Questions and answers

Q. How do practitioners breakdown barriers relating to physical activity?

Dr Carine M. Lenders: A few things can be done during the motivational interview. Understand the parents and build on what they are ready to commit to. Within the ~20 minutes of interaction, there is limited time to tackle multiple challenges. Often, the patient will be unable to address more than one concern, and these can be tackled one by one.

Q. Regarding HMOs, is it the quantity, diversity or the synergistic relationships among the different HMOs that account for their clinical effects?

Professor Liam O'Mahony: From the hundreds of HMOs, there are a few that predominate from a quantity point of view. The enzymatic machinery available for these HMOs from the microbiota is restricted to a small group of microbes. Hence, a varied HMO composition will have a more diverse set of microbes. It is likely that quantity, specific strains and relationships between these microbes will all have distinct clinical effects.

Q. How does inflammation and diet affect neurodevelopment and childhood development in other areas?

Professor Ting Fan Leung: There is emerging evidence that the microbiome, and altering its composition, affects development. There is an intricate relationship between the microbiome altering mechanisms of inflammatory response, which is highly energy consuming and can impair development when disruptions occur excessively at a young age.

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PGPN Symposium and Convocation 2019

The scientific sessions of the Post Graduate Program in Paediatric Nutrition (PGPN) provided a platform for a discussion of recent developments and pragmatic scientific insights on paediatric nutrition. Wyeth Nutrition Science Center (WNSC) Hong Kong supported the PGPN symposium covering topics including nutrition counselling, the role of the gut microbiome in immune development and prevention of allergy in early childhood.

Nutrition counselling

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Effective nutrition counselling strategies

Achieving positive changes in dietary habits is often a difficult process, and involves multiple individual components including both nutrition education and counselling. Nutrition education refers to a set of learning and information-giving experiences thought to improve health-promoting dietary behaviours,[1] while nutrition counselling denotes the supportive process needed to motivate and guide patients and their families towards the behaviours supporting nutritional well-being.[2]

Together, the aim of nutrition education and counselling is to provide guidance and support for patients enabling them to make food choices that are appropriate for their own nutritional requirements.[2] The benefits of nutritional counselling in long-term dietary adherence were shown in a large-scale randomised study.[3]

Barriers to effective nutritional counselling include a lack of time, inadequate clinician training and a lack of supportive resources.[4] For instance, up to 67% of physicians reported having insufficient skills to counsel and ensure continuity of care in collaboration with other healthcare professionals, and 62% may lack sufficient nutrition knowledge.[5,6]

Aside from skill and knowledge development, counselling approaches need to be tailored to individual patients. For example, children younger than five can be communicated with through their parents, 6–12 year olds may be able to communicate directly, and children above 12 years old may even benefit from counselling without their parents present.[7] The interviewer should be respectful, empathetic and careful when disclosing diagnoses. A narrative style of questioning is also helpful.[8] Thereafter, a comprehensive assessment of the patient should follow, with emphasis on the evaluation of dietary and behavioural patterns, physical activity, psychosocial issues, and the exclusion of psychiatric or eating disorders.[9]

Health advice can be provided through a prescriptive (directive) approach for an individual or group[10] or a participatory approach involving negotiation[11] and may be adjusted based on the setting, staff availability/resources and training.[4,12,13]

Motivational interviewing is a patient-centred counselling style that seeks to elicit internal motivation to change personal practices that may be detrimental to health.[14]

Case study:

Arnold is a young boy who is continuing to gain weight despite attempts to reduce it. This is his fourth visit to the clinic in a 7-month period.
Age: 4 years old
Patient history: Previous hernia repair, no serious illness or allergy
Family history: Arnold's father is obese and diabetic, his mother is pre-diabetic.
Physical evaluation: On examination, Arnold is obese-appearing with neck acanthosis, he has no cardiovascular or neurological abnormalities.

Height: 103 cm
Weight: 24.2 kg
BMI: 22.8 kg/m^2 (99th percentile)
Behavioural background: Arnold eats a breakfast at home, walks 30 minutes to school, and eats again once there. Both breakfasts include large portions of starchy foods including rice and beans. After school, he and his 7-year-old brother are home alone. Both parents work full-time and come home late.

With the goal of identifying challenges and motivating the patient and his guardian to change, a motivational interview was performed by the provider (**Table 1**).

Table 1. A motivational interview

Healthcare worker	What would you like to accomplish? What would be your ideal scenario?	Open-ended question
Mother	For Arnold to get healthy and stop gaining so much weight.	
Healthcare worker	That's wonderful! Losing weight gradually by changing your lifestyle is the most effective way to maintain weight loss. How do you think you could approach this?	Affirmation/ reflective listening/ open-ended question
Mother	Well, I did not know Arnold was eating two breakfasts. So, I guess that could change.	
Healthcare worker	Tell me more about that. How do you think we could limit Arnold to one breakfast per day?	Open-ended question
Mother	Well, since he is having breakfast at the school and he likes it, I could avoid making breakfast for him at home, and that way he'll only eat one breakfast per day.	
Healthcare worker	Arnold, how would you feel about that?	Open-ended question
Arnold	I like the breakfast at school.	
Healthcare worker	Let's talk about physical activity. How long do you play in the park?	Open-ended question
Arnold	Well, my brother and I don't get enough time to play in the park nowadays. Dad does not take us to the park a lot. I like to play in the park.	
Healthcare worker	Can I summarise what we have discussed so far?	Asking permission
Mother	Okay.	
Healthcare worker	It sounds like Arnold's rapid weight gain is concerning to you and you want him to be as healthy as possible. You are ready to make some changes at home to help Arnold be successful in becoming healthier. You are going to stop giving Arnold breakfast at home because you know he eats breakfast at the school. Arnold also expresses that he would love to play outside more often.	Summary
Mother	Yes, that's right.	
Healthcare worker	Would it be possible for you or Arnold's father to bring Arnold to the park more often? What are the barriers that might make it difficult to take him and his brother to play?	Open-ended question
Mother	Well, his father and I work full-time, so we do not have much time to take them outside. So, I'm not sure that would be possible.	
Healthcare worker	So, right now, going to the park more often might not be possible, but reducing the number of breakfasts would be. That's a great start! How do you feel about that?	Summary/ open-ended question
Mother	I think that sounds great.	
Healthcare worker	Okay! I will see you in about 1 month.	Summary

In the above example, the practitioner uses open-ended questions, affirmations, reflective listening, and summaries (OARS).[15] Then, in developing the treatment strategy, the specific, measurable, attainable, relevant, timely technique of goal-setting (SMART) was employed. This technique has been associated with a significant reduction in energy intake in trials.[16]

Other techniques such as the five A's (ask, advise, assess, assist, arrange) can promote weight loss. The five A's have also been used in smoking and drinking cessation.[13] Also, core behavioural intervention strategies specific for weight loss include self-monitoring, goal setting, stimulus control, problem solving, relapse prevention, cognitive restructuring and lifestyle education.[17]

Conclusion

Nutrition education and counselling provide food and nutrition professionals a systematic problem-solving approach to target behaviourally-linked dietary issues. A useful approach involves a collaborative conversation method to motivate patients and allows them to commit to change. It is important for clinicians to understand these concepts to equip patients with effective tools for addressing their nutritional status.

The gut microbiome and its role in immune development and child health

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The interaction of the microbiota with the immune system

Microbial communities are found in the human gut, amongst other mucosal surfaces, and are known to influence human health.[18] A healthy microbiome competes with pathogens, improves nutrient metabolism and regulates immune system maturation.[19] Mechanistically, dynamic interactions exist between the microbiota, the immune system and food allergens that may lead to innate and adaptive tolerance.[20–23]

The microbiota and immune health

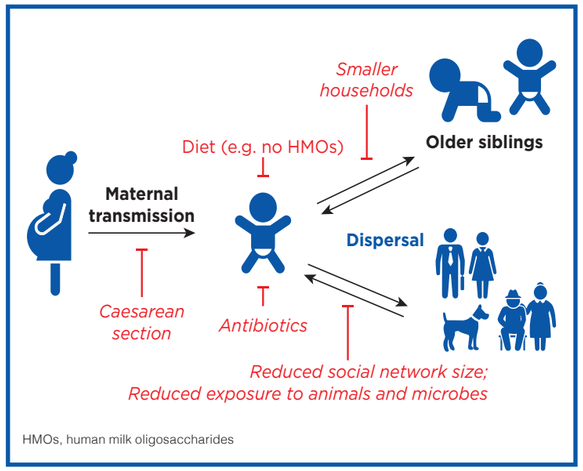
The beneficial effects of a healthy microbiome have been demonstrated in human and animal studies. For instance, in animal models, colonisation of *Anaerostipes caccae* appeared to lower the risk of allergy to dietary antigens.[24] Human studies have likewise shown that early-life gut microbiota composition appears to be influential in resolving milk allergy.[25] *Bifidobacterium infantis* 35624 administration had an immunoregulatory influence on the gut mucosa in healthy adults.[26] It has also been demonstrated that metabolic derangements and microbiome loss due to antibiotics impair the antibody response of individuals with low pre-existing immunity when receiving vaccinations.[27]

Factors affecting microbiome development

Contemporary research has highlighted the impact of early childhood events such as mode of delivery, breastfeeding, maternal exposure to drugs in pregnancy, and environmental contacts and their influence on bacterial colonisation and disease prevention.[28–35] Alongside these factors, the hygiene hypothesis contends that the increased sterility of industrialised nations has led to the upsurge in allergy and autoimmune disease.[36] However, this hypothesis alone cannot account for the pattern and type of allergy and autoimmune changes seen in the population.[37]

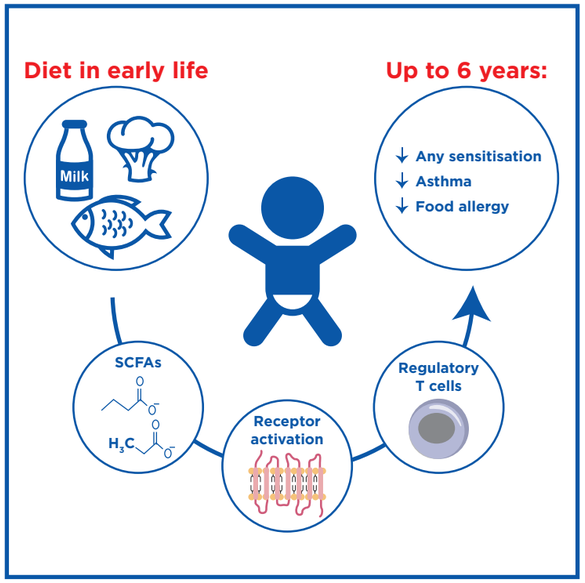
A new model – the ecological theory – proposes that "the combined microbiome of a human population can be viewed as a metacommunity, in which individual humans represent island-like habitats that are colonised by spatially separated microbial communities separated by an inhospitable area." A modern lifestyle reduces the acquisition (e.g., through caesarean delivery) and dispersal (e.g., through reduced social network sizes) of microorganisms, and the extinction of bacteria often occurs due to the irrational or over-use of antibiotics. Finally, a lack of important nutrients such as fibre or human milk oligosaccharides (HMOs) in the diet also discourages the survival of these microbes (**Figure 1**).[37]

Figure 1. The ecological theory[37]



HMOs, human milk oligosaccharides

Figure 2. Short-chain fatty acids (SCFAs) reduce allergic sensitisation[38]



Diet-bacterial interactions: Metabolites

The microbiome exerts protection by preventing the colonisation of pathogens to the gut, supporting the gut lining and aiding in the fermentation of undigested carbohydrates to short-chain fatty acids (SCFAs), such as acetate, butyrate and propionate. Evidence shows that these solutes may lower the risk of inflammatory and atopic diseases and may have immunoregulatory effects (**Figure 2**).[38-40]

HMOs, the third most abundant component of human milk, are agents that selectively encourage the growth of the gut microbiota and suppress pathogenic growth.[41] The effects of HMOs may be individualised owing to HMO composition, which changes depending on factors such as genetic enzyme secretor status, lactation stage, gestational age, maternal health, ethnicity, geographic location and breastfeeding exclusivity.[42] The level of certain HMOs [i.e., 6'-sialyllactose (6'SL), lacto-N-fucopentaose I and III (LNFP I and III)] are lower in mothers who have an infant with cow's milk allergy.[43]

In addition to the protective effects of the gut microbiome on inflammation and atopy, these organisms produce substrates that structurally mimic ligands of the human G-protein coupled receptors, and may therefore have the additional benefits of enhancing metabolism, immune cell differentiation, immune cell trafficking and tissue repair in the host.[44]

Conclusion

Dietary intake determines the composition of gut microbiota in infants and children and may have a role in the development of inflammatory and atopic diseases later in life. Metabolites that are found in the gut (i.e., SCFAs, HMOs) have been observed to support the development of gut microbiota and to suppress pathogenic growth and, thus, may have a protective role against allergic diseases.

The microbiome and childhood allergies – From local experience to practice

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Local and global prevalence of childhood allergies

In Hong Kong, the prevalence rates of asthma and allergic rhinoconjunctivitis in children aged six to seven are 7.9% and 17.7%, respectively.[45] Eczema, on the other hand, is highly prevalent and is seen in about 30% of children 6 to 7 years old.[46] In other parts of the world, similar trends exist with most studies attributing these trends to modern urban living, small family sizes and high standards of personal hygiene.[47]

From hygiene to microbiota hypothesis

Studies have suggested that early exposure to a diversity of microbes could lower the risk of asthma and other atopic diseases.[48,49] For instance, the Allergy and Endotoxin (ALEX) study highlighted that early exposure to stables and farm milk produces a strong protective effect against the development of asthma, allergic rhinitis, and atopic sensitisation.[49]

The various sources of microbes are collectively referred to as the 'exposome'. An individual's exposome will differ based on their lifestyle and living conditions. Some sources include food consumption, and exposure to pets or common urban pests such as rodents and roaches.[50] Different microorganisms are introduced through either ingestion or inhalation with specific strains observed during critical periods such as the prenatal, birth and postnatal stages.

Once introduced to the host's system, these microbes trigger the activation of innate and adaptive immune responses through pattern recognition receptors (PRRs). Downstream regulation pathways modulate T cell effector responses and promote immunologic tolerance.[50]

Factors shaping the neonatal gut microbiome

Studies have shown that bacteria, bacterial DNA and bacterial products are found in meconium, amniotic fluid, and the placenta demonstrating that maternal-to-offspring microbial colonisation starts in utero.[51] Further inoculation occurs at birth when the infant becomes exposed to either lactobacilli during vaginal delivery or staphylococci or propionibacteria during caesarean delivery.[52]

The gut microbiome is then established during the newborn period. As an infant grows, its diet evolves to include bifidobacteria and lactobacilli when drinking milk, and bacteroides and clostridiales upon introduction to solid food. As a result of the increased diversity of dietary substrates, microbial composition approximates that of adults by age 3.[52] Any disruption in the 'normal' composition of the microbiota early on can affect the risk of disease later in life.[52]

Gut microbiota, immunity and allergy

It is an accepted view that the microbiota plays an important role in the induction, regulation, modulation and maintenance of the host immune system. It enhances gut barrier integrity and functions by stimulating the secretion of protective antibodies (i.e., IgA) and mucin, which serves as a primary shield limiting contact between the pathogens and host tissue. The gut microbiota establishes a cross-talk of immunity and inflammation with organs distal from the intestine.[53-55]

An ongoing local cohort study known as the Stool Microbiome and Allergic ReacTion (SMART) study is a prospective study that aims to evaluate the stool microbiome and associated allergy development in 120 healthy ethnic Chinese newborn infants. The results confirm temporal variations in the skin microbiota between the first and sixth months and that infants with persistent atopic dermatitis had lower microbial diversity than those with the transient form. In terms of exposure, the diversity of skin microbiota in infants with atopic dermatitis was observed to be more prominent than those born vaginally versus those born via caesarean section. Also, infants with eczema and exposed to peripartum antibiotics were noted to have lower diversity compared to those without atopic dermatitis.[56]

With the help of advanced techniques for whole genome sequencing (WGS), a local WGS study was initiated to determine the diversity of the microbiota in moderate to severe atopic dermatitis in children. Microbial diversity was found to have an inverse relationship with atopic dermatitis severity on the SCORing Atopic Dermatitis (SCORAD) index. *Staphylococcus aureus* was more prominent on lesional skin than non-lesional skin, but non-lesional skin was shown to be more colonised than the skin of control subjects.[57] These findings were consistent with the observation that dysbiosis, associated with the relative abundance of *Staphylococcus aureus* (or *Staphylococcus epidermidis* in less severe disease), was linked to more frequent atopic dermatitis flares.[58,59]

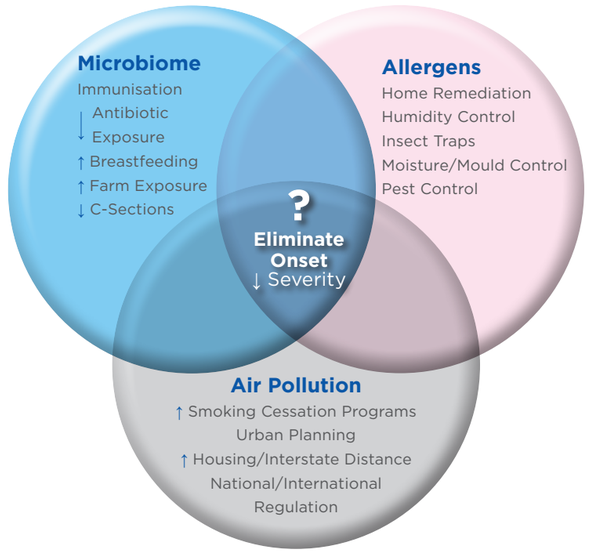
A similar phenomenon can be observed in asthma. The diversity of characteristic lung microbiota in the airways of healthy subjects may be noticeably reduced in asthmatic patients.[60]

Potential interventions to reduce allergy risk

Generally, environmental insults, such as food scarcity or infectious disease, early in life can disrupt the optimal succession of the gut microbiota, thus introducing potentially lifelong developmental alterations.[61] Hypothetically, supplementation of prebiotics or probiotics may be able to address these deficits; however, there are currently no positive recommendations on the use of prebiotics or probiotics for the treatment and prevention of food allergy, allergic rhinitis or asthma from international professional societies. Probiotics may be recommended for the prevention of atopic dermatitis in high risk infants, but this recommendation varies among different guidelines.[62] Research is ongoing for potential interventions to improve the microbiome and systemic immunity.

One such intervention is OM-85 BV, a bacterial lysate containing heat-killed gram-negative *Escherichia coli* Symbio and gram-positive *Enterococcus faecalis* Symbio, which has been assessed for preventing acute respiratory tract infection (ARTI)-provoked wheezing attacks in preschool children with recurrent wheezing. This agent significantly reduced the rate and duration of wheezing attacks in preschool children with ARTIs and showed potential for clinical use in asthma.[63,64] OM-85 BV may also lower the risk of atopic dermatitis in some infants.[65] More clinical studies of this agent are underway. Considerable evidence proposes that the trajectories of child growth and development are primed during specific sections within the first 1,000 days of life, making the time of intervention another major research topic.[61]

Figure 3. Potential interventions to reduce allergy risk



Conclusion

The microbiota plays an important function in the induction, regulation, modulation and maintenance of the host immune system. As seen in the SMART study, infants with lower skin microbial diversity (i.e., born via caesarean section) had more persistent atopic dermatitis. Local WGS techniques support these findings (i.e., an inverse relationship exists between microbial diversity and atopic dermatitis severity). Small interventional studies where microbial lysates are introduced to lower the risk of atopic diseases have shown promising results and may be key in the management of childhood atopy in Hong Kong.