

<http://clipart-library.com/baby-bottle-cliparts.html>

Eliza Lopes & Alexandra Cabana | Dental Hygiene Department, Westbrook College of Health Professions

Research Question

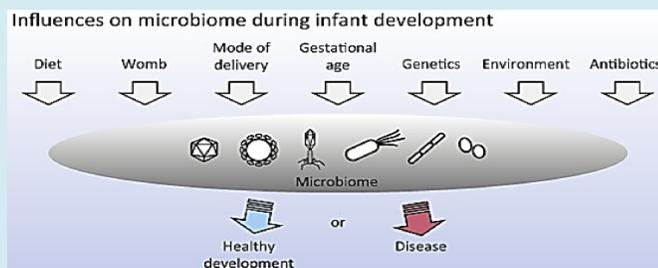
What differences are seen between formula and breastfed babies in the development of the oral microbiome?

Abstract

The bacteria that make up the oral microbiome begins accumulating from birth through interactions with the environment and caregivers. When it comes to the oral cavity, bacteria such as *Streptococcus mutans* and *Lactobacilli*, can be transferred through saliva or feeding. Breastfeeding provides important nutritional and immunological benefits to the development of infants but it also plays a vital role in the development of the oral microbiome that may be superior to that of formula-feeding. Studies show that the oral microbiome of breastfed infants varies greatly from that of a formula fed infant. Breast milk when combined with an infants saliva produces an antibiotic effect that inhibits colonization of several species of opportunistic bacteria.^{1,2} Breast feeding can also introduce strains of the bacterial species *Lactobacilli*, such as *L. gasseri*, which exhibits anti-inflammatory properties. *Lactobacilli* is not affected by the antibacterial conditions in an infant's oral cavity, and in turn, can also encourage the inhibition of cariogenic bacteria, such as *S. Mutans*, from colonizing in the oral cavity.^{3,4} Formula fed infants lack the antibacterial conditions as well as the bacterial strains of *Lactobacilli*.^{2,3,4} The oral microbiome of infants that are formula fed versus breastfed show greater numbers of anaerobic species of bacteria including those which cause inflammation.³ The types of bacteria that initially colonize the oral microbiome in infancy can greatly impact oral health as well as immune response in adulthood. This literature review identifies many differences between the two types of feeding favoring breastfeeding over formula feeding.

Introduction

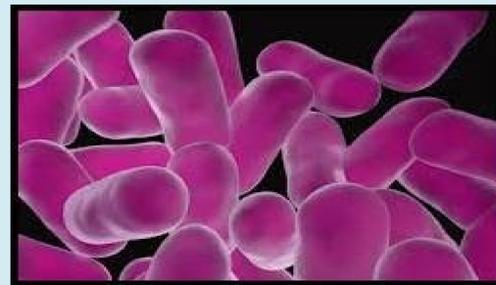
The species of bacteria that make up our oral flora differs greatly from person to person. Colonization of the oral cavity begins at birth. Some bacterial species have greater virulence than others when considering oral diseases, therefore the development of the oral microbiome in infancy can greatly impact the oral health into adulthood.



[https://www.cell.com/trends/microbiology/fulltext/S0966-842X\(16\)30064-6](https://www.cell.com/trends/microbiology/fulltext/S0966-842X(16)30064-6)

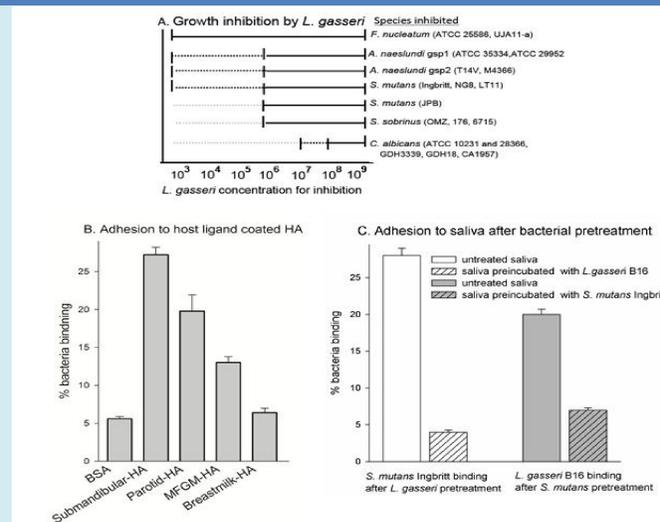
Review of Literature

- Infant saliva possesses precursors to nucleotides that combine with breast milk to produce hydrogen peroxide (H₂O₂) which plays a key role in inhibition of certain bacterial species by way of an oxidation process. This process simultaneously promotes the growth of *Lactobacilli*.¹
- A 2018 study concurs and assessed microbial growth of bacterial strains post exposure to breast-milk and neonatal saliva mixtures over a 24 hour period, showing inhibition of growth in many cases.²
- Study of 207 three month old infants: 146 exclusively breastfed (BF), 38 partially breastfed (PBF), 23 exclusively formula fed (FF). Revealed positive cultures of *Lactobacilli* in 27.8% of BF & PBF infants only.³
- Longitudinal study of 133 infants: 43 BF, 43 FF using standard formula "Semper AB" and 47 fed supplemented "LACPRODAN MFGM-10." Oral swabs were taken to assess activity of *Lactobacillus* species in oral cavity. Found *L. gasseri* to be the most prominent strain in BF versus FF infants, and identified its probiotic properties.⁴
- Human breast milk possesses lactoferrin, a protein with antibacterial activity against Gram negative bacteria, including *S. mutans*, which is associated with dental caries.⁵



<http://www.holisticlifestyle.com/index.php/2015/09/24/fermented-foods-part-4-just-for-the-nerds-review-of-the-literature/>

Bacterial Inhibition Results by *L. gasseri* Isolates



Discussion

Establishment of the neonatal microflora occurs in the first several months of life. Method of feeding is an essential factor that can determine bacterial colonization of the oral cavity.³ Research shows that neonatal saliva possesses nucleotide precursors, and upon combination of neonatal saliva and breast milk, a reactive oxygen species (ROS) is produced. Both mechanisms aid in building neonatal immunity and the establishment of *Lactobacillus*, specifically.¹ The most common strain found in BF infants was *L. gasseri*, which inhibits *S. mutans* growth and binding, and promotes anti-inflammatory effects.⁴ Therefore, choosing to breastfeed over formula feeding may positively impact immune function, as well as host response to pathogenic exposure in the oral cavity.



<https://www.fatherly.com/parenting/7-bottle-feeding-myths-new-parents-can-ignore/>

Conclusion

Breastfeeding can provide superior benefits to neonates when compared with formula feeding due to the combination of biochemical components that occurs with breastfeeding. It is important to understand the positive implications of *Lactobacilli* acquisition, as well as the added antibacterial properties of breast milk. Bacterial colonization of oral cavity in the early stages of life may correlate with an increased chance of developing oral disease later on in life.

References

1. Al-Shehri, S S, Knox, C L, Liley, H G, Cowley, D M, Wright, J R, Henman, M G, Hewavitharana, A K, Charles, B G, Shaw, P N, Sweeney, E L, Duley, J A. (2015). Breastmilk-Saliva Interactions Boost Innate Immunity by Regulating the Oral Microbiome in Early Infancy. *PLoS one*. [accessed 2018 Oct 31];10(9):e0135047. doi:10.1371/journal.pone.0135047. (Al-Shehri et al. 2015)
2. Sweeney, E L, Al-Shehri, S S, Cowley, D M, Liley, H G, Bansal, N, Charles, B G, Shaw, P N, Duley, J A, Knox, C L. (2018). The effect of breastmilk and saliva combinations on the in vitro growth of oral pathogenic and commensal microorganisms. *Scientific reports*. [accessed 2018 Oct 31]; 8(1). 15112. doi:10.1038/s41598-018-33519-3. (Sweeney et al. 2018)
3. Holgerson, P L, Vestman, N R, Claesson, R, Ohman, C, Domellöf, M, Tanner, A C, Hermell, O, Johansson, I. (2013). Oral microbial profile discriminates breast-fed from formula-fed infants. *Journal of pediatric gastroenterology and nutrition*. [accessed 2018 Oct 31];56(2), 127-36. (Holgerson et al. 2013)
4. Vestman, N R, Timby, N, Holgerson, P L, Kressler, C A, Claesson, R, Domellöf, M, Ohman, C, Tanner, A C, Hermell, O, Johansson, I. (2013). Characterization and in vitro properties of oral lactobacilli in breastfed infants. *BMC microbiology*. [accessed 2018 Oct 31]; 13, 193. doi:10.1186/1471-2180-13-193 (Vestman et al. 2013)
5. Aimutis, W (2004). Bioactive Properties of Milk Proteins with Particular Focus on Anticariogenesis. *The Journal of Nutrition*. [accessed 2018 Oct 31]; 134:989S-995S. (Aimutis 2004)