IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876

Research paper  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 10, October 2022

# A Review on Review of Infant Feeding

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***ABSTRACT:*** ***For almost all newborns, the greatest source of nourishment is their mother's milk. Breast milk offers a number of additional advantages as a biologic fluid, including regulation of postnatal intestine function, immunological ontogeny, and brain development. Although breastfeeding is strongly encouraged, it is not always feasible, appropriate, or sufficient. Infant formula is a commercially manufactured infant food replacement. Infant formula is made from cow's milk or soymilk and tries to replicate the nutritional content of breast milk as precisely as possible. There are many alternatives to cow's milk-based formula. We examine the nutritional content of breast milk and baby formulas in this article to get a better knowledge of the significance of nursing and the usage of infant formula from birth to 12 months of age when a replacement source of nourishment is needed.***

***KEYWORDS:*** ***Breast Milk, Cow's Milk, Cow's Milk Allergy, Infant Formula.***

## 1. INTRODUCTION

The World Health Organization advises that babies be nursed exclusively for the first six months of their lives. Breastfeeding for at least 12 months is also recommended by the American Academy of Pediatrics. The Academy of Nutrition and Dietetics recently reaffirmed and updated its mission, stating that exclusive breastfeeding provides optimal nutrition and health protection for the first six months of life, and that breastfeeding with complementary foods from six months to at least 12 months is the best feeding pattern for infants. Breastfeeding is not only nutritious, but it is also easy and cheap, as well as a bonding experience for both the mother and the baby [1]–[3].

Breastfeeding is a very personal choice that is affected by a variety of circumstances. Nursing may be impossible, inappropriate, or insufficient under certain circumstances, necessitating a suspension or discontinuation of breastfeeding. Only 38% of babies worldwide are exclusively breastfed. Only 75% of babies in the United States start nursing at birth; but, by three months, 67 percent, or 2.7 million, of them are relying on baby formula for some part of their nourishment. The overall six-month "any breastfeeding" rate for new moms in the United States is 43%, with just 13% fulfilling the guideline to breastfeed exclusively for six months.

Infant formula is designed to be a safe and effective alternative to breastfeeding. Although it is impossible to produce a product that is identical to breast milk, every attempt has been made to replicate the nutrient profile of human breast milk for normal baby growth and development. The most popular foundation is cow milk or soymilk, with additional components such as iron, nucleotides, and fat mix compositions added to better mimic the composition of human breast milk and to achieve health advantages. Arachidonic acid (AA) and docosahexaenoic acid (DHA) are introduced as fatty acids. Probiotics and chemicals created via genetic engineering are either added to formula or are being evaluated for inclusion [4]–[6].

Providing optimum nutrition throughout the first six months of an infant's life is essential, since the effects of insufficient nutrition may be severe. The goal of this article is to examine

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nutritional facts on breast milk and baby formulae in order to emphasize the significance of nursing while also learning about infant formula's applications.

*1.1. Human Breast Milk:*

Carbohydrates, protein, fat, vitamins, minerals, digestive enzymes, and hormones are all found in human breast milk. It is also high in immune cells, such as macrophages, stem cells, and a variety of other bioactive compounds, in addition to these nutrients. Some of these bioactive compounds are protein-derived and lipid-derived, whereas others, such as oligosaccharides, are protein-derived and indigestible. HMOs have anti-infective effects against pathogens in the baby gastrointestinal tract, such as Salmonella, Listeria, and Campylobacter, by flooding the infant gastrointestinal system with decoys that bind the pathogens and keep them off the intestinal wall. Oligosaccharides are also important for the formation of a varied and balanced microbiota, which is necessary for proper innate and adaptive immune responses, and they help populate up to 90% of the newborn biome [7]–[10].

*1.1.1. Human Breast Milk Composition:*

Human breast milk is a complex matrix consisting mostly of 87 percent water, 3.8 percent fat, 1.0 percent protein, and 7% lactose. The fat and lactose in milk contribute 50 and 40 percent of the total calories, respectively. Human breast milk, on the other hand, is dynamic and varies over time, responding to the changing requirements of the developing kid. For example, during each nursing session, the milk expressed initially (foremilk) is thinner and has a greater lactose content, which satisfies a baby's thirst, while the milk produced thereafter (hindmilk) is creamier and has a considerably higher fat content, which meets the baby's requirements. There are additional differences in breastfeeding stage (infant's age), mother nutrition, maternal health, and environmental exposure.

Human milk protein concentration varies from 1.4–1.6 g/100 mL during early lactation, to 0.8–1.0 g/100 mL after three to four months of breastfeeding, to 0.7–0.8 g/100 mL after six months. The amount of fat in a woman's body changes considerably depending on her diet, and it's also linked to weight growth during pregnancy. Surprisingly, even when a mother's diet is insufficient, her breast milk is nearly always enough in necessary nutrients for her her infant's growth and development. Although the mean contents of protein, salt, chloride, and potassium in early preterm milk are sufficient to fulfill preterm babies' projected nutritional needs, special nutritional supplementation for mother's milk given to preterm newborns is needed.

Lactose concentration in mature milk is relatively stable, unlike protein and fat (after 21 days postpartum). Maintaining a consistent osmotic pressure in human milk requires a stable lactose content. Lactose also improves mineral and calcium absorption. Many carbohydrate-based bioactive molecules, including as oligosaccharides, are linked to lactose in breast milk. Lactose malabsorption and intolerance syndromes may occur if the small intestine does not generate enough of an enzyme (lactase) to breakdown these sugar compounds. Lactase deficiency causes malabsorption and illness in infants who are solely breastfed.

*1.2. Human Breast Milk Protein:*

Breast milk contains two types of protein: casein and whey. In the stomach, casein forms clots or curds, while whey stays a liquid and is simpler to digest. Whey makes up 80 percent to 50 percent of the protein in breast milk, depending on the stage of the milk. In early lactation, the whey/casein ratio in human milk varies between 70/30 and 80/20, then drops to 50/50 in late

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lactation. When compared to the milk of other animals, this percentage is considerably higher. Whey proteins account for just 18% of milk protein in cow's milk. Infant formulae have traditionally been rich in casein, making them more difficult to digest than real breast milk. Because casein and whey proteins have distinct amino acid profiles, the total amino acid composition of human milk changes depending on lactation stage. The most prevalent free amino acid, glutamine, is approximately 20 times greater in mature milk than in colostrum. Glutamine is necessary for the citric acid cycle to produce ketoglutaric acid, may function as a neurotransmitter in the brain, and serves as a primary energy source for intestinal cells.

Alpha-lactalbumin, lactaferrin, and secretory IgA are the most common whey proteins. Lysozyme, folate-binding protein, bifidus factor, casein, lipase and amylase, alpha1-antitrypsin and antichymotrypsin, and haptocorrin are among the other proteins. These proteins are quickly broken down to free amino acids after intake, allowing for absorption and use. The majority of these proteins have both bioactive and non-nutritive activities. Alpha-lactalbumin, for example, is required for lactose production as well as the binding of Ca and Zn ions. Casein aids in the formation of calcium and phosphorus masses. Lactoferrin and lysozyme help to inhibit the spread of potentially harmful germs, which helps to keep babies healthy. The IgA antibody kills germs and protects the gut's mucosal membrane.

*1.1.3. Fats in Human Breast Milk:*

Breast milk is mostly composed of fats, which provide energy and aid in the development of the central nervous system. Milk fat is also a transporter of flavor and fragrance. During lactation, the fat content of human breast milk varies from 3.5 percent to 4.5 percent. Triglycerides, which make up approximately 95 percent of total lipids, are the most important lipid component. Saturated fatty acids account for almost half of milk fatty acids, with palmitic acid (C16:0) accounting for 23% of total fatty acids. Oleic acid (18:1w9) is the monounsaturated fatty acid with the greatest proportion (36%) in milk. Linoleic acid (C18:2w6), which accounts for 15% of human breast milk, and alpha-linolenic acid (C18:3w3), which accounts for 0.35 percent, are both important fatty acids. These two essential fatty acids are transformed into arachidonic acid (AA, C20:4w6) and eicosapentaenoic acid (EPA, C20:5w3), respectively, with the latter being further converted to docosahexaenoic acid (DHA, 22:6w3). Growth, inflammatory reactions, immunological function, vision, cognitive development, and motor systems are all regulated by AA, EPA, and DHA in neonates.

*1.1.4. Vitamins, Minerals and Other Bioactive Components in Breast Milk:*

Except for vitamins D and K, human breast milk has sufficient quantities of most vitamins to ensure normal baby development. Infants who are solely breastfed have much less vitamin D than the minimal required consumption and far less than the recommended food intake. Vitamin D insufficiency, insufficient bone mineralization, and diseases like rickets are all risks for these babies. However, total vitamin D insufficiency risk in breastfed babies is linked to overall sun exposure, with the risk rising in regions with a lower sun index. Supplementing mothers with 400–2000 IU (International Unit) of vitamin D per day may raise vitamin D levels in breast milk, but only a higher dosage (2000 IU) produces adequate levels of 25-OH-D in the baby. Within eight weeks, the normal vitamin D reserves available at birth are depleted. For breastfeeding infants, sunlight exposure and vitamin D supplements are advised. Formula-fed babies had greater levels of vitamin D metabolites in their blood than breastfed babies. Vitamin K is required for the coagulation of blood proteins. Only a little quantity of vitamin K is passed from

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the placenta to the fetus, however. As a result, a newborn infant's vitamin K content is frequently very low, putting him or her at danger of hemorrhagic illness. Vitamin K supplementation is advised after delivery.

*1.2. Human Milk Alternatives Milk Donors and Milk Banks: What's the Difference?*

When a mother's own milk is unavailable, the World Health Organization and the American Academy of Pediatrics suggest pasteurized human donor milk for premature babies. Donor milk is pasteurized, which kills many of the natural commensal bacteria and substantially lowers or eliminates live immune cells, bioactive proteins, and enzymes, limiting some of the health benefits when compared to a mother's own milk. Efforts to improve donor breast milk are still underway. The mother should speak with their baby's health care professionals before utilizing donor breast milk.

*1.3. Formulas for infants:*

Infant formula is designed to be a good replacement for breast milk and is prepared to have the same nutritional profile as breast milk. The FDA's (Food and Drug Administration) newly revised regulation on current Good Manufacturing Practices for baby formula, 21 CFR 106.9 mandates, among other things, that formulas meet the quality criteria of normal physical development and a suitable biological quality of protein component (adequate amounts of protein in a form that can be used by infants). Infant formula is only recommended for healthy babies who do not have any unique medical or nutritional issues. To satisfy national and international quality standards, the production process is strictly controlled and monitored.

*1.3.1. The Infant Formula Market:*

According to the United Nations, the present global population of 7.2 billion people will increase by one billion in the following 12 years, reaching 9.6 billion by 2050. The worldwide demand for baby milk formula will rise as a result of this growth, particularly for novel formulations that include prebiotics and specialized milk protein fractions. The $50 billion baby formula industry is projected to be the fastest-growing packaged food category over the next five years, with annual growth exceeding 7%. Some industry analysts anticipate an even greater yearly growth rate of 8%–9%. According to expert Diana Cowland, the fast rise of baby formulae is expected to continue at a compounded annual growth rate of 11%, with Asia, and especially China, driving demand.

There are three types of infant formulas:

(1) Powder: The cheapest kind of baby formula, which must be combined with water before use;
(2) Liquid: A concentrated liquid that must be combined with water in an equivalent quantity; and
(3) Ready-to-feed: The most costly baby formula that does not need to be mixed.

*1.3.2. Guidelines for Manufacturing of Infant Formula:*

Water, carbohydrate, protein, fat, vitamins, and minerals must all be present in adequate quantities in infant formulae. The content of baby formula is tightly controlled, and each producer must adhere to government-issued standards. For example, the efficacy of all the main components added to formula (protein, fats, and carbs) has a range of minimum and maximum values. These components must have a track record of being safe to use. Throughout the

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product's shelf life, the necessary range of each nutrient must be maintained. Only L forms of amino acids are allowed to be supplied, while D forms are not allowed since they may induce D-lactic acidosis. Due to fructose sensitivity, fructose should be avoided. The use of hydrogenated fats and oils is also prohibited. The use of ionizing radiation on the formula product is prohibited since it may cause the product to deteriorate. Infant formula should have a minimum calorie content of 60 kcal (250 kJ) and a maximum energy content of 70 kcal (295 kJ) per 100 mL. Furthermore, medical and nutritional results must be used to inform product reformulation. "Manufacturers must demonstrate that the formula containing the new ingredient is capable of sustaining physical growth and development over 120 days when formula is likely to be the sole source of infant nutrition," according to the "Evaluation of the addition of Ingredients New to Infant Formula" committee.

The Food and Drug Administration (FDA) in the United States defines the safety criterion for adding new chemicals to baby formula as "reasonable assurance of no damage." The World Health Organization (WHO) has said that unprocessed cow's milk and unprocessed goat's milk should never be given to babies. Different nations' federal and local authorities regulate and monitor baby formula laws, including quality and production procedures in their respective countries, using WHO standards. From a manufacturer's standpoint, it's in their best interest to keep improving their goods so that they're as near to human breast milk as possible.

## 2. DISCUSSION

Human milk oligosaccharides have a high concentration and structural diversity that is unique to humans. The gut microbiota of formula-fed babies is usually not dominated by Bifidobacterium species without probiotics and prebiotics administration. Breastfed babies have a more stable and homogeneous population of oligosaccharides than formula-fed babies, according to studies. Adding probiotics to baby formula is an important approach for reducing the occurrence and severity of diarrhea in children.

A wide range of complex oligosaccharides may be found in domestic animal milk. Sialylated oligosaccharides make up around 80%–90% of the entire pool of oligosaccharides found in milk from all domestic animals. Grazing cows' milk has a greater percentage of sialic acid than non-grazing cows' milk. Cow's milk may be a good source of a variety of sialylated oligosaccharides for baby formula additions. Synthesized oligosaccharides that are chemically similar to human milk oligosaccharides may now be added to commercial baby formula.

The majority of probiotic strains given to formula come from food or the feces of infants. Despite the fact that the use of probiotics has progressed from research to recommendations, further study is needed to confirm particular strains with antiallergenic potential for preventative and therapeutic uses.

The evidence for using Lactobacillus reuteri to treat infantile colic is conflicting. In a population sample of breast- and formula-fed babies with colic, L. reuteri DSM 17938 had no effect. This result varied from smaller studies in certain groups, but it did not support a broad recommendation for probiotics as a treatment for colic. In contrast, L. reuteri was shown to have a protective effect in 138 babies in a prospective, randomized, blinded, controlled study. In comparison to the control group, the treatment group had a reduced number of pediatric consultations for baby colic (p 0.0001). It also cut down on the usage of analgesics and baby formula. Probiotics have been suggested as novel therapies for infantile colic, however only a

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few strains have been studied. To offer evidence-based recommendations, further research is required.

## 3. CONCLUSIONS

The best source of newborn nourishment is believed to be the mother's own milk. Breast milk includes a range of bioactive compounds that alter the operation of the gastrointestinal tract and immune system, as well as brain development, according to extensive research. As a result, breast milk is generally acknowledged as a biological fluid essential for an infant's optimum growth and development. Breast milk is the greatest source of nourishment for an infant's growth and development, and it's also high in antibodies, which serve as the initial source of adaptive immunity in the digestive system of a newborn. When it comes to preterm or low birth weight babies, a mother's own milk is the top choice; if that isn't available, donor breast milk is the next best option. Infant formula is now the best option for healthy infants whose moms are unable to produce enough breast milk.

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