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Comparison of the Effect of Exclusive Breast feeding and infant formula on health status of infant: A Systematic Review

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Abstract

Mothers' own milk is the best source of nutrition for nearly all infants. Beyond somatic growth, breast milk as a biologic fluid has a variety of other benefits, including modulation of postnatal intestinal function, immune ontogeny, and brain development. Although breastfeeding is highly recommended, breastfeeding may not always be possible, suitable or solely adequate. Infant formula is an industrially produced substitute for infant consumption. Infant formula attempts to mimic the nutritional composition of breast milk as closely as possible, and is based on cow's milk or soymilk. A number of alternatives to cow's milk-based formula also exist. In this article, we will make comparison of the effect of exclusive breastfeeding and infant formula on health status of infant.

Materials and Methods

The research methodology is a narrative literature review; a systematic approach was applied in the search for studies through electronic databases such as Medline, CINAHL, EMBASE, PsycINFO and Google search engine. The search terms that were used include: breast feeding, infant formula, effects of breastfeeding among others. The inclusion criteria were studies focusing on breastfeeding and infant formulas as well as studies that were conducted in English. Studies that did not meet the inclusion criteria were excluded from the review. The search terms yielded a total of 201 papers after a thorough database search was done. The papers retrieved were further scrutinized by going through their titles, abstracts and full text of the papers in which forty three (43) papers were included in the review.

Keywords: infant formula, breastfeeding, mother, food supplement



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Introduction

Malnutrition is one of the biggest health problems that the world currently faces and is associated with more than 41% of the deaths that occur annually in children from 6 to 24 months of age in developing countries which total approximately 2.3 million (Sandoval-Priego, 2002). WHO (2001) reported that 54% of all childhood mortality was attributable, directly or indirectly, to malnutrition. Sub-Saharan Africa has a high prevalence of stunting, low weight-for-age and acute malnutrition (Lutter and Rivera, 2003). Feeding practices during infancy are critical for the growth, development and health of a child during the first 1000 days which is two years (WHO, 2002) and of importance for the early prevention of chronic degenerative diseases. Progress in improving infant and young child feeding practices in the developing countries in which Nigeria has been remarkably slow (Ruel, 2003) due to several factors. It is estimated that among children living in the 42 countries with 90% of global child deaths, a package of effective nutrition interventions could save 25% of childhood deaths each year (Jones, 2003). The survival risks of early childhood in Nigeria remain considerable. A new-born Nigerian baby has a 30 times higher chance of dying before the age of 5 years than a baby born in the developed, industrialized countries. The data available on the regional prevalence of diarrhoea, under nutrition and under 5 mortality in Nigeria showed that each of them are far more prevalent in the northern than in the southern part of Nigeria (UNICEF, 2001).

De Pee, Moench-Pfanner and Bloem, (2003) opined that the global drive to promote breastfeeding targeted at all 134 million infants born/year on the planet is one of the most pervasive public health interventions. It is, therefore, critical that the breastfeeding field is rooted in sound evidence. Three important scientific pillars of breastfeeding have been: (1) that human milk (HM) is the product of 200 million years of mammalian evolution; (2) that HM composition should be seen as the gold standard for infant nutritional requirements; and (3) that HM has numerous clinical benefits for the infant. The World Health Organization (WHO) recommends that infant feeding practices are regularly monitored. However, Breastfeeding is one of the most effective ways to ensure child health and survival. However, nearly 2 out of 3 infants are not exclusively breastfed for the recommended 6 months a rate that has not improved in 2 decades. Breastfeeding is the internationally recommended method of infant feeding with proven benefits over infant formula feeding. For infants who are not breastfed the Baby Friendly Initiative (BFI), (a programme supported by the World Health Organization and United Nations Children's Emergency Fund), recommend the use of a standard whey-based infant formula in the first 12 months of life, unless medically indicated by a healthcare professional. This recommendation is supported by Food Safety Authority of Ireland. There are different categories of infant formula and for an infant formula to be described as a standard whey-based infant formula it needs to have a whey: casein protein ratio of 60:40. Only infant formula labelled as 'new-born' or 'first milk' meet this definition. Therefore, the majority of infant formula (i.e. soya-based, hydrolysed, follow-on or growing-up infant formula) can be categorised as non whey-based infant formula.



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De Pee, Moench-Pfanner and Bloem, (2003) further submitted that breast milk is the ideal food for infants. It is safe, clean and contains antibodies which help protect against many common childhood illnesses. Breast milk provides all the energy and nutrients that the infant needs for the first months of life, and it continues to provide up to half or more of a child's nutritional needs during the second half of the first year, and up to one third during the second year of life. Breastfed children perform better on intelligence tests, are less likely to be overweight or obese and less prone to diabetes later in life. Women who breast-feed also have a reduced risk of breast and ovarian cancers. Inappropriate marketing of breast-milk substitutes continues to undermine efforts to improve breastfeeding rates and duration worldwide. Research shows that breastfeeding offers many health benefits for infants and mothers, as well as potential economic and environmental benefits for communities. Breastfeeding provides essential nutrition. Among its other known health benefits are some protection against common childhood infections and better survival during a baby's first year, including a lower risk of Sudden Infant Death Syndrome. Research also shows that very early skin-to-skin contact and suckling may have physical and emotional benefits.

Breastfeeding benefits for the baby

Brown, Kanashiro and Dewey, (1995) The nutritional advantages of breast milk are certainly numerous. The amino acids in breast milk, the building blocks of proteins, are well balanced for the human baby, as are the sugars (primarily lactose) and fats. The baby's intestinal tract is best aided in its digestion by the vitamins, enzymes, and minerals found in breast milk. Breast milk also contains infection-fighting antibodies from the mother, and breastfed babies are believed to be at a reduced risk for many acute and chronic infections early in life. The cholesterol content is also high in human milk and very low in formulas. Cholesterol promotes brain growth and provides the building blocks of hormones, vitamin D, and intestinal bile.

Breast milk is also the least expensive way to feed an infant. However, the mother must maintain good nutrition and continue taking any vitamin/mineral supplements her doctor recommended during the pregnancy. Breastfeeding helps prevent growth faltering and stunting, particularly as it reduces the risk of illnesses. Breastfeeding protects against weight loss due to diarrhea, and in some studies children exclusively breastfed were shown to be less likely to be stunted. Due to its large impact on reduction of infectious diseases, breastfeeding plays a role in reduction of stunting, as infectious diseases are important determinants of stunting. However, breastfed children will still become stunted if they do not receive an adequate quantity and quality of complementary foods from the age of six months onwards.

Benefits in terms of reduced chronic conditions: Reduction of chronic disease risk can be promoted as an additional potential benefit of breastfeeding. Breastfeeding lowers the risk of chronic conditions later in life compared to artificially-fed infants, including allergies, asthma, overweight and obesity, diabetes, heart disease and cardiac risk



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factors such as hypertension and high cholesterol levels and cancers such as childhood leukaemia and breast cancer later in life.

Benefits for intellectual and motor development: Many studies confirm that children who are breastfed do better on tests of cognitive and motor development, as well as academic outcomes than children who are not breastfed. Infants fed breast milk tend to have higher IQ scores. The unique physical contact between mother and infant provided by breastfeeding also is thought to provide psychosocial stimulation and bonding that may have developmental benefits.

Breastfeeding has been linked to higher IQ scores in later childhood in some studies. What's more, the physical closeness, skin-to-skin touching, and eye contact all help your baby bond with you and feel secure. Breastfed infants are more likely to gain the right amount of weight as they grow rather than become overweight children. The AAP says breastfeeding also plays a role in the prevention of SIDS (sudden infant death syndrome). It's been thought to lower the risk of diabetes, obesity, and certain cancers as well, but more research is needed.

Protect against allergies and eczema. If there's a history of either in a family, it may be especially beneficial for you to breastfeed. Proteins in cow's milk and soy milk formulas can stimulate an allergic reaction, while the proteins in human breast milk are more easily digested.

Reduce the risk of viruses, urinary tract infections, inflammatory bowel disease, gastroenteritis, ear infections, and respiratory infections. "The incidences of pneumonia, colds, and viruses are reduced among breastfed babies," says infant-nutrition expert Ruth A. Lawrence, M.D., a professor of pediatrics and OB-GYN at the University of Rochester School of Medicine and Dentistry in Rochester, N.Y., and the author of *Breastfeeding: A Guide for the Medical Profession* (Elsevier-Mosby). Additionally, formula-fed infants are three times more likely to suffer from ear infections than breastfed babies, and up to five times more likely to suffer from pneumonia and lower respiratory-tract infections.

Lessen the risk of SIDS. Although the connection is unclear, breastfed infants account for only half as many SIDS cases as formula-fed infants do. Make vaccines more effective. Research shows that breastfed babies have a better antibody response to vaccines than formula-fed babies.

Breastfeeding Benefits for Mother

Lower the risk of breast and ovarian cancer. Studies show that women who breastfeed have less risk of these cancers later in life.

Jones, Steketee, Black, Bhutta and Morris, (2003) Helps one lose pregnancy weight. Because milk production burns about 300 to 500 calories a day, nursing mothers tend to have an easier time losing pregnancy weight in a healthy way that is, slowly and



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without dieting.

Triggers help the uterus to shrink back to pre-pregnancy size. In fact, in the first few weeks, In fact, a mother who has just put to bed might experience mild contractions when nursing.

Heal the body after delivery. The oxytocin released when the baby nurses helps the uterus contract, reducing post-delivery blood loss. Plus, breastfeeding will help the uterus return to its normal size more quickly at about six weeks postpartum, compared with 10 weeks if you don't breastfeed.

Lutter, (2003) Delays fertility: Ovulation is delayed by breastfeeding baby around the clock Breastfeeding baby around the clock hence menstruation is also delayed."Breastfeeding causes the release of prolactin, which keeps estrogens and progesterone at bay so ovulation isn't triggered. When your prolactin levels drop, those two hormones can kick back in, which means ovulation and, hence, menstruation occurs.

Economic benefits: Analyses of studies show clearly that apart from being the safest and healthiest infant feeding method, breastfeeding is also the least expensive. For many poor households, the high cost of breast milk substitutes, feeding and sterilizing equipment, fuel, represents a substantial drain on scarce household resources. Added to this is the cost of health care for the sick infant. When infant illness requires mothers to miss work, employers and the economy are also affected. Although the economic costs of not breastfeeding generally are considered to be greatest for poor households and poor countries, the evidence suggests that the impact in developed countries is also serious.

Human Breast Milk Composition

Sheth, and Dwivedi, (2006) Human breast milk contains carbohydrates, protein, fat, vitamins, minerals, digestive enzymes and hormones. In addition to these nutrients, it is rich in immune cells including macrophages, stem cells, and numerous other bioactive molecules. Some of these bioactive molecules are protein-derived and lipid-derived, while others are protein-derived and indigestible, such as oligosaccharides. Human milk oligosaccharides (HMOs) possess anti-infective properties against pathogens in the infant gastrointestinal tract, such as Salmonella, Listeria, and Campylobacter, by flooding the infant gastrointestinal tract with decoys that bind the pathogens and keep them off the intestinal wall. Oligosaccharides also play a vital role in the development of a diverse and balanced micro biota, essential for appropriate innate and adaptive immune responses, and help colonize up to 90% of the infant biome.

Savino F., Bebeti S., Lignori S.A., Sorrenti M., Cordero D., Montezemolo L. (2013) noted that human breast milk is a complex matrix with a general composition of 87% water, 3.8% fat, 1.0% protein, and 7% lactose. The fat and lactose, respectively, provide 50% and 40% of the total energy of the milk. However, the composition of human breast milk is dynamic and changes over time, adapting itself to the changing needs of the growing



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child. For instance, during each nursing session, the milk that is expressed first (foremilk) is thinner with a higher content of lactose, which satisfies a baby's thirst, and following the foremilk, hind milk, is creamier with a much higher content of fat for the baby's needs. Variations are also present with the stage of nursing (age of infant), maternal diet, maternal health, and environmental exposure. During early lactation, the protein content in human milk ranges from 1.4–1.6 g/100 ml, to 0.8–1.0 g/100 ml after three to four months of lactation, to 0.7–0.8 g/100 ml after six months. The fat content varies significantly with maternal diet and is also positively related to weight gain during pregnancy. Remarkably, it has been observed that a mother's breast milk is almost always adequate in essential nutrients for her term infant's growth and development, even when her own nutrition is inadequate. Although the mean concentrations of protein, sodium, chloride and potassium in early preterm milk are adequate to meet the estimated requirements for preterm infants, specific nutritional supplementation is required for mother's milk delivered to preterm infants. In contrast to protein and fat, lactose content is fairly constant in mature milk (after 21 days postpartum). The stable concentration of lactose is important in maintaining a constant osmotic pressure in human milk. Lactose also aids the absorption of minerals and calcium. In breast milk, many carbohydrate-based bioactive compounds, such as oligosaccharides, are attached to lactose. If the small intestine does not produce enough of an enzyme (lactase) to digest these sugar complexes, lactose malabsorption and intolerance syndromes can be observed. Lactase deficiency malabsorption and disease are extremely rare in the exclusively breastfed infant (Eidelman, Schanler, Johnston, Landers, Noble, Szucs, and Viehmann, 2012).

Vitamins, Minerals and Other Bioactive Components in Breast Milk

Kozhimannil, Jou, Attanasio, Joarnt and McGovern (2014) opined that human breast milk contains adequate amounts of most vitamins to support normal infant growth, except for vitamins D and K. Infants who are exclusively breastfeeding receive below the minimum recommended intake of vitamin D, and much lower than the recommended dietary intake. These infants are at the risk for vitamin D deficiency, inadequate bone mineralization and conditions such as rickets. However, the overall risk of vitamin D deficiency in breastfed infants is also correlated with overall sun exposure with increasing risk in climates with a lower sun index. Maternal supplementation with 400–2000 IU (International Unit) of vitamin D/day can increase the levels of vitamin D in breast milk, but only a higher dose (2000 IU) achieves satisfactory levels of 25-OH-D in the infant. Normal vitamin D stores present at birth are depleted within eight weeks. Sunlight exposure and vitamin D supplementation are recommended for breastfed infant. Formula-fed infants often have higher serum concentration of vitamin D metabolites than breastfed-infants. Vitamin K is essential to the protein involved in blood coagulation. However, only limited amounts of vitamin K is transferred from the placenta to fetus. Thus, a newborn infant often has an extremely low concentration of vitamin K, and is at risk of developing hemorrhagic disease. After birth, vitamin K supplementation is recommended. In human breast milk, minerals contribute to a variety of physiological functions, forming essential parts of many



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enzymes and are of biological important to molecules and structures. The contents of minerals are comparable between human milk and bovine milk. Over the decades, many other bioactive components have been identified in human milk, including hormones, growth factors and immunological factors.

The Concepts of Exclusive Breastfeeding

Exclusive breast feeding is widely recognized as the optimal means of feeding and caring for the young infants during the first few months of life (Brown, 1995). The WHO (2002) recommends exclusive breast feeding for the first six months of life and continued breastfeeding until the age of two years and beyond. International consensus indicates that complementing breast milk even with water during the first six months of a child's life is unnecessary and may increase the risk of diarrhoea as extra solids and liquids are often contaminated (Martines, 1992). Providing other liquid or food in addition to breast milk during the first six months could potentially be harmful that is, risk of infection, poorer stimulation of breast milk production and should only be done if medical reasons exist (De Pee et al., 2003). Because of the associated exposure to pathogens and interference with successful breastfeeding, current feeding recommendation strongly discourages use of baby bottles throughout childhood (PAHO/WHO, 2003). Over 50% of caregivers in Kaduna state bottle feed their child at the 6th month with infant formula while some in Kebbi state (31.58%) start as early as less than one month of age.

Challenges with Breastfeeding

i. Sore nipples. You can expect some soreness in the first weeks of breastfeeding. Make sure your baby latches on correctly, and use one finger to break the suction of your baby's mouth after each feeding. That will help prevent sore nipples. If you still get sore, be sure you nurse with each breast fully enough to empty the milk ducts. If you don't, your breasts can become engorged, swollen, and painful. Holding ice or a bag of frozen peas against sore nipples can temporarily ease discomfort. Keeping your nipples dry and letting them "air dry" between feedings helps, too. Your baby tends to suck more actively at the start. So begin feedings with the less-sore nipple.

ii. Dry, cracked nipples. Avoid soaps, perfumed creams, or lotions with alcohol in them, which can make nipples even more dry and cracked. You can gently apply pure lanolin to your nipples after a feeding, but be sure you gently wash the lanolin off before breastfeeding again. Changing your bra pads often will help your nipples stay dry. And you should use only cotton bra pads.

iii. Worries about producing enough milk. A general rule of thumb is that a baby who's wetting six to eight diapers a day is most likely getting enough milk. It's best not to supplement your breast milk with formula, and never give your infant plain water. Your body needs the frequent, regular demand of your baby's nursing to keep producing milk. Some women mistakenly think they can't breastfeed if they have small breasts. But small-breasted women can make milk just as well as large-breasted women. Good



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nutrition, plenty of rest, and staying well hydrated all help, too.

iv. Pumping and storing milk. You can get breast milk by hand or pump it with a breast pump. It may take a few days or weeks for your baby to get used to breast milk in a bottle. So begin practicing early if you're going back to work. Breast milk can be safely used within 2 days if it's stored in a refrigerator. You can freeze breast milk for up to 6 months. Don't warm up or thaw frozen breast milk in a microwave. That will destroy some of its immune-boosting qualities, and it can cause fatty portions of the breast milk to become super hot. Thaw breast milk in the refrigerator or in a bowl of warm water instead.

v. Inverted nipples. An inverted nipple doesn't poke forward when you pinch the areola, the dark skin around the nipple. A lactation consultant -- a specialist in breastfeeding education -- can give you tips that allow women with inverted nipples to breastfeed successfully.

vi. Breast engorgement. Breast fullness is natural and healthy. It happens as your breasts become full of milk, staying soft and pliable. But breast engorgement means the blood vessels in your breast have become congested. This traps fluid in your breasts and makes them feel hard, painful, and swollen. Alternate heat and cold, for instance using ice packs and hot showers, to relieve mild symptoms. It can also help to release your milk by hand or use a breast pump.

vii. Blocked ducts. A single sore spot on your breast, which may be red and hot, can signal a plugged milk duct. This can often be relieved by warm compresses and gentle massage over the area to release the blockage. More frequent nursing can also help.

viii. Breast infection (mastitis). This occasionally results when bacteria enter the breast, often through a cracked nipple after breastfeeding. If you have a sore area on your breast along with flu-like symptoms, fever, and fatigue, call your doctor. Antibiotics are usually needed to clear up a breast infection, but you can most likely continue to breastfeed while you have the infection and take antibiotics. To relieve breast tenderness, apply moist heat to the sore area four times a day for 15 to 20 minutes each time.

The concept of infant formula

World Health Organization (2019) submits that complementary feeding should be initiated on the 6th month. Studies in Malawi revealed that children who were given foods according to the timing set by the World Health Organisation were found well-nourished as compared with children who were introduced to solids too early (Madise and Mpoma, 1997). The high proportions of mothers in North Western Nigeria who sustained breastfeeding/bottle feeding/complementary feeding during child's illness indicate that the practice of withholding foods during an episode of illness was uncommon. In rural Africa the prevalence of linear growth retardation, also called stunting, among children is generally high (De Onis, 1993). This can lead to serious



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functional complications, such as lower mental development, reduced work capacity in adulthood and increased obstetric risk (Hautvast, 1999). In Nigeria, 42% of the children were stunted while 10% were wasted and underweight, 25% (NFCNS, 2004).

Stevens, Patrick, and Pickler (2009) Infant formula is a synthetic version of mother's milk and belongs to a class of food materials known as dairy substitutes. Milk and its products are foodstuffs that have various forms of usage in nature. It contains more than twenty different trace elements including copper, zinc, manganese and iron which are cofactors in many enzymes and participates in many physiological functions in mammals. The overview of infant formula reported that breast milk is the best food for infants.

According to Oskarsson (2009) infant formula has almost all the major nutrients as the diet that will enhance the growth of the child and more so that these infant formulae are designed to provide the required nutrients as recommended diet intake (RDI) of minerals for infants and toddlers. Infant formula as food supplements has a part to play in the diets of infants that is very important. In the sense that, they supply the body minerals and vitamins which is required in a larger quantity. Since they are primarily derived from animals or plants, they are therefore mostly milk, soya or cereal-based. They almost have all the nutrient requirements that are in breast milk, although it is difficult to produce a formula equal in all respects to breast milk.

Gura T. (2018) noted that there are different brands of infant formulae manufactured and mostly used worldwide; therefore the availability depends on the demand of the people. They include Milk based formulae – Cowbell infant formula, SMA gold infant milk, NAN infant milk, My Boy infant milk, Lactogen, Frisolac Gold, Nutribenetc and Cereal-based formulae – Cerelac of different ages like 6 months, 8 months, 12 months (Maize, milk & Rice), Friso Gold (wheat base and rice base), Nutrend, Thrive (pediacain), Nutriben (8 cereals and 4 fruits).

Stevens, Patrick, and Pickler (2009) Infant formula is intended as an effective substitute for infant feeding. Although production of an identical product to breast milk is not feasible, every effort has been taken to mimic the nutrition profile of human breast milk for normal infant growth and development. Cow milk or soymilk are most commonly used as the base, with supplemental ingredients added to better approximate the composition to human breast milk and to attain health benefits, including iron, nucleotides and compositions of fat blends. The fatty acids of arachidonic acid (AA) and docosahexenoic acid (DHA) are added. Probiotics and compounds, produced by genetic engineering, are either added or currently being considered for addition to formula. During the first six months of infant life, providing optimal nutrition is critical as the consequences of inadequate nutrition can be very severe. Infant formula is intended as an effective substitute to breast milk and is formulated to mimic the nutritional composition of breast milk. The recently updated FDA (Food and Drug Administration) rule on current Good Manufacturing Practices for infant formula, 21 CFR 106.96,



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requires, among other things, that formulas satisfy the quality factors of normal physical growth and a sufficient biological quality of protein component (adequate amounts of protein in a form that can be used by infants). Infant formula is only for the health of infants without unusual medical or dietary problems. The manufacturing process is highly regulated and monitored to meet national and international quality criteria. Infant formulas are available in three forms: (1) powder: The least expensive form of infant formula that must be mixed with water before feeding; (2) liquid: Concentrated liquid that must be mixed with an equal amount of water; and (3) ready-to-feed: The most expensive form of infant formula that requires no mixing (Guo, 2014).

Classes of Infant Formula Products

Institute of Medicine of the National Academics, (2014) opined that there are three major classes of infant formulas: Cow-milk based formula, soy-based formula and specialized formula. They vary in nutrition, calories, taste, digestion, and cost. Specific kinds of formulas are available to meet a variety of needs. Some cow's milk substitutes are amino acid based or contain extensively hydrolyzed whey or casein proteins. Some are rice-based formula.

Cow Milk-Based Formula

Bovine milk is the basis for most infant formula. However, bovine milk contains higher levels of fat, minerals and protein compared to human breast milk. Therefore, cow milk must be skimmed and diluted to more closely resemble human breast milk composition. Cow-milk-based infant formula contains added vegetable oils, vitamins, minerals and iron for consumption by most healthy full term infants. Cow's milk is one of the first foods introduced into an infant's diet and one of the most common causes of food allergy. Usually, clinical reactions start very early in life, after breastfeeding has stopped and cow's milk is introduced into the diet; symptoms rarely appear during lactation.

Soy-Based Formulas

Formulas made from soy proteins are effective options for infants with galactosemia or congenital lactase deficiency. They help with colic and milk allergies, however, rarely; infants who are allergic to cow's milk may also be allergic to soymilk. Soy products should not be used in infants under six months of age with food allergy. Because phytoestrogens are present in soy-based formula, the uses of soy-based formulas are limited by the concern of potential harm for the infant, although this remains controversial.

Hypoallergenic Formulas

Protein hydrolysate formulas are meant for infants and babies who are unable to tolerate cow milk or soy-based formulas. They contain protein that has been hydrolyzed—partially or extensively—into smaller sizes than those found in cow or soy-based products. For infants who have a protein allergy, extensively hydrolyzed formulas are a satisfactory alternative.

Amino Acid Formulas



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Amino acid formulas are another option for infants who have severe cow milk allergy with reactions to or refusal to ingest appropriate amounts of extensively hydrolyzed formula. They provide protein in the form of free amino acids with no peptides.

Non-Bovine Milk Sources

Elimination of all cow milk products without appropriately modified and fortified substitutions can lead to malnutrition and/or specific nutrient deficiencies at a time when infants and children are growing. Infant milk formulas from different animals (goat, ewe, mare, donkey, or camel), or formulas based on lamb or chicken, have been widely marketed as substitutes for cow milk in the management of cow milk allergy in infants and children. However, other animal-milk-based formulas are currently not acceptable in many places because there are no robust randomized clinical trials.

Probiotics and Prebiotics

The high concentration and structural diversity of human milk oligosaccharides are unique to humans. Without probiotics and prebiotics supplementation, the gut microbiota of formula-fed infants is generally not dominated by the Bifidobacterium species. Studies have shown that breastfed new-born carry a more stable and uniform population of oligosaccharides compared with formula-fed newborns. Adding probiotics to formula represents a key strategy to reduce the incidence and severity of diarrhea in infants.

Bioactive Proteins

Novel dairy fractions from bovine milk have been isolated and are now commercially available. Many of these components are proteins, such as α -lactalbumin, lactoferrin, osteopontin, and milk fat globule membrane proteins. When adding bioactive proteins to infant formulas, it is important to reduce the total protein content of formula. The amino acid composition of formula is also important; serum concentrations of essential amino acids should not be lower than those in breastfed infants. For example, α -Lactalbumin, often the first limiting amino acid in infant formulas, is digested into smaller peptides with antimicrobial and prebiotic activities and has an immunostimulatory effect. It also enhances mineral absorption. Osteopontin is a heavily phosphorylated and glycosylated protein that modulates immune functions and stimulates Th1/Th2 switching. It might also affect bone mineralization and growth, and facilitate the biological function of lactoferrin.

CONCLUSION

Breast milk is the best nutrition for infant growth and development, and is also rich in antibodies that provide the first source of adaptive immunity in a newborn's intestinal tract. In preterm or low birth weight newborns, a mother's own milk is the first choice for preterm infants; when it is unavailable, donor breast milk is considered as the next best choice. For healthy newborns whose mothers are unable to provide sufficient breast milk, the current option of choice is infant formula.

Formula-fed babies may also have the risk of developing an allergy to a particular formula. When a baby develops an allergy to formula, he or she may have symptoms



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that include irritability, crying after feedings, nausea, vomiting, diarrhea, or a skin rash. Breastfed babies eat more often than formula-fed babies since breast milk is more quickly digested and leaves the stomach empty more frequently. This puts a little more stress on the mother because of the potential necessity for more frequent feedings. If the mother develops certain medical conditions, whether or not to continue breastfeeding may need to be reassessed. These conditions should always be discussed with the doctor. However, it is rare that breastfeeding would need to be discontinued completely. In any interaction, the mother's doctor and/or pharmacist should be informed that she is breastfeeding. Some medicines should be avoided during breastfeeding.

Breast milk provides the ideal nutrition for infants. It has a nearly perfect mix of vitamins, protein, and fat -- everything your baby needs to grow. And it's all provided in a form more easily digested than infant formula. Breast milk contains antibodies that help your baby fight off viruses and bacteria.

RECOMMENDATION

In order to meet the Millennium Development Goals, there is the need to strengthen nutrition education among mothers/caregivers focusing on the importance of proper techniques of breastfeeding, proper timing of complementary foods, economic empowerment of caregivers and other intra-household factors.

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