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BREASTFEEDING AND EARLY CHILDHOOD CARIES

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ABSTRACT

Breastfeeding is the gold standard for children nutrition, providing essential nutrients, immunological protection, and supporting optimal growth and development. However, its potential relationship with early childhood caries (ECC) has been debated, particularly in cases of prolonged or nighttime breastfeeding.

This documentary research tries to determine whether breastfeeding is a risk factor for ECC, identify the age at which it may become associated with caries, and establish which breastfeeding patterns carry the highest risk.

This study focused on children aged 0–5 years, breastfeeding exposure, comparison with artificial or mixed feeding, and ECC outcomes.

After applying inclusion and exclusion criterias, 26 relevant studies were included, including cross-sectional studies, observational studies, systematic reviews, and meta-analyses.

This investigation showed that breastfeeding alone is not a direct risk factor for ECC. The risk increases when combined with prolonged duration beyond 12–24 months, nighttime feeding, co-sleeping, poor oral hygiene, or cariogenic dietary habits. ECC prevalence increases after the eruption of primary teeth, because fermentable carbohydrates from milk may remain on tooth surfaces during sleep when salivary flow is reduced. Breastmilk's immunological and antimicrobial components provide protective effects, suggesting low intrinsic cariogenic potential.

In conclusion, breastfeeding should be promoted for its nutritional and immunological benefits, while ECC prevention requires parental education, early oral hygiene practices, and regular dental checkups. The multifactorial nature of ECC show that behavioral and preventive strategies are key, rather than avoiding breastfeeding.

KEYWORDS

Dentistry, Pediatric dentistry, Breastfeeding, Breastmilk, Early childhood caries.

RESUMEN

La lactancia materna es el estándar de oro para la nutrición infantil, ya que proporciona nutrientes esenciales, protección inmunológica y favorece un crecimiento y desarrollo óptimos. Sin embargo, su posible asociación con la caries de la primera infancia (CPI) ha sido objeto de debate, especialmente en casos de lactancia prolongada o lactancia nocturna.

Esta investigación documental tiene como objetivo determinar si la lactancia materna es un factor de riesgo para la CPI, identificar la edad a partir de la cual podría asociarse con la aparición de caries y establecer qué patrones de lactancia presentan el mayor riesgo.

Este estudio se centró en niños de 0 a 5 años, la exposición a la lactancia materna, la comparación con la alimentación artificial o mixta y los resultados relacionados con la CPI.

Tras aplicar los criterios de selección, se incluyeron 26 estudios relevantes, que abarcan estudios transversales, estudios observacionales, revisiones sistemáticas y metaanálisis.

Esta investigación mostró que la lactancia materna por sí sola no es un factor de riesgo directo para la CPI. El riesgo aumenta cuando se combina con una duración prolongada más allá de los 12–24 meses, la alimentación nocturna, el colecho, una higiene oral deficiente o hábitos dietéticos cariogénicos. La prevalencia de la CPI aumenta después de la erupción de los dientes temporales, ya que los carbohidratos fermentables de la leche pueden permanecer sobre las superficies dentarias durante el sueño cuando el flujo salival se reduce. Los componentes inmunológicos y antimicrobianos de la leche materna proporcionan efectos protectores, lo que sugiere un bajo potencial cariogénico intrínseco.

En conclusión, la lactancia materna debe promoverse por sus beneficios nutricionales e inmunológicos, mientras que la prevención de la CPI requiere educación parental, instauración temprana de hábitos de higiene oral y revisiones dentales periódicas. La naturaleza multifactorial de la CPI muestra que las estrategias conductuales y preventivas son clave, en lugar de evitar la lactancia materna.

PALABRAS CLAVE

Odontología, Odontopediatría, Lactancia materna, Leche materna, Caries de la primera infancia.

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1. INTRODUCTION

Historically breastfeeding had been practiced since forever as it was the most natural way to feed a baby. In the last century new feeding methods have been introduced such as artificial milk, allowing the mother to feed her baby with only breastmilk, by mixing breastmilk and artificial formulas or exclusively with artificial milk. With the appearance of these new methods, it has also been suggested that a link exists between the way of feeding a child and the increase of the appearance of early childhood caries (ECC) (1).

Breastfeeding consists in feeding a child with milk coming out from the breast. This way the child receives all the energy and the factors for a correct development of the different body's systems. With time other feeding methods were found and some controversies appeared regarding the relationship between breastfeeding and ECC development (2).

1.1 Knowledge about breastfeeding

The concept of breastfeeding represents the action of feeding a child by making him pump on the mother's breast or on a baby bottle from which mother's milk comes out (2). This phenomenon occurs thanks to suction and hormones such as prolactin which stimulates mammary tissue secreting the milk, and oxytocin stimulating myoepithelial cells leading to muscle contractions making the milk flowing out from breast (3).

There are different types of breastfeeding and way to administer milk. Breastfeeding methods are wide, among all of them, three presents only nutritive objectives which are: exclusive breastfeeding, predominant breastfeeding and partial breastfeeding. Among those, the prevalence of each generally depends on children's age. Exclusive breastfeeding is considered as a gold standard in newborns feeding, it consists in feeding a baby only with breastmilk and no other food. It usually should be performed during the first 6 months of life. The second type found is the predominant breastfeeding consisting in feeding a child with breastmilk and other drinks such as water or water-based beverages. In general, this type of feeding method is also often performed in children from 0 to 6 month. Finally, there is the Partial breastfeeding which is a method indicated in children between 6 month and 2-years-old where the child is fed with solid food but still receives breastmilk as a complement (4,5).

Usually, the way to administer breastmilk can be done directly by suction on the breast or through baby bottles after expressing milk thanks to electric or manual pump (6).

1.1.1 Breastmilk

Breastmilk composition is quite complex as it presents a wide variety of nutrients. Water is the main component of breast milk but if we exclude it, macronutrients are found in larger amount compared to micronutrients (7).

Among these macronutrients we can find carbohydrates, proteins and lipids. The ones found in the largest proportion are carbohydrates ensuring the correct development of gastrointestinal physiological functions and allow the maintenance of intestinal microbiota. One of the most abundant carbohydrates present in breastmilk is the lactose, being a source of glucose for the newborn, and oligosaccharides. Most of the adult ingest carbohydrates in form of glucose but not newborns, as they have no mature gastrointestinal tract, they ingest carbohydrates in form of lactose (8,9). Regarding the lipids, their role is to bring energy and to favor the development of the central nervous system as it is the one bringing most of the nutrients. They are mainly present in form of triglycerides. These triglycerides included in breastmilk are the lineolic and alpha-lineolic acid, being important in the production of arachidonic acid and eicosapentaenoic acid which are the precursors to docosahexaenoic acid (DHA) that cannot be produced by the body; It is mainly acquired through breastfeeding (8,9).

The last macronutrients found in the breastmilk are the proteins. The ones found in breastmilk are the whey, the casein, a micellar quite hard to digest and some peptides. The whey are liquid components easy to digest; some such as alpha-lactalbumin aims to ease the production of lactose and amino acids but also favor minerals absorption. Other whey's proteins like lactoferrin reduces the risk of propagation of some pathogenic bacteria and secretory Immunoglobulins A (IgA) keeping intestinal mucosa safe and eliminating bacteria. To summarize whey's role is to produce lactose and amino acid, favor minerals absorption and protect intestinal mucosa against pathogens. All these proteins allow the functions and the organization of body's cells and are also an important factor for the development, the growth and the function of the baby's essentials systems (8,9).

The breastmilk is also rich in micronutrients such as vitamines A, B1, B2, B6, B12, D, and iodine. Other vitamins are essential for the good development of the newborn but are only found in small amount in breastmilk like vitamin K and D. Among minerals we find more than 20 different varieties like iron, calcium, phosphorous, sodium, potassium, magnesium, chloride, manganese, iodine, selenium, cooper and zinc. Unlike vitamins, minerals have a high bioavailability in human breast milk which means that we do not need to administer complement while breastfeeding. It can be recommended to administer iron since 4-6 month and then give it through solid food as the minerals amount in breastmilk decreases as lactation progress (8).

Hormones play a role in regulation of many systems. The ones found in breastmilk are leptin and ghrelin controlling the energy conversion, body composition and appetite. We also find parathyroid hormone (PTH), insulin, nesfatin, obestatin. Finally, there's the adiponectin suppressing the inflammation and regulates the metabolism. Some studies shown that adiponectin reduces the incidence of obesity when the child will grow (7,8).

Growth factors (GF) act on several body aspect. Among them we can find:

- **Epidermal GF and erythropoietin**: influence intestinal system by allowing mucosa healing and repair and avoiding anemia.
- **Vascular endothelial GF**: act on vascular system and regulate vessels formation (angiogenesis).
- **Ciliary neurotrophic GF**: allow nervous system development by promoting neuron survival and outgrowth.
- **Insulin GF**: act on endocrine systems by stimulating erythropoiesis (7,8).

Concerning the immunological factors provided by the breastmilk, we can find several protecting the newborn against inflammations and infections:

- **Lysozymes and lactoferrin**: enzymes acting together to allow the degradation of some bacteria.
- **Immunoglobulins** (Ig): -IgA are the most important as they protect the mucous membrane, they are the most abundant and owes crucial biological properties. Its action is essentially local, and they prevent the adhesion of pathogens.
  -IgM are the second most abundant Immunoglobulins.They act against bacteria and viruses infecting the mucosa.
  -IgG. They are found in small proportions. Their opsonization activity trigger complement systems to protect mucosa.
- **Lactoperoxidase**: enzyme whose aim is to accelerate the oxidations of bacteria.
- **K-casein**: Protect gastro-intestinal mucosa from *H. pylori*.
- **Alpha-lactalbumin**: Act against some bacteria such as *E. coli, staphylococcus, streptococcus, C. albicans and K. pneumoniae*.
- **Haptocorrin**: impedes bacterial proliferation when the body faces an infection.
- **Cytokines and chemokine**: They are pro-inflammatory cytokines. Their role is to displace immune cells to the site of the infections

- **Osteoprogeterin**: enhance the apoptosis of some cells and allow the development of newborns immunity (10,11).

1.1.2 Breastmilk stage

Breastmilk compositions changes over time to reach all the needs of the newborn. It exists three types of breastmilk and each one allow the correct baby's growth and development (12).
First, we have the colostrum being the first type of milk produced by mammary glands. Characterized by its thickness and its yellowish color, this milk type is the richest in proteins and zinc and the poorest in lipids and carbohydrate making it easier to digest. Its high concentration in protective factor makes this milk the most potent immune booster of all breastmilk stages. The body usually start to produce this milk during pregnancy around the second trimester and the first few days after pregnancy (11).
Then we have the transitional milk replacing the colostrum after 2-5 day postpartum and being quite like it. This milk is proteins, lipids, lactose and vitamin rich. Its aspect becomes gradually thinner and whiter, the amount of production increases and last until being replaced by mature milk excretion(11).
Finally, the mature milk production starts from the second week postpartum. This stage is subdivided in two sub-groups according to the feeding period (at the beginning or at the end of the feeding). At the beginning of the feeding, the milk, called Foremilk, has a thin and bluish aspect; it's rich in lactose and calm the baby's thirst. At the end of the feeding, the milk is called Hindmilk. it's creamier, richer in lipids and provides nutrient required by the baby (13).

1.1.3 Milk benefits

Thanks to its composition, the breastmilk is known to owns a lot of benefits that sometimes can't be brought by artificial milk formulas. Breastfeeding benefits not only to the baby but also to the mother. All immune factors and its rare composition both helps in the development of sensory and cognitive abilities but also reduce de risk to develop infections like ear infections or stomach bugs and chronic disease such as asthma, type 1 diabetes, obesity, cardiovascular disease and sudden infant death syndrome (SIDS) (11). As we said previously breast milk bring a bunch of nutrients helping in growth and its composition varies according to baby's nutritional need. When a newborn is breastfed, his mother shares her antibodies with him strengthening his immune system. In addition to the health benefits, breastfeeding is also convenient as the baby can be fed at any time and in any place. Concerning the benefits to the mother, it was proven that breastfeeding reduces the incidence of malignancies like breast and ovarian cancer, osteoporosis, obesity, hypertension and Type 2 diabetes (14). It is usually recommended to breastfeed the child at least 6 months to improve his

development and growth but there is a new trend consisting in extending the breastfeeding when the newborn become a child. This is a controverted practice because on the one hand some are against this due to social stigma and the parenting attachment to which it leads. On the other hand extending breastfeeding leads to health and emotional benefit even though world health organization (WHO) recommend it for 2 years although in some culture other than in western countries it is common to breastfeed children until 5-7 years old. (15,16).

1.2 EARLY CHILDHOOD CARIES

1.2.1 Definition of early childhood Caries (ECC)

Early childhood caries corresponds to the presence of one or more tooth surfaces with or without a cavity, missing or filled in children under 6 years old that can seriously impact children's lives and further primary and permanent teeth eruption (17–20).

1.2.2 ECC Etiology and risk factors

ECC are caused by several factors. A cariogenic environment favorize the dissolution of the enamel. This environment can be caused by some cariogenic microorganisms; the main ones are the *streptococcus mutans* and *sobrinus* but also *Actinomyces gerencseriae* which initate the appearance of the lesions. It is also common to find lactobacilli that participate in the progression of the caries but not in its initiation.

One of the bacteria found in deep caries are the *Bifidobacterium*.

These bacteria can be transmitted vertically from the mother to the child through saliva depending on the oral hygiene habits of the mother which increases the risk of having an abnormal amount of *S.Mutans* in the newborn saliva. The bacteria metabolize the sugar and the starch present in the plaque producing an acidic environment favoring the enamel dissolution; that is how caries appear (18,19).

Another risk factor for the ECC development is the diet and the feeding pattern. A diet rich in fermentable carbohydrates feeds the bacteria present in the saliva and allow them to produce acid decreasing saliva's pH and increasing the risk to develop early childhood caries. For instance, the cow milk contains a few amounts of lactose and a lot of minerals showing a lower ability to produce caries (19).

Host and teeth susceptibility also play a role in the formation of ECC. As enamel is an inorganic tissue, it gets a defense mechanism through the saliva thanks to its remineralization ability through its buffer system, crevicular fluid, IgA and exposure to fluoride. Any host that has a defect in one of the previous elements is more susceptible to develop ECC. Furthermore a premature birth, a low birth

weight or a child with some developmental delay can show enamel hypoplasia being determinant in the formation of carious lesions, (18,19).
ECC is a multifactorial disease. It can be influenced by various association of different factors. Among them we find biological, behavioral and socioeconomic factors. Indeed, ECC is related to the dietary sugar intake, the poor oral hygiene, an early bacterial colonization (appearing right after eating) and the limitation in the access to oral health care (21).
Concerning the socio-economic statue a child growing in an environment in which the access to dental cares is difficult due to the consultations prices or accessibility is more prone to develop ECC. Indeed the minorities or uniparental families shown higher ECC incidence (19).

To reduce the incidence of ECC the International association of pediatric dentistry (IAPD) recommend to avoid sugar in children younger than 2 years old and reduce it in older children, teach and inform the parents, health professional and general community about ECC and breastfeeding, brush the children teeth two times per days with a tooth paste containing a fluoride amount adapted to the age of the child and finally they recommend early dental intervention with prevention and control at an early age (20).
Concerning the World health organization (WHO) the recommendations are quite similar as IAPD ones as it recommend an early primary prevention, a Carie risk assessment based on the child and the caregiver factors, the promotion of a primary, secondary and tertiary prevention, the parents education, a dental follow up since the age of 1 years old, the integration of an oral health routine at an early age, and finally it recommend the use of effective interventions with the use of dental sealant, dental fluoride application and with minimally invasive restoration (22).

Regarding the feeding method there is a controversy regarding co-sleeping and night breastfeeding effect on the oral health of the babies. Co-sleeping is a convenient method in which the baby sleep with his mother in the same bed allowing the mother to feed her baby during nighttime. This method ensures more sleeping time to the mother and reduces anxiety in the mother and the child. This practice is more often used in newborns and babies but some mothers use to continue the co-sleeping and breastfeeding in older children as, theoretically, there is no real age limit (21,23).

2-OBJECTIVES

The main objective of this document is to determine whether breastfeeding is a risk factor for ECC.

We establish the following secondary objectives:

-To identify the age at which the breastfeeding becomes a risk factor for the onset of ECC.

-To establish which type of breastfeeding carries the highest risk of ECC onset.

3- MATERIAL AND METHOD

This documentary research project about breastfeeding and early childhood caries aims to explore, inform, prevent, and manage the appearance of this disease.

First, a documentary review has been performed to define the keywords of the subject, but also to understand the way of appearance of the ECC and its link with the breastfeeding. Databases used to perform this research were mostly PubMed or Medline with an access thanks to the CRAI library platform of Universidad Europea of Madrid. To select the most relevant articles we tried to seek articles published less than 10 years ago to get the most accurate informations. Articles that were not fully available and sources such as website were discarded to avoid getting non-official Data's.

The following PICO was used to find information.

P: Children aged from 0 to 5 years old.

I: Breastfeeding (exclusive or prolonged).

C: Artificial feeding or shorter duration of breastfeeding.

O: Presence of early childhood caries or S-ECC.

Below are the inclusion and exclusion criteria that allow for the most accurate and relevant selection in relation to this subject.

Inclusion criteria:

1. Population type

Children aged from 0 to 5 years old (or 0 to 71 months).
Studies evaluating early childhood caries (ECC) or severe caries (S-ECC).

2. Exposure/Intervention

Exclusive, predominant, partial, or prolonged breastfeeding.
Studies specifying the duration or pattern of breastfeeding.

3. Comparators

Artificial feeding (formula).
Mixed feeding.
Different durations of breastfeeding (e.g., <12 months vs. ≥12 months).
No breastfeeding.

4. Type of outcomes

Presence or incidence of early childhood caries.
Clinical diagnosis according to ICDAS, WHO, CEO/DMFT criteria, or equivalent diagnoses.
Measures of association : RR, OR, HR, prevalence, or incidence.

5. Type of study

Observational studies :

- Cohort studies
- Cases and controls studies
- Cross-sectional studies
- Clinical trials (unlikely in this topic but included).
- Systematic reviews only for reference review (not for data extraction).

6. Language

Studies published in English, French or Spanish

7. Availability

Studies with accessible full text.

Studies and articles with a publication date from at least 2015

Exclusion criteria:

1. Irrelevant population

Studies in :

Children over 5 years of age.

Adolescents or adults.

Populations with special conditions that cannot be generalized (e.g., rare syndromes) unless justified.

2. Irrelevant exposure

Studies that do not distinguish between breastfeeding and formula feeding.

Research that does not describe the type, exclusivity, or duration of breastfeeding.

3. Irrelevant results

Studies that do not evaluate early childhood caries.

Studies that report only:

- Oral hygiene
- Fluorosis

Eating habits unrelated to breastfeeding

Other dental indicators unrelated to caries

4. Types of studies excluded

Expert opinions, editorials.

Letters, case reports.

Animal studies.

Narrative (non-systematic) reviews.

Articles published more than 10 years ago

Studies not available entirely even if the information found were relevant

Website being not scientific articles

5. Insufficient methodological quality (optional)

(Depending on the protocol, may be excluded after the quality assessment)
High risk of bias according to Newcastle-Ottawa, JBI, or other tool.
Studies without sufficient data to calculate measures of association.

6. Duplicates

Duplicate publications or analyses of the same cohort studies without new data.

4-RESULTS

Initial articles research was performed through electronic Databases such as “Medline”, “Pubmed” using keywords such as “breastfeeding” or “breastmilk” or “early childhood caries” or “risk factors” or “pediatric dentistry”.

More than a thousand of articles were found.

To narrow our research, articles being older than ten years ago, documents being not entirely available, articles being not in English, French or Spanish and with non-relevant conclusion were discarded. 35 articles were found.

After reviewing those documents, we focused on the ones being the most helpful to cover our problematic and to get the most accurate informations, removing articles with insufficient data and lack of clearness, focusing on children between 0 and 5 years old being breastfed, fed exclusively with infant’s formula or combining both breastmilk and infant’s formula. 26 scientific articles were kept and analyzed.

The included studies were published between 2015 and 2026. Among them we can mostly find cross-sectional studies and narrative reviews (meta-analysis) but it also contains clinical epidemiological studies, observational-population-based studies, integrative literature review, perspective articles, laboratory based observational study, consensus declarations, commentary review and systematic reviews. These sources allow us to understand clearly breastfeeding, the milk composition, the mechanisms of appearance of early childhood caries (ECC) and the risks factors contributing to their development.

8 of them focused mainly on the biological mechanisms and were based on the immunological and the protective factors of breastfeeding, 6 focused on the prevention strategies and guidelines, 6 aimed to show the risk association between breastfeeding and ECC and 6 focused on the distribution of ECC and breastfeeding.

4.1.Table presenting all the articles used that presente primary evidences

AUTHORS	**YEAR**	**TYPE OF STUDY**	**SUBJECT OF THE ARTICLE**
Martha K et al	2025	Cross-sectional, clinical epidemiological study	Association between infant feeding practices and early childhood caries (ECC)

Rasmussen KM et al	2017	Commentary/perspective article	Conceptual discussion on breastfeeding terminology and definitions
Bermejo-Haro MY et al	2023	Narrative review	Hormonal physiology and immune components of breastmilk
IAPD Bangkok Declaration	2019	Policy statement/consensus declaration	Global policy framework for prevention on ECC
WHO Implementation Manual	2020	Guideline/ public health declaration	Strategies for ending childhood dental caries
Bürger B et al	2022	Observational population-based study	Factors associated with exclusive breastfeeding duration (SUKIE study)
Zielinska MA et al	2017	Cross-sectional study	Breastfeeding knowledge and exclusive breastfeeding in first 6 month
Kotowski J et al	2020	Integrative literature review	Bottle-feeding as an infant feeding modality
Carillo-Díaz M et al	2021	Cross-sectional study	Oral-health-related quality of life and co-sleeping
Carillo-Díaz M et al	2021	Cross-sectional study	Impact of breastfeeding and co-sleeping on ECC

Talbert JA & Townsend SD	2025	Narrative review	Human milk as a complex product
Kim SY & Yi DY	2020	Narrative review	Components of human breastmilk (macronutrients, microbiome, microRNA)
Yi D & Kim S	2021	Narrative review	Composition and function of human breastmilk in health
Palmeira P & Carneiro-Sampaio M	2016	Narrative review	Immunology of breastmilk
Fron A & Orczyk-Pawitowicz M	2023	Narrative review	Immunological quality of breastmilk in maternal overweight/obesity
Akhter H et al	2020	Laboratory-based observational study	Immunoglobulins content in colostrum and mature milk
Petersohn I et al	2024	Systematic review	Maternal diet and human milk composition
Zheng SW et al	2025	Systematic review & meta-analysis	Breastfeeding and reduced maternal hypertension and diabetes risk
Sens S	2022	Commentary/brief review	Benefits, barriers, and predictors of breastfeeding
Lyons KE et al	2020	Narrative review	Breastmilk microbiome and benefits for infant health

Avila WM et al	2015	Systematic review & meta-analysis	Breast and bottle feeding as risk factors for dental caries
Anil S & Anand PS	2017	Narrative review	ECC prevalence, risk factors and prevention
Dutta S & Mohapatra A	2023	Narrative review	Etiology, prevention, and management of ECC
Alexaki F et al.	2025	Systematic review	Evaluation of whether breastfeeding increases the risk of ECC
Shrestha SK et al.	2024	Systematic review and meta-analysis	Association between breastfeeding practices and the prevalence of ECC
Blanco LG et al.	2021	Observational study	Analysis of the potential relationship between breastfeeding and ECC

5-DISCUSSION

5.1 Objectives of the study

The objective of this documentary research is to determine whether breastfeeding is a risk factor for the onset of ECC. The aim is to identify the age at which it may become a risk factor and establish which type of breastfeeding carries the highest risk for the onset of ECC.

Recently, it has been proven that ECC and breastfeeding have a complex relationship. Breastfeeding is highly recommended as it provides nutritional, immunological, and growth factors, but its role in early childhood caries remains controversial due to the multifactorial etiology of ECC (7–10,15,18–20,22).

The definition of breastfeeding has evolved with time and now include concepts such as prolonged breastfeeding, mixed breastfeeding and exclusive breastfeeding. These concepts brought some controversies regarding the link between breastfeeding and ECC (2).

5.2 Breastfeeding: a risk factor for ECC onset

It was supposed that Breastfeeding was associated to ECC but the relationship between both is more complex as it was revealed that breastfeeding alone is not necessarily a risk factor for ECC onset. ECC caused by breastfeeding can appear when it is associated to other factors and not only with breastfeeding alone.

To assess this relationship, three different variables are considered (17,24,25).

1- whether the child is breastfed or not (1).
2- the duration of the breastfeeding (2).
3- the nighttime breastfeeding (3).
4- the prevalence of early childhood caries (20).

The documents used show that there is no real association between breastfeeding itself and ECC. Indeed, when comparing breastfed and non-breastfed babies, there is no significant difference regarding ECC prevalence (26). Several studies conclude that breastfeeding become a risk factor when it is associated with certain feeding patterns or other predisposing factors such as poor oral hygiene, increased feeding frequency or prolonged exposure to milk carbohydrates. Martha et al. identified that breastfeeding for a long period of the child life show an increase in the prevalence of ECC (1). Concerning Carillo-Díaz et al., they show that an increase of ECC amount is observed in children being breastfed at night or whose mother practices the co-sleeping (21). Regarding Avila et al: they highlighted that, in some cases, breastfed and non-breast fed children may present an increases in the prevalence of ECC especially when the babies are fed at nighttime regardless of if they are bottle or breast fed (17). It describes bottle-feeding as another feeding method that may also have a role in the increase of the risk of ECC when it is prolonged or done at night, suggesting

that the frequency of feeding has a bigger impact than the feeding method (6). Finally, Alexakis et al. and Shrestha et al. both concluded that breastfeeding alone is not a risk factor for ECC onset but when it is associated with a prolonged duration of breastfeeding and with some specific risk factors the caries prevalence is increased (24,26).

These articles put in evidence that breastfeeding alone is not a risk factor for ECC but when it is associated with others behavioral patterns promoting the bacterial fermentation and the plaque retention, it contributes to the increases of caries onset. Indeed, when children are fed for a prolonged duration and breastfed at nighttime, they show a higher prevalence of ECC. Other factors that have an indirect influence on ECC development are the parental education, the socioeconomic status and the feeding practice itself. They can all promote a prolonged feeding pattern of the children and therefore an increase in ECC prevalence (4).

5.3 Age at which breastfeeding may become a risk factor

Another factor able to influence the appearance of ECC is the age of the children. Some author highlighted that a child being breastfed over a certain age is more prone to develop ECC (25).

- **0 to 6- months-old**: During the first six month of life of the baby, the literatures state that breastfeeding does not represents a risk factor for ECC as at this age, the newborn usually does not have any teeth present in mouth. On the other hand, the exclusive breastfeeding is highly recommended for its nutritional and immunological benefits in children (5,15). Breastmilk decreases the risk of infectious diseases development and promote the correct development of the immunity as it contains bioactive components, immunoglobulins, antimicrobial proteins, and beneficial microbiota (7–10,16).

  in addition, breastfeeding during this period of life is considered as a protective factor for the development of the child as breastmilk composition allow the correct development of the mucosal immunity and of the oral microbiota. It can also be stated that an early life feeding pattern can influence the microbiota composition influencing the future susceptibility to cariogenic bacterias (8,9,16).
- **6- to 12-month-old**: After the eruption of the primary tooth, we observe a potential increase in the risk of ECC onset. Indeed, teeth become an ideal surface for bacterial retention, colonization and fermentation of carbohydrates being a macronutrient widely present in milk. During this stage, the baby usually receives complementary food while being breastfed being able to increase the exposition to cariogenic foods, in addition, if the breastfeeding is performed at night we have a situation where milk and food carnohydrates remain on teeth surface and can’t be removed due to the decrease in the salivary flow creating a favorable

environment for bacterias proliferation, increasing the acid production and therefore the ECC development (18,19,21).

- **12- to 24-month-old**: Shrestha et al. and Alexaki et al. showed that the ECC prevalence increases significantly in children being usually breast fed at night (24,26). In this period, breastfeeding that is frequent and for a long period of time can increase the likelihood of ECC. It is mainly due to the decrease of the saliva flow at night so the mouth is less able to wash away sugars and food residues promoting the fermentation of the carbohydrates allowing the formation of ECC (1,24,26).

Nevertheless, those literatures highlight that this increase of ECC prevalence is highly associated with the prolonged feeding, dietary and oral hygiene patterns and is not only related to breastmilk. The WHO states that the ECC is the consequence of a combination of a prolonged exposure to fermentable carbohydrates present in the milk with a poor oral hygiene promoting cariogenic bacteria colonization (20,22).

5.4 Breastfeeding patterns and caries risk

The impact of breastfeeding patterns on ECC development is a factor studied by several authors. Some of them consider that not all the ways to breastfeed has the same impact on the primary dentition and ECC onset.

- **Exclusive breastfeeding**: Avila et al. state that in babies being younger than 6 months old, it is considered as risk free and it is highly recommended as it allows the ideal development of the child immune system and brings most of the nutrients being important for the newborn growth (17).
- **Prolonged breastfeeding**: Shrestha et al. show that the association of a prolonged breastfeeding with nighttime breastfeeding is the feeding method being the most commonly associated with ECC and showing the highest prevalence of early childhood caries (26).

The saliva has a buffer capacity allowing the remineralization and natural teeth cleaning. Nevertheless, while sleeping, the body suffer hyposalivation which reduces the buffer capacity of the saliva. The consequence of this hyposalivation is the reduction of the removal of milk carbohydrates having a high fermentation capability. While studying the literature performed by Dutta and Mohapatra we observe that the combination of cariogenic bacterias, fermentable carbohydrates, host teeth susceptibility and time during which the bacterial deposit and the carbohydrates stay on tooth surface play a major and critical role in ECC pathogenesis (19).
When this fermentable carbohydrate remains for a long time on the teeth surfaces, the cariogenic bacterial activity is promoted and ECC appears (18,19,26).

Regarding Co-sleeping, it is a method controverted as on the one hand it facilitates the nocturnal feeding but on the other hand it can be associated to an increase in ECC prevalence. However, co-sleeping alone does not necessarily lead to caries apparition. With a correct oral hygiene routine after each breastfeeding time, the ECC risk significantly decreases (21,23). All these elements allow us to suspect that the feeding frequency and the lack oral hygiene have an important role in ECC appearance.

5.5 Breastmilk biological properties

The composition of the milk is a factor that must be considered in the assessment of cariogenic capability of breastmilk. Kim SY & Yi DY consider that breastmilk is a complex biological fluid in which it can be find immunoglobulins, immunological proteins, oligosaccharides and microbiota. All of them play an important role in the immunological growth of the baby (8,9).

Among all the milk components we can find some immune cells such as immunoglobulins, lactoferrin and lysozyme allowing the development of the immunity of the newborn as it protect him against infections (3,10).

Other authors such as Lyons KE et al. state that the presence of these immune components and microbiota help in growth of an healthy microbiome in children (16).

The biological properties of breastmilk show that breastmilk itself is not cariogenic as its antimicrobial characteristic is a protective factor inhibiting the proliferation of pathologic bacterias (7,11). Froń and Orczyk-Pawiłowicz states that the immunological factors found in breastmilk can inhibit the cariogenic bacterial proliferation and promote the oral immune protection (11). However the milk composition can vary according to the mother's diet or health statue (13). Those literatures are another example that shows that breastfeeding is not the primary cause of ECC.

5.6 Clinical practice and prevention.

As healthcare giver it is crucial to educate the mother on ECC and breastfeeding to avoid further complications. The prevention of ECC is one of the main challenges faced by public health in children. Some organisms such as IAPD state that ECC prevention and early intervention has a major importance in public health (4).

Regarding WHO, various strategies have been developed to improve oral health. They try to give an access to educations regarding oral health, show the importance of early dental visits and try to improve the preventive care in young children (5).

As soon as the first tooth erupt, an oral healthcare routine must be set up, nocturnal feeding should be limited, and regular dental check-up must be performed to make sure that the mouth is healthy, the oral hygiene is correctly performed et to set up some preventive measures to limit the onset of

ECC with for example, fluoride application to make sure that the risk of Early childhood caries is significantly lowered and to allow the baby to receive all the benefits of the breastmilk without risking of developing dental caries (18–20,22).

On the other hand, breastfeeding should be encouraged as it allows the baby to get immunological and nutritive benefits from breastmilk but it is crucial to inform the parents about potential complications that may appear if a correct oral hygiene is not performed after each feeding time (16,19).

To summarize, breastfeeding should be considered as a risk factor when the baby is exposed to contributing factors rather than as an independent etiological factor.

6-CONCLUSION

1. The aim of this documentary research was to determine whether breastfeeding represents a risk factor for early childhood caries (ECC), to identify the age at which breastfeeding may become associated with ECC onset, and to establish which breastfeeding patterns carry the highest risk. Based on the literature reviewed, the relationship between breastfeeding and ECC is complex and multifactorial. The findings of this work indicate that breastfeeding alone should not be considered as a direct risk factor for ECC. Breastmilk presents protective immunological components such as immunoglobulins, lactoferrin, antimicrobial proteins, and beneficial microbiota that contribute to the development of a healthy oral environment. These biological properties show that breastmilk has a low intrinsic cariogenic potential. Therefore, the presence of ECC cannot be attributed only to breastfeeding.

2. Age also plays an important role in this relationship. During the first six months of life, breastfeeding is not considered a risk factor for ECC, as teeth are usually not present and exclusive breastfeeding is recommended for optimal development. After tooth eruption, especially beyond 12 months, the risk may increase when breastfeeding is prolonged and associated with nighttime feeding, poor oral hygiene, or cariogenic diet.

3. However, the reviewed studies highlight that some feeding patterns may increase the risk of ECC. Prolonged breastfeeding beyond 12–24 months, frequent nighttime feeding, and co-sleeping practices may contribute to the development of caries, particularly after the eruption of primary teeth. During sleep, salivary flow decreases, reducing the natural buffering capacity of saliva and favoring the retention of milk carbohydrates on tooth surfaces. These factors, rather than breastfeeding itself, seem to be responsible for the increased prevalence of ECC observed in some children.

From a clinical point of view, these findings show the importance of preventive strategies. We should educate the parents about the need of optimal oral hygiene as soon as the first tooth erupts, limit frequent nighttime feeding when possible, and perform early dental visits. These measures allow children to benefit from breastfeeding while decreasing the risk of ECC development.

To conclude, breastfeeding should be encouraged, as it provides essential nutritional, immunological, and developmental factors. Early childhood caries is a multifactorial disease influenced by feeding

ways, oral hygiene, bacterial colonization, and socio-environmental factors. Finally, we can state that a correct parental education and early preventive care are key factors to reduce ECC incidence while preserving breastfeeding to gain all its benefits.

7-SUSTAINABILITY

This study contributes to sustainability by promoting preventive oral health strategies and supporting breastfeeding as a natural practice providing essential elements for correct child development. ECC is one of the most common chronic diseases in children and often requires restorative treatments and regular dental visits, increasing healthcare resource use. By highlighting the relationship between breastfeeding, co-sleeping, and ECC, we highlight preventive approaches aiming to reducing ECC incidence and the need for complex treatments. Preventive measures such as fluoride use, parental education, and regular dental checkups allow a more sustainable healthcare system.

Breastfeeding is also a sustainable feeding method from an environmental perspective. Compared to artificial formula, it does not need industrial production, packaging, transportation, or waste generation, reducing costs and pollution. It is natural, accessible, and economical providing essential nutrients and immunological development. When combined with appropriate oral health education, breastfeeding allows children to benefit from its advantages without increasing ECC risk.

This study also supports social sustainability by promoting parental education and early prevention. Indeed, ECC is more prevalent in populations with low socioeconomic status and limited access to dental care. Educating caregivers about feeding patterns, nighttime breastfeeding, co-sleeping, and oral hygiene helps to reduce oral health inequalities and improves long-term outcomes.

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9-ANNEXES