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THE ROLE OF THE GUT MICROBIOME IN INFANT HEALTH AND IMMUNITY

The What?

The surface of our planet is covered in microbes, and we are no different. Microbes are found on any external surface of our body, including the skin and gut[1] and these bacterial cells are thought to number 10 to 100 times higher than our own human cells[2]. The combination of all the genetic information of the microbes on your body is your 'microbiome[3]. Our gut alone, in particular the large intestine, contains 1000 known species of bacteria and is the area with the highest levels of bacteria on our body[1,4].

The Why?

The gut microbiome has been increasingly researched over recent years, with over 16,000 scientific papers on the topic[5]. Through this research it is becoming increasingly apparent that the gut microbiome links to overall health, particularly in the areas of digestion and absorption of nutrients, gut-brain interactions and immunity[6,7]. Bacteria digest fibres, in the large intestine, and this leads to production of important metabolites e.g. short chain fatty acids (SCFA)[8]. SCFAs are estimated to contribute 10% of energy requirements[9], highlighting the microbiome's important role in extracting nutrients from our diet.

70-80% of the body's immune cells are in the gut and the bacteria in the gut communicate with these cells, therefore the gut microbiome provides the most important stimulation source for developing immunity[10,21]. In relation to immunity, studies have found links between gut microbiome and allergy incidence, e.g. caesarean infants, who had a different microbiota composition to vaginal delivered infants, were found to have increased cytokine IL-13 production suggesting higher asthma incidence[11].

The How?

The gut microbiome develops rapidly in early years, reaching adult-like composition by around 3 years[12]. The early years of life are a crucial period to support development of a healthy microbiome and can be influenced by environmental factors including: mode of delivery (e.g. vaginal or c-section), gestational age at birth and diet[13].

Early life nutrition is an important factor, influencing the development of the gut, microbiome and immune system[2].

Breast milk is the best nutrition for newborns and has been shown to support optimal growth and development of infants. Exclusive breastfeeding is widely recommended as the first choice for infant nutrition[14]. Breast milk has a highly diverse range of components, including human milk oligosaccharides (HMOs), live bacteria and their metabolites[15,16]. These are acknowledged to play a crucial role in the development of the gut microbiome and immune system[17].

Specific nutritional components can support a healthy gut microbiome. These include probiotics, prebiotics, synbiotics and postbiotics.

The importance of the gut microbiome towards overall health has become more apparent over recent years and is likely to continue in this direction in the future. It is clear that early life is a critical period for the development of the gut microbiome and that nutrition is a major factor in which to help this development.

Quick definitions

- **Probiotics** are beneficial bacteria that affect the host microbiome when ingested in adequate amounts[19]
- **Prebiotics** are substrates that pass to the gut where they stimulate the growth or activity of beneficial bacteria[18]
- **Synbiotics** are a combination of prebiotics and probiotics[19]
- **Postbiotics** are bioactive compounds produced by beneficial bacteria, which have biological activity in the host[19]
- **Human milk milk oligosaccharides (HMOs)** are a complex pool of carbohydrates that exist in high levels in human milk, with prebiotic and other important benefits[20]

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