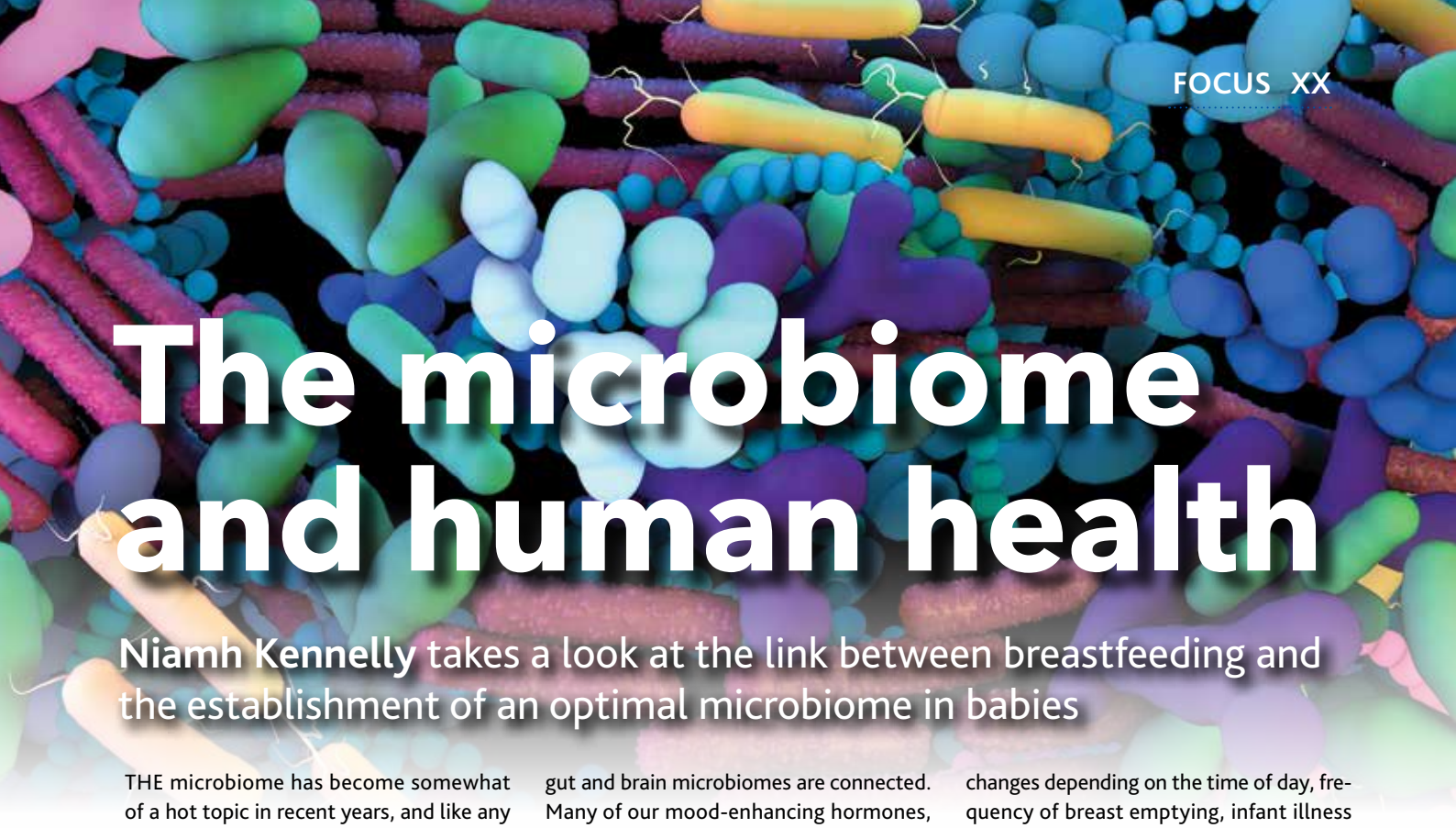

The microbiome and human health

Niamh Kennelly takes a look at the link between breastfeeding and the establishment of an optimal microbiome in babies

THE microbiome has become somewhat of a hot topic in recent years, and like any new specialty area there is a lot of generalisation and misinformation. This article will attempt to clarify what the microbiome is, how it functions and the factors that can affect it. I will also discuss ways in which we can promote gut health, including the use of probiotics and explore the role of breastfeeding in the development and function of the microbiome.

Most people associate the microbiome with gut health, however the microbiome actually refers to a population of micro-organisms that exist in and on the entire human body on whom humans are dependent to keep us alive and healthy. These include fungi, parasites and bacteria.[1] In fact, there are as many microbes in/on the body as human cells.[2] The most critical period for the development of the microbiome occurs over the first three years during infancy and early childhood, during which time any medical interventions can have lifelong consequences for the gut and overall health.[3]

Role of the Microbiome

Different microbes dwell in specific areas of our bodies, meaning that there are specific microbiomes present in various areas of the body, including the gut, brain, lungs, and skin. The theory is that these microbiomes are connected and that microbial dysbiosis or disharmony is leading to the rise in many chronic conditions such as infant overweight and obesity, skin issues, autoimmune conditions such as inflammatory bowel disease, multiple sclerosis, diabetes, allergies, asthma, autism and cancer.[4,5,6] There is also emerging research in the area of mental health, whereby our gut and brain microbiomes are connected. Many of our mood-enhancing hormones, such as serotonin-the 'happy' hormone, are made in the gut and if our gut is not in harmony, it cannot function optimally.[7,8]

Factors affecting microbiome

Mode of delivery

It has been espoused that the mode of delivery plays a significant role in the development of a healthy microbiome, and indeed there have been differences found in the early microbial balance of a newborn. According to the systematic review by Rutayisire,[9] babies born via vaginal delivery had a more diverse pattern of gut microbiota during the first three months of life. However, after six months the observed differences disappeared.

Aagaard[10] casts further uncertainty on the debate in suggesting that intrauterine life may have more of a role to play than previously thought and that microbial presence in the maternal uterus, upper reproductive tract and preterm placenta may be just as important as the mode of delivery.

Infant diet

Breastfeeding provides the most consistent early source of probiotic bacteria, which includes staphylococcus (via the mother's skin bacteria), infant saliva bacteria and bacteria produced in the milk glands.[1] Breast milk delivers 800,000 bacteria daily directly to the baby's mouth and GI tract. Babies who are formula fed will receive environmental pathogens and will have higher amounts of gut bacteria, but they are far less diverse and are missing the highly specialised human milk microbiome.[1]

Breastfeeding stage

Breast milk is not a static substance. It changes depending on the time of day, frequency of breast emptying, infant illness or dehydration, maternal illness and so on. However, breast milk also alters in composition as mother and baby move through various ages and stages.[11] When our babies start to leave our family circle to attend crèche or childcare, they start to pick up more bugs and viruses. A mother's more mature immune system makes antibodies for these germs and transmits them to her child through her breast milk. Therefore we are giving our babies significantly more protection by breastfeeding them for longer.

Gestational age

When a baby is born preterm, they are far more likely to need neonatal assistance which involves separation from their mothers, and the possible introduction of very necessary medical interventions. This will give those babies a different microbial cocktail, but giving these baby's breast milk is hugely protective of their overall health.[4]

Also, mothers of preterm babies produce breast milk that is higher in immune components and anti-infective properties than mothers of term babies.[12] In fact, the American Academy of Paediatrics recommends that preterm infants should receive human milk as an essential medical intervention, and in the absence of their mother's milk should receive donor human milk.[13]

Medicines

Antibiotics are a well-known cause of microbial imbalance within the body. They work very well by killing bacteria that are harmful to us, but they also kill our resident good bacteria. If the balance of these micro-organisms is compromised, there can be both short and long-term health repercussions.[3,4]

Maternal diet and lifestyle

'You are what you eat' is a famous phrase that is as true today as it was when it was first coined in 1826 by the French lawyer Anthelme Brillat-Savarin. A diet that is high in sugar, processed foods and low in fibre has a negative impact on gut health.[14] Stress can also play a role in affecting gut health and is a leading cause of irritable bowel syndrome.[7] Chronic stress and anxiety can cause abdominal pain, diarrhoea, and lack of appetite. In fact, resilience to stress and immune-related disorders may be dependent on the diversity and complexity of our gastrointestinal microbiota.[15]

Promoting a healthy infant microbiome

Taking into account all of the factors that affect the microbiome, it is not difficult to see ways to promote a healthy infant microbiome. In the antenatal stage it is important to maintain a healthy diet, reduce stress, and keep active.

The preferred mode of delivery is a vaginal delivery (if possible). Postnatally, there should be minimal mother-baby separation, uninterrupted skin-to-skin for the first three hours, unrestricted infant access to the breasts with breastfeeding on demand.[11]

If there is mother-baby separation for any reason, the mother should be assisted to hand express/pump her colostrum/mature milk every two to two and a half hours so that it can be fed to her baby via syringe, cup or tube feeding. This will also protect the mother's supply until she and her baby are reunited and direct feeding can resume.

When a newborn ingests colostrum, it coats the gut wall in a thick honey like substance that is packed with probiotics, good bacteria, and proteins that optimise immunity. These proteins are full of immunoglobulins, antibodies and live cells that give baby an amazing boost to their immune system. The more breast milk a baby drinks and the longer they breastfeed for, the greater the immunity.[11]

Parents should be made aware of the effects of antibiotic use, so that they are not used without due consideration for the dangers of using them as well as the benefits. Where antibiotics are used, probiotics should also be encouraged – under medical supervision – in order to promote the rebalancing of the infant gut microbiome.

Parents should be encouraged to breastfeed their babies well into toddlerhood, and as long as both mum and baby are happy to do so. Breastfeeding isn't just for small babies. Breast milk continues to provide immunities and vitamins and is an excellent parenting tool in providing nutrition, comfort, security and reassurance.[16]

Prebiotics and probiotics

Simply put; prebiotics provide the food for bacteria to grow and flourish, while probiotics provide the bacteria. They are promoted as helping with digestive issues such as diarrhoea, constipation, infant reflux and yeast infections.[17] Both are available for over-the-counter use in Ireland, but the Food Safety Authority of Ireland has not recognised them as a 'health benefit' but as a 'health claim'.[18]

Prebiotics

Prebiotics are food components (complex sugars) that may provide a health benefit by helping bacteria to grow in your gut. Foods such as onion, garlic, asparagus, oats and avocado are considered prebiotic foods. Breast milk actually contains its own natural prebiotic: HMOs (human milk oligosaccharides). HMOs are complex sugars that are the third most abundant component of breast milk, but are indigestible to babies. These sugars feed babies' gut microbes so that they can multiply and colonise the microbiome.[19]

Probiotics

Probiotic foods include fermented foods such as kefir and yoghurts – which can only be called 'live' if they contain at least 10 of the main colony forming starter microorganisms such as *Lactobacillus acidophilus* and *Bifidobacterium infantis*.[18]

Probiotic supplements come in pill, powder or liquid form and seem to be everywhere, but are they safe or effective? Firstly, not all probiotics are created equal. Manufacturers use different strains of bacteria or yeast, in different quantities. Therefore there is no 'one size fits all'.[17,20] Probiotics are not recommended for anyone who is immunocompromised or those with open wounds following major surgery.[2]

In general, probiotics are considered safe for use, but should only be used after consulting with a doctor. It is also preferable to choose a reputable, well-known brand that has probiotic strains formulated specifically for various complaints such as digestive issues or candida.

In general, it is considered that if a healthy varied diet is consumed, there should be no need for prebiotics or probiotic supplements. However in times of illness or antibiotic therapy, probiotics may play a role in recovery. Interestingly, Nami et al envision probiotic therapy as a possible future preventative treatment so that antibiotic use is decreased, but more research is required in this area.[21]

Conclusion

The microbiome plays a significant role in the health of humans. It is considered by many as another organ, such is its extensive impact. However, as it is not visible to the naked eye, like the heart or lungs, it is difficult for us to be mindful of. Processed and heavily engineered foods are all around us and it can be difficult and expensive to make consistently healthy food choices.

When it comes to the health of our

babies however, there are very clear steps we can take to ensure we give them the very best start in life. Mode of delivery, infant diet, ie. breastfeeding or not, and maternal/infant antibiotic treatment seem to be the most important factors in optimal microbiome development.[22]

Information is key, and knowledge is power. Parents need to be informed about the importance of the microbiome and the ways in which they can promote gut health within themselves and their family.

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