Immunological Benefits of Breastfeeding for Maternal and Child Health

RESUMO

Objetivo: Investigar os benefícios imunológicos da amamentação exclusiva para a saúde materno-infantil. Método: Revisão de literatura realizada nas bases PubMed, SciELO, BVS e Lilacs, com os descritores: Aleitamento materno exclusivo; Benefícios imunológicos; Saúde materno-infantil. Resultados: A amamentação exclusiva proporciona diversos benefícios imunológicos. Para a mãe, inclui redução do risco de câncer, prevenção de depressão pós-parto e menor chance de desenvolver diabetes tipo 2. Para o bebê, garante composição nutricional adeguada, prevenção de doenças e fortalecimento do vínculo afetivo com a mãe.Conclusão: Apesar dos comprovados benefícios, a adesão à amamentação exclusiva ainda é limitada. Profissionais de enfermagem têm papel essencial no suporte e educação das gestantes, considerando aspectos sociais e familiares para promover a prática com equidade e valorização da maternidade.

DESCRITORES: Aleitamento materno exclusivo; Benefícios imunológicos; Saúde materno-infantil.

ABSTRACT

Objective: To investigate the immunological benefits of exclusive breastfeeding for maternal and child health.Method: A literature review was conducted using PubMed, SciELO, BVS, and Lilacs databases, with the descriptors: Exclusive breastfeeding; Immunological benefits; Maternal and child health.Results: Exclusive breastfeeding provides several immunological benefits. For mothers: reduced risk of depression, prevention of postpartum hemorrhage, and lower risk of type 2 diabetes. For infants: adequate nutritional composition, disease prevention, and stronger emotional bonding with the mother. Conclusion: Despite its well-known benefits, adherence to exclusive breastfeeding remains limited. Nursing professionals play a key role in providing support and education, considering the social and family context to effectively promote breastfeeding and reaffirm the commitment to equity and maternal health.

DESCRIPTORS: Exclusive breastfeeding; Immunological benefits; Maternal and child health.

RESUMEN

Objetivo: Investigar los beneficios inmunológicos de la lactancia materna exclusiva para la salud maternoinfantil. Método: Se realizó una revisión de la literatura en las bases de datos PubMed, SciELO, BVS y Lilacs, utilizando los descriptores: Lactancia materna exclusiva; Beneficios inmunológicos; Salud maternoinfantil.Resultados: La lactancia materna exclusiva aporta diversos beneficios inmunológicos. Para las madres: menor riesgo de cáncer, prevención de depresión posparto y protección frente a la diabetes tipo 2. Para los bebés: composición nutricional adecuada, prevención de enfermedades y fortalecimiento del vínculo afectivo con la madre. Conclusión: A pesar de sus beneficios reconocidos, la práctica de la lactancia materna exclusiva sigue siendo limitada. El profesional de enfermería desempeña un papel fundamental al brindar apoyo y educación, considerando los contextos sociales y familiares para promover la lactancia de forma equitativa y valorando la maternidad. DESCRIPTORES: Lactancia materna exclusiva; Beneficios inmunológicos; Salud materno-infantil.

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INTRODUCTION

xclusive breastfeeding (EBF) is a process of great importance for human health, as breast milk is a complete food, capable of fully meeting the energy needs of newborns and infants. As well as being a continuation of intrauterine nutrition, breastfeeding also contributes to the maturation of the baby's gastrointestinal and renal systems [1]. Thus, the first few hours of life are considered crucial due to the immune immaturity of the newborn, who is exposed to a large number of foreign microorganisms shortly after birth [2]. The immunomodulatory action of breast milk protects the mucous membranes, which are responsible for around 90% of the infections that affect humans^[3].

Breast milk is a complex body fluid made up of lipids, proteins, vitamins and protective factors, offering benefits to both the child and the mother [4]. Its composition is not uniform and is influenced by maternal factors such as nutritional status, age, stage of lactation, behavioral habits and the presence of previous chronic diseases. These variations allow breast milk to continuously adapt to the baby's nutritional needs ^[5].

The protective factors in breast milk can be classified as specific and non-specific. The specific ones include immunoglobulins (IgA, IgM and IgG), with emphasis on IgA, which is synthesized directly in the mammary gland and is found in dimeric form, known as secretory IgA. Due to its high molecular weight, this immunoglobulin is neither digested by gastric and intestinal secretions nor absorbed by the newborn's body [1].

The mother's exposure to environmental pathogens stimulates the migration of immune system cells to the mammary gland, promoting the production of specific IgA against these agents. This immunoglobulin is then transferred to the newborn through

breast milk. By coating the intestinal mucosa, IgA acts as a protective barrier, preventing bacterial infections, neutralizing toxins and preventing the entry of other antigens [6].

Among the most important non-specific factors are bifido factor, lysozyme, lactoferrin and lactoperoxidase, which play fundamental roles in protecting and developing the baby's immune system, as well as the chemical composition of breast milk [1]. Proteins make up around 1% of human milk, being more abundant at the beginning of lactation and decreasing over the months. The main proteins include casein, a-lactalbumin, lactoferrin, secretory IgA, lysozyme and serum albumin^[7].

Carbohydrates make up around 7% of breast milk, with lactose being the main component, helping with osmolarity and nutrient absorption.

The oligosaccharides in human milk modulate the intestinal microbiota and strengthen the baby's immunity. Fat represents almost 50% of the infant's nutritional supply and is essential for growth and the development of the nervous system. Fat content increases throughout lactation, with triglycerides being the main lipid form. Short-chain fatty acids provide energy, while polyunsaturated fatty acids (PUFAs) influence infant body composition. In addition to macronutrients, breast milk contains essential micronutrients such as B vitamins, C, E, calcium, phosphorus and potassium [7].

In this context, nurses play a fundamental role in guiding, encouraging and promoting breastfeeding, in line with public policies such as the National Breastfeeding Incentive Program. They must educate mothers about the immunological benefits of breastfeeding and make parents aware of the importance of family support during this period. By getting to know each patient's reality, nurses can plan interventions that reinforce the desire to breastfeed [8].

Against this backdrop, this study aims to verify the immunological benefits of breastfeeding for both maternal and infant health, based on current scientific literature.

METHOD

This study was conducted by means of a literature review carried out at the University of Rio Verde, based on a survey of scientific articles and dissertations indexed in databases such as Google Scholar, SciELO, VHL, Lilacs and PubMed, using the keywords: "breastfeeding" and "immunological benefits".

Articles without language restrictions and within the proposed theme were considered, as well as books, doctoral theses and master's dissertations. The files were discussed before being integrated into the work for better coherence of the data obtained. Only those papers that deviated from the emphasized theme and did not clearly demonstrate the implementation methodology were excluded from the research. Initially, 6,073 articles were identified. After careful analysis, 37 papers were selected to make up the review, ensuring coherence and relevance in the discussion of the data obtained

LITERATURE REVIEW

GENERAL ASPECTS OF BREASTFEE-DING

The World Health Organization (WHO) recommends that exclusive breastfeeding be maintained until the child is six months old and that breastfeeding continue until the child is two years old or older, with the introduction of complementary foods in an appropriate manner. The early introduction of complementary foods can be detrimental to children's health [9].

The WHO classifies breastfeeding into five definitions (Table 1)^[9].

TABLE 1 - Types of breastfeeding	J
Types of breastfeeding	Description
Exclusive Breastfeeding	The infant receives only breast milk (straight from the breast, milked or from another source), with no other liquids or solids, except vitamins, medicines and mineral supplements.
Breastfeeding Predominant	Infants receive breast milk, but can also drink water, tea, fruit juice and other fluids.
Breastfeeding	Infants receive breast milk, regardless of whether they consume other types of food.
Breastfeeding Complemented	The infant receives breast milk and, as a complement (without replacing it), solid and semi-solid foods.
Mixed Breastfeeding or Partial	Infants receive breast milk, but also other types of milk, formulas and other foods

Source: adapted from Brasil (2009).

Lactation is a natural physiological process in women, which begins during pregnancy and continues through the puerperium. This process occurs through the action of the pituitary gland, a gland located at the base of the brain, close to the hypothalamus, which is responsible for secreting prolactin in its anterior portion, the adenohypophysis ^[10].

Prolactin increases progressively from the fifth week of pregnancy until the baby is born. This increase in hormone levels is known as lactogenesis I. During pregnancy, the hormones oestrogen and progesterone prevent prolactin from acting fully. After childbirth, with the removal of the placenta, there is a drop in the levels of these hormones, allowing prolactin to act fully. This process is called lactogenesis II and marks the beginning of breast milk production [11].

Only when estrogen and progesterone levels drop does the breast enter the phase known as lactopoiesis, which is responsible for maintaining milk production. This process depends directly on the stimulus generated by the baby's sucking. Lactopoiesis represents the last phase of the mammary glands' adaptation to the postpartum period, culminating in the ejection of milk,

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known as apoptosis, which occurs between the third and fourth day after childbirth. During this phase, there is an increase in the contraction of the mammary ducts due to the production of oxytocin, as well as the growth of the mammary glands, favored by increased blood flow and the maturation of the mammary alveoli [11].

Although it is a physiological process, many women and their babies face difficulties during this period, such as breast trauma, breast engorgement, mastitis, candidiasis and incorrect latch-on [12]. In addition, factors such as early motherhood, paternal absence, return to work, lack of knowledge, maternal insecurity, lack of active listening, trivialization of pain by health professionals and cultural myths are among the main causes of early weaning [13].

One of the most common myths is that of "weak milk", which leads many mothers to opt for artificial formulas. The watery aspect of breast milk, especially colostrum, leads some women to believe that their milk is of poor quality and insufficient to meet the baby's needs [13]. Faced with these challenges, it is essential to promote educational activities throughout pregnancy, preparing mothers for the lactation period through guidance based on scientific knowledge. These actions should demystify erroneous beliefs and provide the necessary support to ensure the continuity of breastfeeding^[14].

Breastfeeding is fundamental for the first moments of life and for childhood. As well as ensuring complete nutritional support, it promotes the emotional bond between mother and baby and benefits maternal health. Despite being a natural process, education and family support are fundamental to ensuring its effectiveness [15].

The support network plays a significant role in the prevalence and duration of breastfeeding. The family, especially grandmothers and mothers-in-law, can influence this process through their previous maternal experiences. In addition, the father plays a fundamental role, being the person closest to the woman during this period, offering emotional support and helping with household chores [16].

Nurses are also part of this support network and are responsible for clarifying doubts, encouraging breastfeeding and using complementary practices that promote women's well-being. Nurses work on the front line of primary care, monitoring pregnancy, childbirth and the puerperal period ^[14].

Through educational activities such as pregnancy groups, conversation circles and culture circles, the nursing team plays a fundamental role in maternal and child health care. These activities encourage the exchange of experiences and help to reduce feelings such as anxiety, depression, fear and insecurity, which are common during pregnancy [17].

Despite the efforts of national and international organizations, bills and programs to encourage breastfeeding, the responsibility also lies with health professionals, especially nurses. Technical and scientific knowledge about lactation is essential, but not enough. It is necessary to adopt a holistic approach, taking into account women's

emotional, cultural and social aspects. This vision must start from recognizing the importance of the mother, offering active listening and promoting her empowerment ^[18].

IMMUNOLOGICAL BENEFITS OF EX-CLUSIVE BREASTFEEDING FOR IN-FANT HEALTH

Immediately after birth, the newborn's immune system has to act intensely due to exposure to foreign organisms. The reduced immunological memory inherited from the mother, combined with the early stage of development of the immune system, increases the newborn's vulnerability to infectious agents. In this way, innate immunity plays a fundamental role in the first moments of life, since the adaptive response is still in the process of maturing^[19].

The innate immune system is made up of macrophages, neutrophils, natural killer (NK) cells and dendritic cells, which act immediately to defend the body against pathogens. As newborns have a still immature adaptive immunity, they depend largely on the innate immune response to protect themselves against infections. Adaptive immunity, in turn, is mediated by B and T lymphocytes and is developed through previous contact with pathogens. However, due to the immaturity of neonatal lymphocytes, the adaptive immune response of newborns is less efficient. This is due to the fact that neonatal B cells have a limited repertoire of immunoglobulins, acquired transplacentally and still in development^[19].

The first evidence of maternal-fetal transmission of antibodies emerged in the studies of Brambell et al. who, when analyzing rabbits, observed that the fluid present in the embryo's yolk sac had a protein profile similar to that of maternal plasma. Among these proteins, maternal immunoglobulins were identified that crossed the embryonic yolk sac, suggesting the passive transfer of maternal immunity to the fetus [20].

Transplacental immunity is characterized as passive immunization, in which maternal immunoglobulin G (lgG) is transferred to the fetus and remains in circulation for the first few months of the infant's life. This process contributes to reducing the incidence of infections by specific pathogens, benefiting both healthy newborns and those whose mothers have pathological conditions that could compromise the newborn's immune response^[19].

The development of the neonatal immune system is strongly influenced by the intrauterine period and breastfeeding. After birth, breast milk plays an essential role in strengthening the baby's immunity, providing a wide range of immune components, such as immunoglobulin A (IgA), immune cells and bioactive factors, which help protect against pathogens and the proper development of the defense system. Secretory IgA, for example, acts by coating the mucous membranes of the gastrointestinal and respiratory tracts, preventing the adhesion of pathogenic microorganisms and reducing the risk of infections^[21].

Colostrum, the first milk secretion produced by the mother after giving birth, has a highly immunological composition and is rich in immunoglobulins, antimicrobials, immunomodulatory substances, anti-inflammatory agents and growth factors. Its high viscosity and high protein concentration guarantee essential nutrition for the newborn, as well as strengthening its immune defenses. The transition period from colostrum to mature milk occurs up until the seventh day postpartum, according to the Ministry of Health^[22].

Mature milk, produced from the 15th day of the baby's life, retains some of the immune components of colostrum, but has a more balanced composition, with adequate amounts of proteins, sugars, vitamins and minerals. It also contains growth-regulating hormones and immune factors that play an essential role in the baby's healthy development and protection against infectious diseases. Among these components are antioxidants and quinones, which help prevent oxidative damage and bleeding disorders, while secretory IgA coats the immature digestive tract, reducing the adhesion of bacteria, viruses and parasites ^[7].

The growth factors present in breast milk contribute to the maturation of the infant's systems, including intestinal, vascular, nervous and glandular development. Lactoferrin, one of the main immunological agents in milk, has antimicrobial, immunomodulatory and trophic functions, promoting intestinal growth and defense against infections. Lysozyme, another essential enzyme, acts in bacterial lysis and in regulating the immune response ^[23].

In addition, casein, a protein present in breast milk, protects the intestinal microbiota and facilitates digestion. The cytokines present in milk mainly perform anti-inflammatory functions, promoting the growth of epithelial cells and suppressing unnecessary lymphocyte functions. The presence of antioxidant enzymes prevents lipid oxidation, protecting cells and tissues from damage structural^[23].

Studies show that the duration of exclusive breastfeeding directly influences the child's metabolic development. Early interruption of exclusive breastfeeding, before the age of four months, increases the risk of overweight and obesity, as it is associated with a lower body mass index (BMI) and less healthy eating habits in adulthood ^[24].

In addition to immune protection, breast milk also contributes to the prevention of chronic diseases throughout life. Evidence shows that breastfed children have a lower risk of developing diabetes, obesity and metabolic disorders. This protective effect is related to the presence of leptin in breast milk, a hormone responsible for regulating satiety and energy metabolism, promoting better control of body weight from the earliest stages. years of life^[25].

Breastfeeding is an essential pillar for the newborn's immune health, providing not only essential nutrients, but also a range of bioactive components that strengthen the immune system, promote tissue development and protect against infections and chronic diseases throughout life. The transfer of maternal immunoglobulins, especially secretory IgA, combined with the presence of antimicrobial factors, antioxidants and immune modulators, gives breast milk an irreplaceable role in the maturation of the baby's defense system ^[26].

In addition, the benefits of breastfeeding extend beyond childhood, reducing the risk of metabolic diseases and promoting healthier eating habits in adulthood^[27]. This reinforces the importance of promoting and encouraging exclusive breastfeeding in the first months of life as a fundamental strategy for public health, positively impacting the population's quality of life in the long term^[28].

IMMUNOLOGICAL BENEFITS OF EX-CLUSIVE BREASTFEEDING FOR MA-TERNAL HEALTH

Women's perception of exclusive breastfeeding (EBF) is shaped by multiple factors, especially their prior knowledge, personal and cultural experiences. Evidence shows that women with a higher level of education tend to breastfeed for longer periods of time, since they have a greater understanding of the multiple benefits of breastfeeding for both the baby and their own health ^[29].

However, in addition to schooling, other variables such as marital status, family support, socio-economic conditions and access to information also have a direct influence on the decision and duration of breastfeeding. In order

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to achieve the ideal lactation time recommended by public health guidelines, it is essential that the puerperal woman has a structured support network. This support should include help with domestic demands and making her work routine more flexible, allowing her to dedicate herself fully to breastfeeding at the beginning of motherhood ^[29].

During the lactation period, the baby's sucking on the mother's nipple stimulates the release of oxytocin, a hormone that plays a central role in the process of uterine involution. Oxytocin promotes contractions of the uterus, favoring its return to its pre-pregnancy size and position, as well as acting to prevent complications such as postpartum hemorrhage and anemia. Notably, when in high concentrations in the mother's blood, this hormone can raise the pain threshold, relieving the discomfort common in the first days of the puerperium. Thus, oxytocin not only facilitates a woman's physical recovery, but also contributes to her emotional well-being [28].

Another relevant physiological effect of exclusive breastfeeding is the temporary suppression of ovarian activity. The high levels of prolactin during lactation inhibit the pulsatile secretion of gonadotropin-releasing hormone (GnRH), resulting in the interruption of the ovulatory cycle [30]. This condition, known as lactational amenorrhea, can provide natural protection against a new pregnancy, with efficacy of approximately 96% during the first six months postpartum, as long as breastfeeding is truly exclusive and on demand^[31].

From the point of view of maternal mental health, several studies have shown that women who do not start or maintain breastfeeding are at greater risk of developing postpartum depression. Breastfeeding acts as a regulator of the hypothalamic-pituitary-adrenal axis, modulating the release of cortisol throughout the day. Stability in the levels of this hormone is strongly associated with a reduction in depressive symptoms, as well as promoting a greater sense of emotional connection between mother and baby ^[32].

Lactation also has a proven protective effect against breast cancer. It is estimated that the risk of developing this neoplasm can be reduced by more than 4% among women who breastfeed. This is mainly due to the reduction in circulating estrogen levels during breastfeeding, which results in less cell proliferation and, consequently, less chance of mutations in breast tissue. In the long term, this factor may represent an important preventive strategy for women's health ^[33].

With the growing incidence of metabolic diseases such as type 2 diabetes mellitus, it is becoming increasingly important to highlight the role of breastfeeding in maternal metabolic regulation ^[34]. The oxytocin released during lactation has been shown to reduce insulin resistance, contributing to a better glycemic balance. Studies show that women who have never breastfed have an up to 50% higher risk of developing type 2 diabetes, even when compared to those who have breastfed for short periods ^[35].

Given all these aspects, it can be said that breastfeeding has a significant and multifactorial influence on women's health after childbirth. As well as contributing to immediate physiological recovery, it provides long-lasting protective effects against various physical and mental illnesses. For this reason, it is essential that pregnant women are given ample information about the benefits of breastfeeding, not only for the baby, but also for themselves. At the same time, it is essential to ensure that mothers' individual choices are respected, valued and welcomed by the entire health team and support network, promoting more humane, woman-centered care [36].

Finally, it is essential to reinforce

that breastfeeding is a practice that strengthens the emotional connection between mother and child, as well as favoring the overall health of both. When mothers are well-informed and feel supported, they are more likely to continue breastfeeding for longer periods, which results in lasting positive impacts. Recognizing the immunological, hormonal, metabolic and emotional benefits of breastfeeding for women should be part of all maternal and child health promotion strategies ^[37].

CONCLUSION

In view of the above, although the benefits of breastfeeding are widely recognized and backed up by scientific evidence, its practice and dissemination have not yet reached satisfactory levels in today's society. As well as promoting the healthy development of the baby, breastfeeding plays an essential role in the mother's physical and emotional health, contributing to the prevention of various diseases and disorders. Because of its importance, it is considered a fundamental human right and should be encouraged and protected by public policies and multidisciplinary actions. In this sense, it is essential that pregnant and breastfeeding women have access to quality information and adequate support throughout pregnancy and the puerperium.

Nursing professionals, as strategic agents in prenatal care, must identify the social and family context of these women, as well as their levels of knowledge, in order to promote effective educational interventions. The promotion of breastfeeding is the practice of commitment to equity, the well-being and valuing motherhood.

In this sense, it is important to carry out new studies that deepen the understanding of breastfeeding, addressing issues that have not been mentioned before, such as sociocultural, socioeconomic and emotional factors, as well as the impact of public health policies, the role of health professionals in supporting mothers, and the structural barriers that can hinder the practice of breastfeeding. It is also essential to investigate how different regional and cultural realities interfere with breastfeeding practices, as well as the effect of the use of infant formula and the dissemination of misinformation.

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