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To what extent do the numerous links between breast feeding and health relate to bioactive factors?

To enable mothers to establish and sustain exclusive breastfeeding for six months, the WHO and UNICEF recommend the following:¹

- Initiation of breastfeeding within the first hour of life
- Breastfeeding on demand (as often as the child wants, day and night)
- Exclusive breastfeeding (the infant only receives breastmilk without any additional food or drink, even water)
- Exclusive breastfeeding for the first 6 months of life, with continued breastfeeding along with appropriate complementary foods up to two years of age or beyond

In addition to increasing mother-infant bonding, there are both long-term and short-term physiological benefits of breastfeeding for both the mother and the infant [Figure 1].

Figure 1: Benefits of breastfeeding²⁻⁴

For the baby:

- Protection against infections, dental caries and malocclusions
- Increase in intelligence
- Reduction in overweight and diabetes later in life



For the mother:

- Protection against breast cancer
- Increased birth spacing
- Probable reduction in ovarian cancer and type 2 diabetes mellitus (T2DM)



Human milk is a complex, living fluid, containing carbohydrates, peptides, growth factors, lipids, sterols, minerals, hormones, enzymes, immune factors, and vitamins, as well as bacteria and other cells. Having been studied and characterised for over 100 years, we now have increased knowledge not only about the components of human milk but also in its structure and organisation, all of which has an impact on consumption, bioactivities and benefits to the infant.

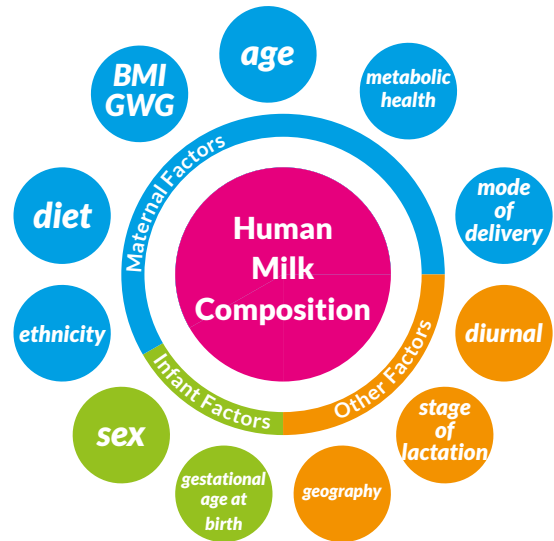
Mothers' milk is a rich source of nutrients, essential for energy, and growth and development, as well as being a rich source of bioactives. These bioactives, such as immunoglobulins, cytokines, growth factors, hormones, glycans and cells, to name a few, affect biological processes and have an impact on body function or condition and, ultimately, health.

Although known to be present in human milk, bioactives are dynamic and can change, depending on maternal factors, infant factors and factors beyond both mother and baby [Figure 2]. Consequently, the mother, baby and environment all need to be optimized for the best start. For example, we know that poor maternal environment (under-nutrition, over-nutrition, sometimes the double burden) may increase metabolic health conditions for offspring such as small for gestational age/preterm, as well as obesity, type 2 diabetes (T2DM) and cardiovascular events in later life.

References:

1. World Health Organization. Ten steps to successful breastfeeding. Available at: <https://www.who.int/teams/nutrition-and-food-safety/food-and-nutrition-actions-in-health-systems/ten-steps-to-successful-breastfeeding> [Accessed May 2022]; 2. Horta BL, et al. World Health Organization. <https://apps.who.int/iris/handle/10665/79198> [Accessed May 2022]; 3. Horta BL, et al. World Health Organization. <https://apps.who.int/iris/handle/10665/95585> [Accessed May 2022]; 4. Victora CG, et al. Lancet. 2016;387:475-90; 5. Fields DA, et al. Obesity (Silver Spring). 2016;24(6):1213-21; 6. Cabrera-Rubio R, et al. Am J Clin Nutr. 2012;96:544-51; 7. Collado MC, et al. Pediatr Res. 2012;72:77-85; 8. Storck Lindholm E, et al. Prostaglandins Leukot Essent Fatty Acids. 2013;88:211-7; 9. Harris JE, et al. Nat Metab. 2020;2:678-687; 10. Zandarvo V, et al. Environ Health Perspect. 2005;113:1410-3; 11. Bachour P, et al. Breastfeed Med. 2012;7:179-88; 12. Szigatys-Sidorkiewicz A, et al. Acta Paediatr. 2013;102:e353-9. *Test your knowledge answers: Q1. b. First hour; Q2. b. Maternal dietary intake.

Figure 2: Factors influencing human milk composition⁵



Modifiable factors:

- Dietary Intake (food, supplements)
- Lifestyle (smoking, caffeine consumption)
- Physical activity (Gestational Weight Gain)

Diet is the biggest modifiable factor that can have an impact on mother's milk and bioactives. The more bioactives included in the diet, the more are available for the infant. Modifiable nutrients in diet include; amino acids, long chain polyunsaturated fatty acids (LCPUFAs), iodine, selenium, thiamine, riboflavin, niacin, vitamin B6, vitamin B12, choline, vitamin C, vitamin A, pro-vitamin A carotenoids, vitamin D, vitamin K. Conversely, non-modifiable factors that are tightly regulated in human milk, include calcium, magnesium and copper.

In addition to a healthy balanced diet, physical activity also has a positive impact on milk bioactives. Milk from obese mothers has been shown to have a less diverse bacterial community, lower TGF-β2 and sCD14 levels (which help to regulate the immune system), and lower LCPUFAs.⁶⁻⁸ Accordingly, it is important to try to decrease obesity in mothers by increasing physical activity. A recent study on the effects of exercise and physical activity on breastmilk has shown exercise-induced increases in the oligosaccharide 3'-sialyllactose in milk in humans and mice, associated with beneficial metabolic health and cardiac function.⁹

Lifestyle is also an important modifiable factor influencing human milk. It has been demonstrated that smoking (even passive smoking) during lactation reduces key bioactives in mothers' milk.¹⁰⁻¹²

KEY TAKE HOME MESSAGES:

- Message 1:** Mother's milk is a rich source of nutrients, essential for energy, growth and development, as well as being a rich source of bioactives
- Message 2:** In Diet is the biggest modifiable factor that can have an impact on mother's milk and bioactives
- Message 3:** Physical activity also has a positive impact on human milk bioactives



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