EDITORIAL
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Gut microbiota offers new insight into public health

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Research in the field of gut microbiota has grown rapidly in the last decade after the discovery of the role of gut microbiota (GM) in various aspects of human health. This phenomenon is also supported by the growing accumulated data after the gut microbiome project.[1] The consortium of the human GM consists of around 100 trillion microbes, with the total number of genes (microbiome) are estimated at a hundred times of the human genome. With the interphase hypothesis between GM, health and diseases, it stimulates GM research for the prevention of various diseases.

Gut microbiota is dynamic towards maturity and stability in line with the development of human life. *Bifidobacteria* are dominant microbiota in early human life, which are stimulated by human milk oligosaccharide (HMO) in breast milk, which in turn changes with increasing age. Three-years after birth, the composition, diversity, and population of GM begin to stabilize like adult. So, it can be understood that the GM composition is very much influenced by the early life environment. The mode of birth and breastfeeding are some of the determinants of GM composition. Likewise, the consumption of family foods with recipes, formulations, types of ingredients, and household habits that are unique for each family as well as geographical factors will also affect the composition of GM.[2] The consumption of plant-based foodstuffs induces a different group of bacteria compared to the consumption of animal-based foods. People who consume traditional plant-based foods showed more diversity of GM with a better fermentation activity compared to people with industrialized eating styles.

Alongsidetheglobalizationandindustrialization, lifestyles are changing, marked by high mobility that increases stress. On the other hand, better availability of food at more affordable prices has led to changing in the habits of the industrial society, which directly contribute to the nutritional transition, thus giving a domino effect on the GM consortium. This condition will gradually lead to changes in the microbiome, the whole genetic structure and function of humans, inducing the creation of new normal conditions in humans which were initially triggered by industrialist eating habits. As a consequence, it has the potency to cause loss of a group of beneficial microbes, which are components of the degradation engine of substrates into healthy metabolites such as short chain fatty acids (SCFAs).[3] The loss of this microbial component has occurred, and will be increasingly threatening, if we do not immediately realize the important role of the human internal symbiont, namely the GM group. We need to pay attention and maintain the balance of GM group because their activities produce beneficial metabolites, produce food groups for gastrointestinal tract cells, foster and maintain the balance and harmonization of millions of intestinal microbial cells, and at the same time is at the forefront of the mucosal immune response in the digestive tract. On the other hand, the new normal in GM due to the long-term intervention effects of industrialist products is characterized by the emergence of certain microbial groups (for example, *Akkermansia muciniphila*[4]), a mucus-degrading bacterium in the digestive tract, producing metabolites which can also be a carbon source for GM components.

Dysbiosis in the gut microbiota and its implications for health

Dysbiosis is a condition of GM imbalance. Disorders of GM balance can be triggered by internal factors including genetic makeup as well as external factors such as breastfeeding, use of antibiotics, lifestyle, and food consumption patterns. Dysbiosis is characterized by changes in microbiota composition, such as an increase of opportunistic pathogens and harmful bacteria, while on the other hand, there is a decrease in the group of beneficial bacteria. The consequence of dysbiosis is the occurrence of various diseases, both locally intra-intestinal and extra-intestinal such as the brain (gut-brain axis), respiratory tract (gut-lung axis), urogenital tract (vaginosis), skin and others. Therefore, restoring GM from dysbiosis, or in other languages, re-programming gut microbiota has become a hot topic that is currently attracting

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the attention for many studies. All of these are indications of an approach through GM as a new horizon in preventing the emergence of various diseases.

The problem of malnutrition is a classic example where a multi-disciplinary approach is required, in which GM has been making a significant contribution. Excess nutrition analogous to obesity is a manifestation of gut microbiota dysbiosis, where there is a decrease in the proportion of *Bacteroides* in the gut and an increase in the number of *Phylum Firmicutes*. On the other hand, stunting, the major nutritional problem which has threatened Indonesian generation, occurs due to overgrowth of the oropharyngeal microbiota. GM disorders was found to be strongly associated with these malnutrition events,[5] hence, the GM approach is considered to play a significant role in increasing nutrient absorption in stunting children.

Maintaining the balance of the gut microbiota is a new approach in public health programs

With the increasing scientific evidence of the contribution of GM to health and disease, various approaches are sought to maintain, restore or modulate the groups of beneficial bacteria in the digestive tract. Those approaches are mainly performed through three different ways including administration of probiotics, prebiotics, and fecal microbial transplantation. The probiotic approach is commonly attained through the consumption of live bacteria which can improve the health of the host, while prebiotic approach is the consumption of food ingredients or food components that increase the growth of beneficial bacteria in the digestive tract. Meanwhile, fecal microbial transplantation (FMT) has been beginning to perform under certain conditions in which fecal microbiota is introduced into individuals with certain disease and has been showing encouraging results. Even though the application of probiotics (bacteriotherapy) in maintaining or modulating of GM yet to fully recognized by some countries, the approach has showed positive impact on human health demonstrated in certain diseases prevention. Similar evidence was obtained from studies that revealed the beneficial outcomes of prebiotic and FMT intervention for human GM, which consequently improve human health. Therefore, it is noticeable that the composition of GM is a promising aspect which may need to be considered in developing an innovative intervention program to alleviate certain public health problem.

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