

A Current Review on Gut Microbiota For Healthy Life

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Abstract

The human gastrointestinal tract is highly populated by a vast and diverse community of different microbes. Every individual is provided with a unique gut microbiota which varies according to their food habits and dietary intakes. This human gastrointestinal tract gut microbiota has various functions by participating in host mechanisms or metabolisms acts as or gives protection against the pathogens invading microbes into the gut, and also play an important role in facilitating the immune system development and function. A slight alteration even in this natural flora of gut in the intestine can cause infectious disease and disorders to the human. Various infections due to antibiotics and gut bacterial communities, bacterial interactions, mood disorders, metabolic disorders, diabetes, allergic disease, inflammatory bowel disease, hormonal and many neurological processes can happen. Hence, it is very important in maintaining the natural flora of the gut as it maintains a healthy gut microbiota, structural integrity and protection. Recently ayurvedic medicines are used over allopathy for its less sides on the body and for maintaining a healthy gut microbiome. This review aims on the current status of the gut microbiota for healthy life under key problems identification and maintaining the current healthy gut microbiota in the human gastrointestinal tract.

Keywords: Gut ; Microbiota ; natural flora ; disease ; function ; healthy ; gastrointestinal tract ; infections.

Introduction

The human gastrointestinal tract gut microbiota have received increasing attention over the last years. Every individual is provided with a unique gut microbiota profile. ¹ Intestinal microbiota is a natural flora of the human gastrointestinal tract which is a diverse community of various different types of microbes. Natural flora of the human intestinal gut have different compositions and are linked with various health and disease. ² Microbiota has different taxonomic factors, although these gut

microbiota have been explored from several decades, investigations of the various role of microorganisms residing in the human gut have been attracted much attention beyond classical infectious diseases. ³ Different types of microbes may include firmicutes, Bacteroidetes, actinobacteria and proteobacteria are some microbes in the gut microbiota. These microbes maintain the natural flora microbiota. ⁴ The human gastrointestinal tract is populated by a wide range of diverse communities of microbes. The natural flora gut microbiota maintains and plays a major role in various host functions and different diversity of the microbiota. ⁵ Human gut microbiota is the natural flora so even a small alternation or disturbance in this natural flora will lead to many infectious disease and gut interactions and many disorders. ⁶ This natural flora is based on the individuals food habits, their dietary intake for maintaining a normal healthy gut. ⁷

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Recent articles show that common medications including all antibiotics and laxatives, can alter gut microbiome. These medications will increase the risk

of intestinal infections, gut disorders, skin rashes, colon cancer, obesity, mood disorders, diabetes, lung cancer⁸. These allopathy medicines have a lot of side effects and therefore ayurvedic medicine is used more recently. Hence, many herbs are explored for their pharmacological profile and can be used for management of diseases such as cancer^{9,10} diabetes, oxidative stress induced liver injury,¹¹ inflammation^{13,14,15,16,17,18} As nanomedicine is ruling the industry now for its excellent properties people are using various plants and plant products for preparing eco friendly nanoparticles¹⁹ to cure various disease^{20,21,22} As increased antibiotics cause various damages, ayurvedic and nanomedicine is playing a vital role which may be opted for better protection of gut microbiota.

GUT - NATURAL FLORA

Human intestinal microbiota is the natural flora of the human gastrointestinal tract which is of a diverse community of a wide range of differing types of microbes. This natural gut flora aims at maintaining various host metabolisms, functions and diversity of the microbiota. Human microbiomes have differences even in healthy individuals with occupying different habitats such as the gut, skin, and vagina of every individual. This diversity remains unexplained although diet, host genetics, environmental factors and the early microbial exposure has also been implicated.²³ As numerous studies have already reported changes in the natural gut microbiota is not only during obesity, diabetes and liver disease but also cancer and even neurodegenerative disease. So this human gut microbiota is viewed as a potential source of novel therapeutics.

As every individual is provided with a very unique gut microbiota profile, the natural flora of the human intestinal gut has different compositions and are linked with various health and disease. The microbiota has different taxonomic factors. They maintain the functional characterization of a healthy gut microbiota and plays a major role in maintaining the structural integrity of the gut mucosal barrier, as a specific role in host nutrient metabolism, immuno modulation and also acts as a protection against the pathogens or against invading microbes in the gut microbiota.

Health and Immune Response

As gut microbiota is an important component for the development of gut immune system and the gut immunological homeostasis which is influenced by the host - microbe interactions. As an underdeveloped immune system and immune functions, which would be restored by the colonisation of certain bacteria such as segmented filamentous bacteria. Other hand, symbiotic microbes maintain the immune balance through both direct and indirect pathways. A good immune system and gut interactions is always necessary for maintaining the normal gut flora free from any disease and disorders. Healthy intestinal microbiota that contributes to host resistance to infection through their involvement in the development of various host immune systems and complex interactions.

GUT MICROBIOTA DISORDERS AND DISEASES

Gut microbiota have various relations in mood disorders of each individual. Approximately 10% of the world's total population is mood disorders due to socio economic burdens of significant individuals. Among the general population, people with mood disorders tend to have a Higher rate of mortality and a very decreased life expectancy. But however the underlying mechanism of gut interactions and alterations of mood disorders are not sufficiently characterised. The human body can be considered as a meta organism made up of its own eukaryotic cells and trillions of microbes that colonise on the superficial body sites, such as the skin, airways and gastrointestinal tract. The co-evolution of hosts and microbes brought about a variety of molecular organisms. Genetic and environmental factors contribute to the major cause of mood disorders such as genetic vulnerability and susceptibility, chronic non infectious inflammation, oxidative stress, neurotransmitter imbalance, insufficient signalling by many factors and abnormalities.

As the natural flora of the human gastrointestinal gut relates to various types of disease such as inflammatory bowel disease, type -I diabetes, mood disorders, hormonal disorders neurotransmitter modulation and cancers²⁴ As said in previous articles the oral microbiota to an extent influence on the oral squamous cell carcinoma.

Inflammatory Bowel Disease

The intestinal microbiota has communities colonising the small and large intestine, bowel movements play an important role in a multitude of host functions. Alterations in intestinal gut microbiota, of intestinal bacteria functions in the energy extraction from food, production of key metabolites for the host physiology and also in the protection and response to gastrointestinal infectious disease.¹⁹ Normally in a human gut upto 100 trillions of bacteria colonise as estimated 200 to 1000 distinct bacterial species. And the intestinal epithelium provides an essential barrier which ensures a space between the microbes and the host in the gut microbiota.

Type I Diabetes

Gut microbiota always has a correlation between diabetes mellitus and obesity as reviewed in many articles.²⁵ Changes in the gut microbiota have been implicated in the emergence of both diabetes and obesity in humans. These changes appear to be attenuated by dietary interventions, as a fibre enriched diet may improve the insulin resistance. Type I diabetes is a debilitating autoimmune disease that results from the T cells mediated destruction of insulin producing Beta cells.²⁶ Type I diabetes incidence was increasing during the past several decades in all the developed countries around the world, suggesting that these changes in the environment may influence disease pathogenesis due to the alterations in the natural flora of gut microbiota.²⁷

Neurotransmitter Modulation

Gut microbiota is not only essential in maintaining structural integrity of host, maintaining immune system and metabolic health but also seems to have influence in the development of central nervous systems, neurodegenerative disease and neuro immune mediated disorders. Gut microbiota consumes a wide range of neurotransmitters such GABA,²⁸ acetylcholine, serotonin²⁹, dopamine and histamine. As known, more than 90% of the neurotransmitter, serotonin, in the body of humans are produced in the gut, which can affect emotion regulation when transmitted to the CNS. As the natural flora of the human gastrointestinal gut relates to hormonal disorders and neurological processes also. So, it is mandatory to maintain a healthy and normal gut

metabolisms. As the human gastrointestinal gut plays a wide range of functions and helps in maintaining a good health, understanding the disturbances and alterations in the natural flora of gut is essential.³⁰

Conclusion

This review article highlights the importance of a healthy microbiota. Every individual is provided with a very unique gut microbiota, having various functions, that plays a major role in maintaining the structural integrity of the gut mucosal barrier, specific role in host nutrient metabolism, protecting against the invading microbes in the gut. The normal flora of gut microbiota depends on dietary and food habits of the individual and also age. Any small disturbance in the gut microbiome can lead to various diseases. Healthy gut can be maintained by increasing the intake of fibre rich food, fruits with citric acid and vegetables. Avoiding unnecessary antibiotics can also maintain a normal and healthy gut microbiota.

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References

1. Bhattacharjee S, Kalbfuss N, da Costa CP. Parasites, microbiota and metabolic disease [Internet]. Vol. 39, Parasite Immunology. 2017. p. e12390. Available from: <http://dx.doi.org/10.1111/pim.12390>
2. Upadhyay V, Fu Y-X. Linking the microbiota and metabolic disease with lymphotoxin [Internet]. Vol. 25, International Immunology. 2013. p. 397–403. Available from: <http://dx.doi.org/10.1093/intimm/dxt018>
3. Goodman B, Gardner H. The microbiome and cancer [Internet]. Vol. 244, The Journal of Pathology. 2018. p. 667–76. Available from: <http://dx.doi.org/10.1002/path.5047>
4. Coggshall K, Brooks L, Nagarajan P, Arron ST.

- The Microbiome and Its Contribution to Skin Cancer [Internet]. *Microbiome and Cancer*. 2019. p. 87–106. Available from: http://dx.doi.org/10.1007/978-3-030-04155-7_5
5. Maruvada P, Leone V, Kaplan LM, Chang EB. The Human Microbiome and Obesity: Moving beyond Associations [Internet]. Vol. 22, *Cell Host & Microbe*. 2017. p. 589–99. Available from: <http://dx.doi.org/10.1016/j.chom.2017.10.005>
 6. Dreyer JL, Liebl AL. Early colonization of the gut microbiome and its relationship with obesity [Internet]. Vol. 10, *Human Microbiome Journal*. 2018. p. 1–5. Available from: <http://dx.doi.org/10.1016/j.humic.2018.08.002>
 7. Sharma AM. Moving Beyond Scales and Tapes: The Edmonton Obesity Staging System [Internet]. *Controversies in Obesity*. 2014. p. 137–43. Available from: http://dx.doi.org/10.1007/978-1-4471-2834-2_17
 8. Gheena S, Ezhilarasan D. Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells. *Hum Exp Toxicol*. 2019 Jun;38(6):694–702.
 9. Perumalsamy H, Sankarapandian K, Veerappan K, Natarajan S, Kandaswamy N, Thangavelu L, et al. In silico and in vitro analysis of coumarin derivative induced anticancer effects by undergoing intrinsic pathway mediated apoptosis in human stomach cancer. *Phytomedicine*. 2018 Jul 15;46:119–30.
 10. Ezhilarasan D, Lakshmi T, Vijayaragavan R, Bhullar S, Rajendran R. Acacia catechu ethanolic bark extract induces apoptosis in human oral squamous carcinoma cells [Internet]. Vol. 8, *Journal of Advanced Pharmaceutical Technology & Research*. 2017. p. 143. Available from: http://dx.doi.org/10.4103/japtr.japtr_73_17
 11. Sharma P, Mehta M, Dhanjal DS, Kaur S, Gupta G, Singh H, et al. Emerging trends in the novel drug delivery approaches for the treatment of lung cancer. *Chem Biol Interact*. 2019 Aug 25;309:108720.
 12. Ezhilarasan D, Sokal E, Najimi M. Hepatic fibrosis: It is time to go with hepatic stellate cell-specific therapeutic targets. *Hepatobiliary Pancreat Dis Int*. 2018 Jun;17(3):192–7.
 13. Lakshmi T, Krishnan V, Rajendran R, Madhusudhanan N. *Azadirachta indica* : A herbal panacea in dentistry - An update [Internet]. Vol. 9, *Pharmacognosy Reviews*. 2015. p. 41. Available from: <http://dx.doi.org/10.4103/0973-7847.156337>
 14. Ashwini S, Ezhilarasan D, Anitha R. Cytotoxic Effect of *Caralluma fimbriata* Against Human Colon Cancer Cells [Internet]. Vol. 9, *Pharmacognosy Journal*. 2017. p. 204–7. Available from: <http://dx.doi.org/10.5530/pj.2017.2.34>
 15. Ezhilarasan D. Oxidative stress is bane in chronic liver diseases: Clinical and experimental perspective [Internet]. Vol. 19, *Arab Journal of Gastroenterology*. 2018. p. 56–64. Available from: <http://dx.doi.org/10.1016/j.ajg.2018.03.002>
 16. Mehta M, Deeksha, Tewari D, Gupta G, Awasthi R, Singh H, et al. Oligonucleotide therapy: An emerging focus area for drug delivery in chronic inflammatory respiratory diseases [Internet]. Vol. 308, *Chemico-Biological Interactions*. 2019. p. 206–15. Available from: <http://dx.doi.org/10.1016/j.cbi.2019.05.028>
 17. Anitha R, Ashwini S. Antihyperglycemic activity of *Caralluma fimbriata*: An In vitro approach [Internet]. Vol. 13, *Pharmacognosy Magazine*. 2017. p. 499. Available from: http://dx.doi.org/10.4103/pm.pm_59_17
 18. Ezhilarasan D, Lakshmi T, Nagaich U, Vijayaragavan R. Acacia catechu ethanolic seed extract triggers apoptosis of SCC-25 cells [Internet]. Vol. 13, *Pharmacognosy Magazine*. 2017. p. 405. Available from: http://dx.doi.org/10.4103/pm.pm_458_16
 19. Rajeshkumar S, Venkat Kumar S, Ramaiah A, Agarwal H, Lakshmi T, Roopan SM. Biosynthesis of zinc oxide nanoparticles using *Mangifera indica* leaves and evaluation of their antioxidant and cytotoxic properties in lung cancer (A549) cells [Internet]. Vol. 117, *Enzyme and Microbial Technology*. 2018. p. 91–5. Available from: <http://dx.doi.org/10.1016/j.enzmictec.2018.06.009>
 20. Rajeshkumar S, Agarwal H, Venkat Kumar S, Lakshmi T. Brassica oleracea Mediated Synthesis of Zinc Oxide Nanoparticles and its Antibacterial Activity against Pathogenic Bacteria [Internet]. Vol. 30, *Asian Journal of Chemistry*. 2018. p. 2711–5. Available from: <http://dx.doi.org/10.14233/>

- ajchem.2018.21562
21. Menon S, Ks SD, R S, S R, S VK. Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism. *Colloids Surf B Biointerfaces*. 2018 Oct 1;170:280–92.
 22. Karthiga P, Rajeshkumar S, Annadurai G. Mechanism of Larvicidal Activity of Antimicrobial Silver Nanoparticles Synthesized Using *Garcinia mangostana* Bark Extract [Internet]. Vol. 29, *Journal of Cluster Science*. 2018. p. 1233–41. Available from: <http://dx.doi.org/10.1007/s10876-018-1441-z>
 23. Frame L, Costa E, Jackson S. Current Explorations of Nutrition and the Gut Microbiome: A Systematic Review (P20-032-19) [Internet]. Vol. 3, *Current Developments in Nutrition*. 2019. Available from: <http://dx.doi.org/10.1093/cdn/nzz040.p20-032-19>
 24. Jose A, Surendran M, Fazal S, Prasanth B-P, Menon D. Multifunctional fluorescent iron quantum clusters for non-invasive radiofrequency ablation of cancer cells [Internet]. Vol. 165, *Colloids and Surfaces B: Biointerfaces*. 2018. p. 371–80. Available from: <http://dx.doi.org/10.1016/j.colsurfb.2018.02.058>
 25. Grigorescu I, Dumitrascu DL. IMPLICATION OF GUT MICROBIOTA IN DIABETES MELLITUS AND OBESITY. *Acta Endocrinol* . 2016 Apr;12(2):206–14.
 26. Prashanthi M, Sundaram R, Jeyaseelan A, Kaliannan T. Bioremediation and Sustainable Technologies for Cleaner Environment. Springer; 2017. 358 p.
 27. Sujatha J, Asokan S, Rajeshkumar S. ANTIDERMATOPHYTIC ACTIVITY OF GREEN SYNTHESISED ZINC OXIDE NANOPARTICLES USING CASSIA ALATA LEAVES [Internet]. Vol. 7, *Journal of Microbiology, Biotechnology and Food Sciences*. 2018. p. 348–52. Available from: <http://dx.doi.org/10.15414/jmbfs.2018.7.4.348-352>
 28. Strandwitz P. Neurotransmitter modulation by the gut microbiota [Internet]. Vol. 1693, *Brain Research*. 2018. p. 128–33. Available from: <http://dx.doi.org/10.1016/j.brainres.2018.03.015>
 29. Rinninella E, Raoul P, Cintoni M, Franceschi F, Miggianno G, Gasbarrini A, et al. What is the Healthy Gut Microbiota Composition? A Changing Ecosystem across Age, Environment, Diet, and Diseases [Internet]. Vol. 7, *Microorganisms*. 2019. p. 14. Available from: <http://dx.doi.org/10.3390/microorganisms7010014>
 30. Lässiger-Herfurth A, Pontarollo G, Grill A, Reinhardt C. The Gut Microbiota in Cardiovascular Disease and Arterial Thrombosis [Internet]. Vol. 7, *Microorganisms*. 2019. p. 691. Available from: <http://dx.doi.org/10.3390/microorganisms7120691>