuberculosis is treated for a minimum of 2 weeks and is documented that she is no longer infectious.[86] Mothers who develop varicella 5 days before through 2 days after delivery should be separated from their infants, but their expressed milk can be used for feeding.[87] In 2009, the CDC recommended that mothers acutely infected with H1N1 influenza should temporarily be isolated from their infants until they are afebrile, but they can provide expressed milk for feeding.[88]

In the industrialized world, it is not recommended that HIV-positive mothers breastfeed. However, in the developing world, where mortality is increased in non-breastfeeding infants from a combination of malnutrition and infectious diseases, breastfeeding may outweigh the risk of the acquiring HIV infection

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from human milk. Infants in areas with endemic HIV who are exclusively breastfed for the first 3 months are at a lower risk of acquiring HIV infection than are those who received a mixed diet of human milk and other foods and/or commercial infant formula.[89] Recent studies document that combining exclusive breastfeeding for 6 months with 6 months of antiretroviral therapy significantly decreases the postnatal acquisition of HIV-1.[90,91]

There is no contraindication to breastfeeding for a full-term infant whose mother is seropositive for cytomegalovirus (CMV). There is a possibility that CMV acquired from mother's milk may be associated with a late-onset sepsis-like syndrome in the extremely low birth weight (birth weight <1500 g) preterm infant. Although not associated with long-term abnormalities, such a syndrome may warrant antiviral therapy.[92] The value of routinely feeding human milk from seropositive mothers to preterm infants outweighs the risks of clinical disease, especially because no long-term neurodevelopmental abnormalities have been reported.[93] Freezing of milk reduces but does not eliminate CMV.[94] Heating, either as Holder pasteurization (heating at 62.5°C for 30 minutes) or high-temperature short pasteurization (72°C for 5–10 seconds) eliminates the viral load from the milk but also affects bioactive factors and nutrients.[95] Thus, fresh mother's own milk is preferable for routinely feeding all preterm infants.

Maternal substance abuse is not a categorical contraindication to breastfeeding. Adequately nourished narcotic-dependent mothers can be encouraged to breastfeed if they are enrolled in a supervised methadone maintenance program and have negative screening for HIV and illicit drugs.[96] Street drugs such as PCP (phencyclidine), cocaine, and cannabis can be detected in human milk, and their use by breastfeeding mothers is of concern, particularly with regard to the infant's long-term neurobehavioral development and thus are contraindicated.[97] Alcohol is not a galactogogue; it may blunt prolactin response to suckling and negatively affects infant motor development.[98,99] Thus, ingestion of alcoholic beverages should be minimized and limited to an occasional intake but no more than 0.5 g alcohol per kg body weight, which for a 60 kg mother is approximately 2 oz liquor, 8 oz wine, or 2 beers.[100] Nursing should take place 2 hours or longer after the alcohol intake to minimize its concentration in the ingested milk.[101] Maternal smoking is not an absolute contraindication to breastfeeding but should be strongly discouraged, because it is associated with an increased incidence in infant respiratory allergy[102] and SIDS.[103] Smoking should not occur in the presence of the infant so as to minimize the negative effect of secondary passive smoke inhalation.[104] Smoking is also a risk factor for low milk supply and poor weight gain.[105,106]

MATERNAL DIET

Well-nourished lactating mothers have an increased daily energy need of 450 to 500 kcal/day that can be met by a modest increase in a normally balanced varied diet.[107–109] Although dietary reference intakes for breastfeeding mothers are similar to or greater than those during pregnancy, there is no routine recommendation for maternal supplements during lactation.[108,109,110] Many clinicians recommend the continued use of prenatal vitamin supplements during lactation.[109]

The mother's diet should include an average daily intake of 200 to 300 mg of the ω-3 long-chain polyunsaturated fatty acids (docosahexaenoic acid [DHA]) to guarantee a sufficient concentration of preformed DHA in the milk.[111,112] Consumption of 1 to 2 portions of fish (eg, herring, canned light tuna, salmon) per week will meet this need. The concern regarding the possible risk from intake of excessive mercury or other contaminants is offset by the neurobehavioral benefits of an adequate DHA intake and can be minimized by avoiding the intake of predatory fish (eg, pike, marlin, mackerel, tile fish, swordfish).[113] Poorly nourished mothers or those on selective vegan diets may require a supplement of DHA as well as multivitamins.

MATERNAL MEDICATIONS

Recommendations regarding breastfeeding in situations in which the mother is undergoing either diagnostic procedures or pharmacologic therapy must balance the benefits to the infant and the mother against the potential risk of drug exposure to the infant. There are only a limited number of agents that are contraindicated, and an appropriate substitute usually can be found. The most comprehensive, up-to-date source of information regarding the safety of maternal medications when the mother is breastfeeding is LactMed, an Internet-accessed source published by the National Library of Medicine/National Institutes of Health.[114] A forthcoming AAP policy statement on the transfer of drugs and other chemicals into human milk will provide additional recommendations, with particular focus on psychotropic drugs, herbal products, galactagogues, narcotics, and pain medications.[115] In general, breastfeeding is not recommended when mothers are receiving medication from the following classes of drugs: amphetamines, chemotherapy agents, ergotamines, and statins.

There are a wide variety of maternally administered psychotropic agents for which there are inadequate pharmacologic data with regard to human milk and/or nursing infant's blood

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concentrations. In addition, data regarding the long-term neurobehavioral effects from exposure to these agents during the critical developmental period of early infancy are lacking. A recent comprehensive review noted that of the 96 psychotropic drugs available, pharmacologic and clinical information was only available for 62 (65%) of the drugs.[116] In only 19 was there adequate information to allow for defining a safety protocol and thus qualifying to be compatible for use by lactating mothers. Among the agents considered to be least problematic were the tricyclic antidepressants amitriptyline and clomipramine and the selective serotonin-reuptake inhibitors paroxetine and sertraline.

Detailed guidelines regarding the necessity for and duration of temporary cessation of breastfeeding after maternal exposure to diagnostic radioactive compounds are provided by the US Nuclear Regulatory Commission and in medical reviews.[117–119] Special precaution should be followed in the situation of breastfeeding infants with glucose-6-phosphate-dehydrogenase deficiency. Fava beans, nitrofurantoin, primaquine, and phenazopyridine should be avoided by the mother to minimize the risk of hemolysis in the infant.[120]

HOSPITAL ROUTINES

The Sections on Breastfeeding and Perinatal Pediatrics have published the Sample Hospital Breastfeeding Policy that is available from the AAP Safe and Healthy Beginnings Web site.[3,5] This sample hospital policy is based on the detailed recommendations of the previous AAP policy statement "Breastfeeding and the Use of Human Milk"[1] as well as the principles of the 1991 WHO/UNICEF publication "Tens Steps to Successful Breastfeeding" (Table 4)[121] and provides a template for developing a uniform hospital policy for support of breastfeeding.[122] In particular, emphasis is placed on the need to revise or discontinue disruptive hospital policies that interfere with early skin-to-skin contact, that provide water, glucose water, or commercial infant formula without a medical indication, that restrict the amount of time the infant can be with the mother, that limit feeding duration, or that provide unlimited pacifier use.

In 2009, the AAP endorsed the Ten Steps program (see Table 4). Adherence to these 10 steps has been demonstrated to increase rates of breastfeeding initiation, duration, and exclusivity.[122,123] Implementation of the following 5 postpartum hospital practices has been demonstrated to increase breastfeeding duration, irrespective of socioeconomic status: breastfeeding in the first hour after birth, exclusive breastfeeding, rooming-in, avoidance of pacifiers, and receipt of telephone number for support after discharge from the hospital.[124]

The CDC National Survey of Maternity Practices in Infant Nutrition and Care has assessed the lactation practices in more than 80% of US hospitals and noted that the mean score for implementation of the Ten Steps was only 65%.[34,125] Fifty-eight percent of hospitals erroneously advised mothers to limit suckling at the breast to a specified length of time, and 41% of the hospitals gave pacifiers to more than some of their newborns—both practices that have been documented to lower breastfeeding rates and duration.[126] The survey noted that in 30% of all birth centers, more than half of all newborns received supplementation commercial infant formula, a practice associated with shorter duration of breastfeeding and less exclusivity.[34,125] As indicated in the benefits section, this early supplementation may affect morbidity outcomes in this population. The survey also reported that 66% of hospitals reported that they distributed to breastfeeding mothers discharge packs that contained commercial infant formula, a practice that has been documented to negatively affect exclusivity and duration of breastfeeding.[127] Few birth centers have model hospital policies (14%) and support breastfeeding mothers after hospital discharge (27%). Only 37% of centers practice more than 5 of the 10 Steps and only 3.5% practice 9 to 10 Steps.[34]

There is, thus, a need for a major conceptual change in the organization of the hospital services for the mother and infant dyad (Table 5). This requires that medical and nursing routines and practices adjust to the principle that breastfeeding should begin within the first hour after birth (even for Cesarean deliveries) and that infants must be continuously accessible to the mother by rooming-in

TABLE 4 WHO/UNICEF Ten Steps to Successful Breastfeeding

1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in the skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within the first hour of birth.
5. Show mothers how to breastfeed and how to maintain lactation even if they are separated from their infants.
6. Give newborn infants no food or drink other than breast milk, unless medically indicated.
7. Practice rooming-in (allow mothers and infants to remain together) 24 h a day.
8. Encourage breastfeeding on demand.
9. Give no artificial nipples or pacifiers to breastfeeding infants.[a]
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from hospital.

[a] The AAP does not support a categorical ban on pacifiers because of their role in SIDS risk reduction and their analgesic benefit during painful procedures when breastfeeding cannot provide the analgesia. Pacifier use in the hospital in the neonatal period should be limited to specific medical indications such as pain reduction and calming in a drug-exposed infant, for example. Mothers of healthy term breastfed infants should be instructed to delay pacifier use until breastfeeding is well-established, usually about 3 to 4 wk after birth.

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arrangements that facilitate around-the-clock, on-demand feeding for the healthy infant. Formal staff training should not only focus on updating knowledge and techniques for breastfeeding support but also should acknowledge the need to change attitudes and eradicate unsubstantiated beliefs about the supposed equivalency of breastfeeding and commercial infant formula feeding. Emphasis should be placed on the numerous benefits of exclusive breastfeeding. The importance of addressing the issue of the impact of hospital practices and policies on breastfeeding outcomes is highlighted by the decision of The Joint Commission to adopt the rate of exclusive breast milk feeding as a Perinatal Care Core Measure.[127] As such, the rate of exclusive breastfeeding during the hospital stay has been confirmed as a critical variable when measuring the quality of care provided by a medical facility.

Pacifier Use

Given the documentation that early use of pacifiers may be associated with less successful breastfeeding, pacifier use in the neonatal period should be limited to specific medical situations.[128] These include uses for pain relief, as a calming agent, or as part of structured program for enhancing oral motor function. Because pacifier use has been associated with a reduction in SIDS incidence, mothers of healthy term infants should be instructed to use pacifiers at infant nap or sleep time after breastfeeding is well established, at approximately 3 to 4 weeks of age.[129–131]

Vitamins and Mineral Supplements

Intramuscular vitamin K_1 (phytonadione) at a dose of 0.5 to 1.0 mg should routinely be administered to all infants on the first day to reduce the risk of hemorrhagic disease of the newborn.[132] A delay of administration until after the first feeding at the breast but not later than 6 hours of age is recommended. A single oral dose of vitamin K should not be used, because the oral dose is variably absorbed and does not provide adequate concentrations or stores for the breastfed infant.[132]

Vitamin D deficiency/insufficiency and rickets has increased in all infants as a result of decreased sunlight exposure secondary to changes in lifestyle, dress habits, and use of topical sunscreen preparations. To maintain an adequate serum vitamin D concentration, all breastfed infants routinely should receive an oral supplement of vitamin D, 400 U per day, beginning at hospital discharge.[133]

Supplementary fluoride should not be provided during the first 6 months. From age 6 months to 3 years, fluoride supplementation should be limited to infants residing in communities where the fluoride concentration in the water is <0.3 ppm.[134] Complementary food rich in iron and zinc should be introduced at about 6 months of age. Supplementation of oral iron drops before 6 months may be needed to support iron stores.

Premature infants should receive both a multivitamin preparation and an oral iron supplement until they are ingesting a completely mixed diet and their growth and hematologic status are normalized.

GROWTH

The growth pattern of healthy term breastfed infants differs from the existing CDC "reference" growth curves, which are primarily based on data from few breastfeeding infants. The WHO multicenter curves are based on combined longitudinal data from healthy breastfed infants from birth to 24 months and cross-sectional data from 2 to 5 years of the same children from 6 diverse geographical areas

TABLE 5 Recommendations on Breastfeeding Management for Healthy Term Infants

1. Exclusive breastfeeding for about 6 mo
   - Breastfeeding preferred; alternatively expressed mother's milk, or donor milk
   - To continue for at least the first year and beyond for as long as mutually desired by mother and child
   - Complementary foods rich in iron and other micronutrients should be introduced at about 6 mo of age
2. Peripartum policies and practices that optimize breastfeeding initiation and maintenance should be compatible with the AAP and Academy of Breastfeeding Medicine Model Hospital Policy and include the following:
   - Direct skin-to-skin contact with mothers immediately after delivery until the first feeding is accomplished and encouraged throughout the postpartum period
   - Delay in routine procedures (weighing, measuring, bathing, blood tests, vaccines, and eye prophylaxis) until after the first feeding is completed
   - Delay in administration of intramuscular vitamin K until after the first feeding is completed but within 6 h of birth
   - Ensure 8 to 12 feedings at the breast every 24 h
   - Ensure formal evaluation and documentation of breastfeeding by trained caregivers (including position, latch, milk transfer, examination) at least for each nursing shift
   - Give no supplements (water, glucose water, commercial infant formula, or other fluids) to breastfeeding newborn infants unless medically indicated using standard evidence-based guidelines for the management of hyperbilirubinemia and hypoglycemia
   - Avoid routine pacifier use in the postpartum period
   - Begin daily oral vitamin D drops (400 IU) at hospital discharge
3. All breastfeeding newborn infants should be seen by a pediatrician at 3 to 5 d of age, which is within 48 to 72 h after discharge from the hospital
   - Evaluate hydration (elimination patterns)
   - Evaluate body wt gain (body wt loss no more than 7%
   from birth and no further wt loss by day 5: assess feeding and consider more frequent follow-up)
   - Discuss maternal/infant issues
   - Observe feeding
4. Mother and infant should sleep in proximity to each other to facilitate breastfeeding
5. Pacifier should be offered, while placing infant in back-to-sleep-position, no earlier than 3 to 4 wk of age and after breastfeeding has been established

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(Brazil, Ghana, India, Norway, Oman, and the United States).[135] As such, the WHO curves are "standards" and are the normative model for growth and development irrespective of infant ethnicity or geography reflecting the optimal growth of the breastfed infant.[136] Use of the WHO curves for the first 2 years allows for more accurate monitoring of weight and height for age and, in comparison with use of the CDC reference curves, results in more accurate (lower) rates of undernutrition and short stature and (higher) rates of overweight. Furthermore, birth to 6-month growth charts are available where the curves are magnified to permit monitoring of weight trajectories. As such, the WHO curves serve as the best guide for assessing lactation performance because they minimize mislabeling clinical situations as inadequate breastfeeding and identify more accurately and promptly overweight and obese infants. As of September 2010, the CDC, with the concurrence of the AAP, recommended the use of the WHO curves for all children younger than 24 months.[137,138]

ROLE OF THE PEDIATRICIAN

Pediatricians have a critical role in their individual practices, communities, and society at large to serve as advocates and supporters of successful breastfeeding (Table 6).[139] Despite this critical role, studies have demonstrated lack of preparation and knowledge and declining attitudes regarding the feasibility of breastfeeding.[140] The AAP Web site[141] provides a wealth of breastfeeding-related material and resources to assist and support pediatricians in their critical role as advocates of infant well-being. This includes the Safe and Healthy Beginnings toolkit,[5] which includes resources for physician's office for promotion of breastfeeding in a busy pediatric practice setting, a pocket guide for coding to facilitate appropriate payment, suggested guidelines for telephone triage of maternal breastfeeding concerns, and information regarding employer support for breastfeeding in the workplace. Evidence-based protocols from organizations such as the Academy of Breastfeeding Medicine provide detailed clinical guidance for management of specific issues, including the recommendations for frequent and unrestricted time for breastfeeding so as to minimize hyperbilirubinemia and hypoglycemia.[4,142,143] The critical role that pediatricians play is highlighted by the recommended health supervision visit at 3 to 5 days of age, which is within 48 to 72 hours after discharge from the hospital, as well as pediatricians support of practices that avoid non–medically indicated supplementation with commercial infant formula.[144]

TABLE 6 Role of the Pediatrician

1. Promote breastfeeding as the norm for infant feeding.
2. Become knowledgeable in the principles and management of lactation and breastfeeding.
3. Develop skills necessary for assessing the adequacy of breastfeeding.
4. Support training and education for medical students, residents and postgraduate physicians in breastfeeding and lactation.
5. Promote hospital policies that are compatible with the AAP and Academy of Breastfeeding Medicine Model Hospital Policy and the WHO/UNICEF "Ten Steps to Successful Breastfeeding."
6. Collaborate with the obstetric community to develop optimal breastfeeding support programs.
7. Coordinate with community-based health care professionals and certified breastfeeding counselors to ensure uniform and comprehensive breastfeeding support.

Pediatricians also should serve as breastfeeding advocates and educators and not solely delegate this role to staff or nonmedical/lay volunteers. Communicating with families that breastfeeding is a medical priority that is enthusiastically recommended by their personal pediatrician will build support for mothers in the early weeks postpartum. To assist in the education of future physicians, the AAP recommends using the evidence-based Breastfeeding Residency Curriculum,[4] which has been demonstrated to improve knowledge, confidence, practice patterns, and breastfeeding rates. The pediatrician's own office-based practice should serve as a model for how to support breastfeeding in the workplace. The pediatrician should also take the lead in encouraging the hospitals with which he or she is affiliated to provide proper support and facilities for their employees who choose to continue to breastfeed.

BUSINESS CASE FOR BREASTFEEDING

A mother/baby-friendly worksite provides benefits to employers, including a reduction in company health care costs, lower employee absenteeism, reduction in employee turnover, and increased employee morale and productivity.[145,146] The return on investment has been calculated that for every $1 invested in creating and supporting a lactation support program (including a designated pump site that guarantees privacy, availability of refrigeration and a handwashing facility, and appropriate mother break time) there is a $2 to $3 dollar return.[147] The Maternal and Child Health Bureau of the US Department of Health and Human Services, with support from the Office of Women's Health, has created a program, "The Business Case for Breastfeeding," that provides details of economic benefits to the employer and toolkits for the creation of such programs.[148] The Patient Protection and Affordable Care Act passed by Congress in March 2010 mandates that employers provide "reasonable break time" for nursing mothers and private non-bathroom areas to express

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breast milk during their workday.[149] The establishment of these initiatives as the standard workplace environment will support mothers in their goal of supplying only breast milk to their infants beyond the immediate postpartum period.

CONCLUSIONS

Research and practice in the 5 years since publication of the last AAP policy statement have reinforced the conclusion that breastfeeding and the use of human milk confer unique nutritional and nonnutritional benefits to the infant and the mother and, in turn, optimize infant, child, and adult health as well as child growth and development. Recently, published evidence-based studies have confirmed and quantitated the risks of not breastfeeding. Thus, infant feeding should not be considered as a lifestyle choice but rather as a basic health issue. As such, the pediatrician's role in advocating and supporting proper breastfeeding practices is essential and vital for the achievement of this preferred public health goal.[35]

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