Diverse and mature microbiota linked to less allergy-related wheezing and asthma in early childhood

September 11 2023

Credit: Unsplash/CC0 Public Domain

Babies and young children with more mature communities of bacteria present in their gut are less likely to develop allergy-related wheezing or

asthma, according to research presented at the European Respiratory Society International Congress held in Milan, Italy, Sept 9–13.

These communities of bacteria, known as microbiota, develop in the human body during the early years of life and are involved in processes that are helpful to the body, such as synthesizing vitamins and boosting the immune system, or occasionally unhelpful, such as the role they play in inflammatory bowel disease and stomach ulcers.

Babies already have some microbiota in their guts from their mothers when they are born. The diversity of microbiota increases and matures as they grow older and are exposed to more different types from sources such as other children, animals, and different foods.

Dr. Yuan Gao, a research fellow at Deakin University, Geelong, Australia, who presented the study, said, "Our studies on the Barwon Infant Study showed that a more mature infant gut microbiota at one year of age was associated with a lower chance of developing food allergies and asthma in childhood. This appeared to be driven by the overall composition of the gut microbiota rather than specific bacteria. We then hypothesized that advanced maturation of the infant gut microbiota in early life is associated with decreased risk of allergy-related wheeze in later childhood."

The Barwon Infant Study (BIS), which has been running in Australia since 2010, recruited 1,074 babies between 2010 and 2013, and researchers have been following the babies as they grow. For this current study, Dr. Gao and her colleagues looked at the bacteria present in fecal samples collected from the BIS babies one month after birth, 6 months and 1 year. At the 1-year and 4-year postnatal reviews, the BIS investigators asked the parents to report on whether their children had developed allergy-related wheeze or asthma in the previous 12 months. They also did skin-prick tests to see if the children had allergic reactions

to any of 10 foods and any airborne substances that can trigger an allergic response, such as rye grass or dust.

In a randomly selected sub-group of 323 children, the BIS team used a DNA sequencing technique to identify and characterize the gut microbiota. They calculated "microbiota-by-age z-score" (MAZs), which is a mathematical estimate of the maturity of the children's gut microbiota.

"We found that if babies had more mature gut microbiota when they were 1 year old, they were less likely to have an allergy-related wheeze at 1 and 4 years old," said Dr. Gao. "If MAZ increased within a certain range, known as standard deviation, it halved the risk of allergy-related wheeze at both these ages. In other words, the more mature the gut microbiota, the less likely were the children to have allergy-related wheeze. We did not find a similar association with MAZ scores at 1 or 6 months."

The mechanisms by which mature gut microbiota contribute to preventing allergy-related disease is not completely understood. "Given the complex origins and development of both gut microbiota and the infant immune system, it is likely that the protective effect of a healthy gut microbiota occurs as a result of communities of bacteria acting in multiple different ways, rather than via one particular mechanism," said Dr. Gao.

"We hope that by understanding how the gut microbiota improves the immune system, new ways of preventing allergy-related disease such as asthma can be developed. For instance, it might be possible to suggest ways of advancing the maturation of gut microbiota in early life, which would lead to fewer children developing asthma and other allergy-related diseases in the future. With so little known about why babies develop allergies and asthma, more research is needed."

The researchers are planning to recruit 2,000 children from Australia and New Zealand to a new clinical trial, called ARROW, to see whether giving young children a mixture of dead bacteria, taken orally, can protect them from wheezing illnesses or asthma by boosting a healthy immune response to viral infections. Viruses are the commonest causes of childhood illnesses and can lead to chest infections and wheezing.

"ARROW has the potential to dramatically improve the health of children with recurrent wheeze and asthma," said Dr. Gao.

Strengths of the study include its design, which allowed researchers to analyze the development of gut microbiota as the children grew older, and also the fact that the BIS children were drawn from the general population. Limitations include the fact that the DNA methods used to characterize the gut microbiota cannot provide insights into the function of the bacteria.

Dr. Erol Gaillard, Secretary of the European Respiratory Society group on pediatric allergy and asthma, and associate professor in child health and honorary consultant in pediatric respiratory medicine at the University of Leicester and Leicester Royal Infirmary, Leicester, U.K., was not involved with the research. He commented, "Allergy-related illnesses such as asthma and eczema are some of the commonest conditions affecting children, and the incidences are rising in many parts of the world. We are not sure why this happens, but theories include smaller families where children are less exposed to several other siblings and the germs they inevitably carry, less diverse food eaten at an early age, and less exposure to farm animals in some communities.

"Dr. Gao and colleagues report that more mature gut microbiota in early infancy may protect against the development of wheezing illness and allergies. This fits with some of these other theories because exposure to a variety of bacteria from an early age is very likely if babies and

children are regularly mixing with other children and animals and are exposed to a larger variety of foods. If we can find ways to boost the maturity of gut microbiota, this could have a significant effect on the incidence of allergies, and so it will be interesting to see the results of the ARROW study."

More information: Gut microbiota maturity in infancy and atopic wheeze in childhood, k4.ersnet.org/prod/v2/Front/Pr … ?e=379&session=16582

Provided by European Respiratory Society