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BREASTFEEDING IS THE - "GOLD STANDARD" OLD EXPERIENCE AND NEW SCIENTIFICALLY PROVEN BENEFITS

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Summary

The article presents the advantages of natural feeding, current recommendations for breastfeeding of infants obtained by analyzing the scientific literature. It details current evidence emphasizing the importance, uniqueness of the qualitative and quantitative composition of breast milk, the best form of infant feeding. Emphasis is placed on existing scientifically defined facts explaining the importance of natural feeding as a natural model, vividly illustrating the main points of the concept of optimal infant feeding. Focuses on the fact that adequate feeding is considered one of the major components of the health and optimal growth of the newborn infant. The importance of colostrum at the beginning of enteral feeding for the newborn's body is emphasized. The properties of colostrum that fully meet the morpho-functional needs of the infant are described.

It focuses on new, scientifically supplemented, over the past few years, data on the benefits of breast milk: optimal and balanced levels of nutrients; high assimilation of breast milk by the body of the child; the presence of a wide range of biologically active substances, essential fatty acids and amino acids, enzymes, vitamins and protective factors; favorable effect on intestinal microflora. Namely, it is shown that breast milk contains in the right quantities to provide individual not only nutritional but also immunological, endocrine needs of the child, depending on the age: alpha-lactalbumin proteins, beta-lactoglobulin, caseins, enzymes, growth factor, hormones, lactoferrin, lysozyme, secretory IgA, IgG and IgM. Non-protein components: alpha-aminonitrogen; creatine; creatinine; glucosamine; non-nucleic acid polyamines; urea; uric acid. Composition of mature milk: lipids; fat-soluble vitamins (A and carotene, D, E, K); fatty acids; phospholipids; sterols and hydrocarbonates; triglycerides; carbohydrates; water-soluble vitamins; biotin; folin; cholate; inositol; niacin; pantothenic acid; riboflavin; thiamin; vitamins B12, B6, C. Cells: cytoplasmic fragments, epithelial cells, lymphocytes, leukocytes, macrophages, neutrophils, minerals, bicarbonates, calcium, chloride, citrate, magnesium; potassium; soda; sulfate; trace elements: chromium; cobalt; copper; iodine; iron; manganese; molybdenum; nickel; selenium; zinc.

Biologically active substances that are part of breast milk: hormones, enzymes, immune complexes, help newborns to overcome birth stress faster and better adapt to new living conditions.

It is noted that the nature of breastfeeding in the first year of life to a large extent determines the health of the child not only in the early years, but also in subsequent periods of his life.

Keywords: *Breastfeeding; Colostrum; Mature Milk; Breast Milk; Microbiome; Oligosaccharides; Newborn.*

All great things begin with the small, often simple but at the same time irreplaceable. Mother's milk, from ancient times, was perceived not only as adequate food, but also as a powerful countermeasure to many diseases [1]. Our ancestors could not explain what its protective effect was, but they saw for themselves and understood that children who were breastfed rarely get sick, grow and develop well. The benefits of breastfeeding for the mother include: protection from dangerous diseases; breastfeeding can help reduce the risk of cardiovascular diseases, type 2 Diabetes Mellitus, ovarian cancer and breast cancer; positive effects on the mental health of the mother - breastfeeding reduces the risk of developing postpartum depression. It strengthens not only the emotional, but also the mother-child bonding in general, helps to improve and strengthen family relationships[2]. Safety and comfort for the baby is also achieved through breastfeeding; it provides natural contraception for the mother. Breastfeeding allows for breaks between pregnancies - hormonal effects often cause the absence of menstruation. This is a natural (although not 100% reliable) method of preventing pregnancy, known as the lactational amenorrhea method (up to 90% in the first six months with mandatory compliance with all recommendations).

Thus, breastfeeding is the safest, most reliable and affordable way to feed an infant, which serves as an influential factor in the formation of good health of the child, as well as helping the mother to recover optimally and naturally after childbirth.

Despite the accessibility, reliability and safety of breastfeeding for the child, according to the literature, free-feeding in preterm infants up to 6 months of age is only 48%; in children over 6 months of age 29.6%, with a clear downward trend in infants up to one year of age - 18.4% [3]. According to the WHO, less than 50% breastfeed exclusively at 3 months and about 25% at 6 months [4]. While 85% of mothers plan to exclusively breastfeed for the first 6 months before birth.

Pain, discomfort, physical fatigue and exhaustion with the fullness and rapidity of time in each day, inherent in maintaining a high economic level, financial ability to take the easy route of greater freedom for the mother, and planning her own time - these factors negatively affect the type of infant

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feeding, are associated with decreased frequency of breastfeeding and are considered the main reasons for mothers in developed countries to restrict or refuse to breastfeed.

In the first days after delivery, only a limited amount of milk is produced before lactogenesis begins on days 2-4 [5]. This is a critical period during which separation of mother and baby can delay the initiation of breastfeeding or even prevent the initiation of this process. According to WHO, 1991 [6], changes in the composition of a woman's milk during the first days, weeks of lactation are characteristic: colostrum, transitional milk, mature milk. So, the beginning of lactotrophic nutrition, on the one hand between hemotrophic and amniotrophic periods, is colostrum, an important intermediate form of food of the newborn baby. Colostrum, a sticky yellowish fluid that fills the mammary gland during the last trimester of pregnancy, is produced for another 5 days after delivery, slowly transitioning to traditional breast milk over a period of 2 weeks. The amount of colostrum varies widely from up to 100 ml/day to about 50 ml/day on average [1]. The composition of colostrum: less lactose, fat and water-soluble vitamins than in mature milk, more proteins, fat-soluble vitamins (E, A, K) and more minerals (Nα, Zη), high levels of immunoglobulins, growth factors. There are 142 kcal in 100 ml of colostrum.

The importance of colostrum for the body of the newborn: colostrum fully meets the morpho-functional needs of the infant. Namely: insufficiently developed kidneys of the newborn cannot process large volumes of fluid without metabolic stress; production of lactose and other intestinal enzymes is just beginning, there is no proper protection against oxidative damage and hemorrhagic diseases provided by inhibitors and quinones of colostrum and breast milk; immunoglobulins contained in colostrum cover immature intestinal surface of the baby, thus protecting it from bacteria, viruses, parasites and other pathogenic factors; its growth factors stimulate newborn's own systems. Colostrum acts as a modulator of child development even if the mother has been nursing another child throughout the pregnancy, her milk will pass the colostrum stage just before and just after the new birth.

Thus, during the first - second day of life, the baby, eating a small amount of colostrum, is fully provided with the necessary calories, proteins, carbohydrates, immunological protection while exclusively breastfeeding.

It is important to remember and emphasize to the mother that the action of colostrum is weakened by the addition of water or eliminated altogether by the introduction of other media into the digestive tract of the child.

What happens to colostrum next? With frequent application to the breast, with the mother and baby together, skilled support from medical personnel both in the maternity unit and at home, up to 4 weeks after birth, the milk is transformed into mature milk. Its composition changes slightly during the whole period of breastfeeding.

The newborn, whose development is still far from perfect, requires an optimal, genetically determined type of feeding, achieved by breastfeeding from the mother. Breast milk contains essential nutrients: proteins and essential amino acids, fats and essential fatty acids, carbohydrates, minerals, vitamins and trace elements, which are in sufficient amounts and are well absorbed by the baby. The main nutrients in breast milk: alpha-lactalbumin; beta-lactoglobulin; caseins; enzymes; growth factor; hormones; lactoferrin; lysozyme; secretory IgA and IgG, IgM. Non-protein components: alpha-aminonitrogen; creatine; creatinine; glucosamine; non-nucleic acid polyamines; urea medium; uric acid. Composition of mature milk: lipids; fat-soluble vitamins (A and carotene, D, E, K); fatty acids; phospholipids; sterols and hydrocarbonates; triglycerides; carbohydrates; water-soluble vitamins; biotin; folin; cholate; inositol; niacin; pantothenic acid; riboflavin; thiamin; vitamins B12, B6, C. Cells: cytoplasmic fragments, epithelial cells, lymphocytes, leukocytes, macrophages, neutrophils, minerals, bicarbonates, calcium, chloride, citrate, magnesium; potassium; soda; sulfate; trace elements: chromium; cobalt; copper; iodine; iron; manganese; molybdenum; nickel; selenium; zinc. Biologically active substances contained in breast milk, hormones, enzymes, immune complexes, help newborns to overcome birth stress faster and better adapt to new conditions of life.

The average milk contains 3-5% fat, 0.8-0.9% protein and 6.9-7.2% carbohydrates, with an additional 0.2% minerals. Milk fats account for 40-55% of the total energy in breast milk, and lactose provides an additional 40%.

More than 200 different fatty acids are found in women's milk, with triglycerides accounting for more than 98% of the fat. Complex lipids play a central role in brain and digestive tract development, as well as in protection against pathogenic bacteria, particularly group B streptococcus [7]. Of the more than 400 unique proteins found in women's milk, casein, α-lactalbumin, lactoferrin, immunoglobulin IgA, lysozyme, and serum albumin are the most common [8]. Milk proteins play a very important role in the development of the intestine and immune system of newborns, contribute to the absorption of nutrients and protect against pathogens due to their antimicrobial activity [9].

Breast milk is a reliable immunological defense. Soluble components include immunoglobulins (IgA, IgG, IgM) along with lysozymes and other enzymes, lactoferrin, bifidum factor and other immune-regulating substances. Cellular components include macrophages, lymphocytes, neutrophil granulocytes and epithelial cells. In mature milk, unlike in colostrum, their concentration decreases. However, since the decrease in their concentration is compensated by an increase in milk volume, the baby receives them in more or less constant amounts during the whole period of lactation. It has been found that a newborn raised exclusively with breast milk receives 0.5 secretory IgA per day, the most important fraction of globulin, in terms of kilograms of body weight.

The anti-infective protection of colostrum and breast milk is characteristic of both soluble and cellular components. A newborn baby may immediately encounter a number of problems, including intestinal colonization by microorganisms, the toxins they produce, and ingestion of

macromolecular antigens; all three factors can cause pathological reactions [10]. Macrophages are found in the highest concentrations, followed by lymphocytes and neutrophil granulocytes. These cells help to prevent infection both by phagocytosis and by secreting immune substances specific to those microorganisms with which the mother is in contact. Immunoglobulins (Ig) are important components that protect the infant gut from pathogenic bacteria. Immunoglobulins found in breast milk include IgA, secretory IgA (SIgA), IgM, secretory IgM (SIgM), and IgG, with SIgA playing a leading role in protecting the baby from infectious diseases [10]. High concentrations of SIgA are detected in colostrum, although SIgA is present in milk throughout the breastfeeding period [11]. By binding to pathogens in the intestinal lumen, SIgA prevents them from attaching to epithelial cells and mucosal areas [11].

Cytokines play an important role in the formation of the pathophysiological inflammatory response - proteins secreted in the mother's milk contribute to the immune system of infants due to their anti-inflammatory and immunosuppressive properties. The variety and concentration of individual cytokines differs from mother to mother and throughout the breastfeeding period. However, interleukins-6, 8 and 10 (IL-6, IL-8 and IL-10), tumor necrosis factors-α and β (TNF-α and TNF-β) and transforming growth factors-α and β (TGF-α and TGF-β) are commonly found in all lactating mothers throughout the lactation period [10,12]. The presence of a wide range of growth factors in a woman's milk is particularly important during the first weeks of life, when active growth and development of a number of systems occurs. Epidermal growth factor (EGF) is initially present in amniotic fluid; after birth, it is found in both colostrum and mature milk. In the infant's intestine, EGF promotes proliferation and maturation of epithelial cells and is involved in the repair of intestinal mucosa [13]. Neuronal growth factors (NGF) are involved in the growth and development of the nervous system with emphasis on both prenatal and postnatal brain maturation.

The next important component of breast milk is considered to be erythropoietin (Epo), found in high concentration in women's milk, which is a hormone involved in intestinal development and increased production of red blood cells, which, in turn, reduces the risk of anemia [13]. Lactoferrin is an unsaturated iron-binding glycoprotein that "fights for iron" with iron-dependent microorganisms and is thus bacteriostatic.

Female milk contains a large amount of lactoferrin, known for its antibacterial activity against pathogenic microorganisms that acquire virulence through an iron-mediated mechanism [13]. Lactoferrin has the ability to bind to two iron ions, due to which it is believed to inhibit bacterial pathogens; lactoferrin has demonstrated antimicrobial activity against viruses and bacterial species that do not require iron for metabolic processes [14].

It is known that the basic carbohydrate requirements of the infant are provided by lactose, the most common carbohydrate in breast milk, and the oligosaccharides of human milk (OHM) are of most interest when discussing the infant microbiome. OHMs are the third largest component in human milk, and although infants are unable to digest them, they play an important role in the formation of the functionally developing intestinal microbiota as well as the formation of the immature immune system [15].

Over 200 unique OHMs have now been identified, ranging from 3 to 22 sugars per molecule.

Breast milk (BM) was once thought to be sterile; in fact, BM is the source of 104-106 bacterial cells per day consumed by an infant, at an average feeding of 800 mL per day [16]. Although the source of bacteria present in human milk is known in part, it is thought to be a combination of bacteria from the infant's mouth, the mother's nipple, and the surrounding skin. In exclusively breastfed children, the most common bacterial genera are bifidobacteria, lactobacilli, staphylococci, and streptococci. Bifidobacterium species dominate 70% of the strains. The most frequently identified bifidobacterial species that contribute to a healthy intestinal flora are B. breve, B. longum, B. dentium, B. infantis, and B. Pseudocatenulatum [17]. Bifidum factor, a nitrogen-containing carbohydrate that is easily destroyed by heating, plays an important role in the antimicrobial action; it counteracts colonization by lactobacilli in the presence of lactose. The resulting low pH in the intestinal cavity inhibits the growth of both E. coli, Gram-negative bacteria, and fungi such as Candida albicans. Breast milk also contains viral fragments that cannot be replicated but stimulate antibody sensitivity in infants.

If breast milk is the only source of nutrition during the first 6 months of an infant's life, the amount of pre-populated intestinal bacteria is significantly dependent on the mother [18]. Breastfed infants still have higher levels of bifidobacterial and lactobacillus species. The homogeneity of the infant's microbiome is achieved by introducing rigid foods into the infant's diet. Only after the cessation of breastfeeding does the infant's microbiome begin to resemble that of an adult [18].

Breastfeeding for at least 6 months has a significant positive association with IQ scores at age 6 years (n=13889 infants) [19]. Analysis of the literature shows that poor infant feeding at an early age leads to impaired growth, intellectual development, the occurrence of certain diseases in adolescents and adults, and determines the level of health of the nation later in life [20].

Social, socio-economic problems, lack of prenatal training in breastfeeding, the proper psychological preparation of parents for the arrival of the child in the family contributes to formula feeding. In addition, the quality and duration of breastfeeding may be impaired by insufficient milk production due to limited mother-infant contact, if the principles of breastfeeding are not followed, the mother's anxiety about the child not getting enough milk, anxiety, irritability of the child and insufficient sleep. Despite these negative factors, a limited number of infants are medically dependent on formula feeding to maintain optimal breastfeeding. According to the CDC, as of 2015, 17.2% of infants are formula-fed within the first 48 hours [21].

To strengthen the understanding of the benefits and value of breastfeeding it is necessary

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to constantly emphasize the understandable disadvantages of formula for most parents, namely: it is impossible to include in the formula a number of bioactive components contained in the breast milk. The intestine microbial composition of formula-fed infants differs significantly from that of breastfed infants, which will definitely have a negative impact on the functioning of the immune, digestive, and endocrine systems [22]. It has been studied that even for mixed-feeding infants, the intestinal microbiota more closely resembles the composition of the microflora of exclusively formula-fed infants. The infant microbiota shifts more rapidly toward the composition of the adult microbiocenosis with a higher total bacterial diversity, including opportunistic bacteria. Staphylococcus, streptococcus, enterococcus and clostridium species and specific Bifidobacterium species predominate in the intestine of formula-fed infants [23]. In addition, infants fed exclusively formula have a higher prevalence of Escherichia coli species in the intestine: C. difficile, B. fragilis and Lactobacilli [24]. Formula-fed infants within six months of birth show higher levels of bacterioides, Clostridium difficile, Clostridium perfringens and Clostridium coccoides with a less mature microbiota overall [25].

The enzymatic function of the infant remains hypersensitive to the occurrence of abnormalities until six months of age. Although enzymes are present in saliva to help digest food, it is not until 6 months of age that the pancreas secretes sufficient enzymes, including α-amylase, to digest starches and proteins [25]. Until the pancreas begins to function fully, there are huge amounts of undigested carbohydrates that are digested by the colon and promote the proliferation of beneficent microorganisms.

Conclusions

1.Breast milk is not only a staple food for the infant in the first year of life, but also a source of nutrients that contribute to the formation of the intestinal micropeisis, maturation of the intestinal mucosal barrier and differentiation of the immune response. The substances in breast milk contribute to normal digestion, proper metabolism, immune support and the formation of a protective intestinal microflora in the baby and subsequently a full immune system.

2. Breast milk reduces the risk and provides protection against infectious diseases and the development of atopic disorders due to its immunological components, including immunoglobulins, cytokines, growth factors and microbiological factors.

Breast milk contains hundreds of commonly known components, while differing in composition not only between mothers, but even in the same woman in different mammary glands, from lactation to lactation, not to mention the entire lactation interval, that is, meets the individual needs of the child.

3.The positive effects of breastfeeding on the health of the child persist throughout life. Breastfed children are stronger, get sick less often, recover more quickly, and have a higher coefficient of intellectual development than artificially breastfed children.

4. The evolution of the mankind over millions of years has led to natural feeding patterns specific to each mammalian species. Trying to feed a newborn baby with the milk of another species is essentially an ecological disaster. Breast milk is the natural and most appropriate food for babies in their first year of life - the Gold Standard!

Suggestions:

1.Provide prenatal breastfeeding education, proper psychological preparation of parents for having a baby in the family.

2.Inform and educate pregnant women, mothers and their families about the benefits and methods of breastfeeding.

3.Explain the benefits of breastfeeding to mothers and their young ones.

4.Provide information on the initiation of lactation, conditions for prolonging lactation after childbirth.

5.Help mothers successfully initiate early breastfeeding.

6.Explain the importance of mother and newborn being together, early attachment to the breast, skin-to-skin contact.

7.Teach breastfeeding techniques.

8.Provide information on proper maternal nutrition during breastfeeding.

9.Encourage mothers to breastfeed exclusively with breast milk for up to six months and to extend breastfeeding to one year or more with timely introduction of complementary foods.

10.To inform parents about breastfeeding as a reliable protection against infectious diseases.

11. Conduct a discussion on the rejection of the use of pacifiers in breastfed children.

12.Constantly emphasize the disadvantages of formula to most parents to reinforce the benefits and value of breastfeeding.

13. To point out to parents the positive impact of breastfeeding on the child's health status, which lasts throughout life.

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ГРУДНЕ ВИГОДОВУВАННЯ ДІТЕЙ - «ЗОЛОТИЙ СТАНДАРТ», ДАВНІЙ ДОСВІД І НОВІ НАУКОВО ДОВЕДЕНІ ПЕРЕВАГИ

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Резюме

У статті представлені переваги природнього вигодовування, сучасні рекомендації з грудного вигодовування дітей, отримані шляхом аналізу наукової літератури. Деталізовані сучасні дані, що підкреслюють значущість, унікальність якісного і кількісного складу грудного молока – найкращого виду вигодовування немовлят. Акцентована увага на існуючі науково визначені факти, що пояснюють значення природного вигодовування як природну модель, яка яскраво ілюструє основні положення концепції оптимального вигодовування немовлят. Зосереджена увага на тому, що адекватне вигодовування вважається одною з головних складових здоров'я і оптимального росту новонародженої дитини. Підкреслена важливість молозива у початку ентерального харчування, для організму новонародженого. Описані властивості молозива, що повністю відповідають морфо-функціональним потребам немовляти.

Зосереджена увага на нові, науково-доповнені, за останні кілька років, переваги жіночого молока: оптимальний і збалансований рівень харчових речовин; високу засвоюваність жіночого молока організмом дитини; наявність широкого спектру біологічно активних речовин, незамінних жирних кислот і амінокислот, ферментів, вітамінів і захисних факторів; сприятливий вплив на мікрофлору кишечника. А саме, показано, що у грудному молоці містяться в потрібній кількості для забезпечення індивідуальних не тільки харчових, але й імунологічних, ендокринних потреб дитини, залежно від віку: білки альфа-лактальбумін; бета-лактоглобулін; казеїни; ензими; фактор росту; гормони; лактоферин; лізоцим; секреторний IgA, IgG та IgM. Небілкові компоненти: альфа-амінонітроген; креатин; креатинін; глюкозамін; не нуклеарні кислоти поліаміни; сечовина; сечова кислота. Склад зрілого молока: ліпіди; жиророзчинні вітаміни (А та каротин, Д, Е, К); жирні кислоти; фосфоліпіди; стероли і гідрокарбонати; тригліцериди; карбогідрати; водорозчинні вітаміни; біотин; фолін; холат; інозітол; ніацин; пантотенова кислота; рибофлавін; тіамін; вітаміни В12, В6, С. Клітини: фрагменти цитоплазми, епітеліальні клітини, лімфоцити, лейкоцити, макрофаги, нейтрофіли, мінерали, бікарбонати, кальцій, хлорид, цитрат, магній; калій; сода; сульфат; мікроелементи: хром; кобальт; мідь; йод; залізо; марганець; молібден; нікель; селен; цинк.

Біологічно активні речовини, які входять до складу грудного молока: гормони, ферменти, імунні комплекси, допомагають новонародженим швидше подолати пологовий стрес та краще адаптуватись до нових умов життя.

Зазначено, що характер вигодовування на першому році життя, значною мірою, визначає стан здоров'я дитини не тільки в ранньому віці, але й у наступні періоди її життя.

Ключові слова: грудне вигодовування; молозиво; зріле молоко; материнське молоко; мікробіом; олігосахариди; новонароджений.

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