The human microbiome and childhood obesity : a brief comment

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The Human Microbiome is the collection of all the microorganisms living in association with the human body (1). These microorganism include eukaryotes, archaea, bacteria and viruses. In an average human, there are ten times more bacteria than human cells (1). There are a total of about 1000 more genes in bacteria in human body than the human genome (1). However, microorganisms make up about 1%-3% of the body mass (1). Most of the microorganism that comprise the human microbiome are not harmful to humans; in fact, they are essential to human health (1). A number of studies have reported that changes in the composition of our microbiomes correlate with numerous disease states, raising the possibility that modifying microbiome could be used to treat disease.

Longitudinal studies of children from birth to about 3 years of age have found that the microbiome undergoes three distinct phases of maturation from birth to about 2 to 3 years of age based on the emergence of specific species of bacteria found in infant stool. These phases include the first month of life, the transition period from roughly 2 months of age to 24 months, and a final phase after roughly age 2, which resembles an adult state. A study by Bokulich et al, simultaneously compared the diversity of the microbiome based on mode of birth, antibiotic exposure and type of nutrition (breastmilk vs formula) (2). Their study found that after accounting for the other variables, antibiotic exposure in infancy resulted in a 6 month delay in maturation in the diversity of the microbiome compared with toddlers who were unexposed to antibiotics (2). Furthermore, a study by Yassour et al, showed that infants exposed to antibiotics within the first 3 years of life were more likely to have less diversity in both species and number of strains within each species of gut bacteria (3). The microbiome of children exposed to antibiotics was also shown to have lower stability, and more likely to express antibiotic resistance compared to unexposed children (3).

More in depth studies on the timing of antibiotic exposure and the effects on obesity have also been studied with interesting results. A longitudinal study by Trasande et al. showed that childhood exposure to antibiotics within the first 6 months of life was associated with a statistically significant increase in body mass index (BMI) at 38 months of age even when other social exposures were accounted for such as maternal smoking, maternal obesity, childhood screen time (4). Interestingly, exposure to antibiotics later in infancy and at the toddler age was not seen with a statistically significant elevation in BMI. This was further reported by a study from Mbakwa et al. who also noticed that very early exposure (<6 months of age) to antibiotics increased height as well as weight even up to the age of 10 years (5). This suggests that exposure to antibiotics after the age of 2, when the microbiome has matured to an adult state, causes less long standing effects on growth. The implications of this, concerning adult health outcomes were not established and require further investigation (5).

It has long been understood that farm animals treated with high dose antibiotics will gain weight, thus creating great value for slaughter (6). While the cause of this weight gain is incompletely understood, it has been suggested that exposure to antibiotics can cause dysbiosis which could result in initiation of growth factors. It has also been suggested that dysbiosis can disrupt the intestinal wall barrier and promote leakage of bacterial endotoxin thus creating a low-grade inflammatory state which promotes weight gain.

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