Comprehension of Immune–Microbiota in the Digestion: Review Article

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ABSTRACT
Microbiotas have a essential role on the training, induction, and function on immune system host. in response, the immune system has main evolvement and relation with different types microbes. When microbiota and the immune system operated in best and optimal way, this correlation allow to induce a defensive responses to a certain pathogens and preserve pathways to regulate inoffensive antigens. Nevertheless, the elimination of nematodes and the changing in diet has a selective microbiota that can tolerate, and diverse with the immune responses. This occurrence is established to account the theatrical rise in inflammatory disorder and the autoimmune. This review article aimed to understand the correlation between gut microbiota and the immune system and its impact, effect and link with disease, host and the health of the body, as well as the role and the impact of gut microbiota on the overabundance of pathologies. Additionally, the biomedical effect and importance was discussed as well precisely, the interaction between the host and the microbiota. In spite of the huge progress in the techniques, instruments and pathways, it is much easier now to demonstrate a basic mechanism that highlighted this interaction.

Keywords: immune system, microbiota, gut, autoimmune, disease

II. IMMUNE HOMEOSTASIS AND GUT MICROBIOTA

More than a few studies show that the signs that resulting from microbiota of gut are important to develop the immune system like the models of germ free (GF) by which it provide a strong evidence for the immune homeostasis role with microbiota (10-11). It was noticed that the gut microbiota have influence on responses of the immune system.

Since the birth of human the microbes start to linked with the intestine which step by step will be saturated with different kinds of bacteria, and viruses which refers to the microbiota of gut, it affect the intestine on many side such as stipulation and gaining of nutrients, physiology of the host, and provides certain pathogens, this increase the interest of the scientists since more than 20 years (12-15).

Elie Metchnikoff study how gut microbiota can affect the health and how can this be promoted with probiotics and he suggest that microbiota can adapt the resistance of the immune system towards the rising diversity of the diseases (16-18).

Recently, and using the instrumentation and technologies, scientists become more able to study the colonies and the structures of microbes to understand it’s ecology, development stages as well as the disturbances inside intestinal tract (18-21). The scale of these studies keeps growing to resolve and discover that the microbes can reach a relative stability and functionality when the human reach the age of 3 years, and these microbiota can be affected with factors like host, antibiotics administration, medicines, and geographical location. Bacteria sometimes combine with cancer cell line especially in gut as shown in figure 1 that indicates the cancer and the bacteria in colon (22).
Figure 1: The tumor of colon surface with bacteria grows (the arrow) and without it (18).

Notably, it was established that health controls can be linked to different microbes and the structure of its colonies and this can be noticed clearly in bowel diseases, toxicity, cardiovascular diseases, type 2 diabetes health problems as well as bad and poor nutrition which previously were not related to microbiota (23).

Recent studies indicate that microbiota in the human fecal is associated and related to certain diseases, it is comprised with autoimmunity, obesity, food allergy, malnutrition which indicated a very solid proof of the correlation between the worse feelings of the diseases with microbiota. Therefore, a collection of certain strains can symbolized serious factors that conjugated to the genetics hosts with the influences of the environment that has influence on the susceptibility of the diseases (24). The changes in the composition of microbiota has no relation with the disease itself, but it has a connection role host pathogenic development which bring the attentions of the scientists and place the microbiota in their biomedical researches and combine the findings with the disease and eventually they demonstrate what they call Microbiota Repairs, by which they indicates that the diseases could be alleviated. This finding leads to direct their work to different fields to connect the host health modulate with microbes (16, 17, 25).

III. AUTOIMMUNITY AND GUT MICROBIOTA

Since the gut microbiota has a very such deep effects on the modified immune system and the innate, it does not astonish the linkage between the autoimmune diseases with various types of the gut microbiota. A considerable interest has been carried out on the relation between GI and the related autoimmune diseases and the effect of gut microbiota on these diseases, therefore, current studies are designed to study the impact of gut microbiota on extra intestinal diseases. Table 1 indicates these impacts on the disorders of the autoimmune outside and within the gut (22).

Table 1: the roles of gut microbiota on the immune system (10)

| Disease | Animal model | Manipulation method of microbiota (signal) | Effects in GF animal | Reference |
|---------|--------------|------------------------------------------|----------------------|-----------|
| IBD     | IL-2**      | GF                                       | less severity        | 84        |
|         | TCRgfp**    | GF                                       | no disease           | 66        |
|         | IL-10**     | GF                                       | no disease           | 83        |
|         | Helicobacter Intermedius- induced colitis in Flag | Introducing H. Fluor | less severity        | 73        |
|         | OF5-induced colitis | Introducing Clostridium | less severity        | 44        |
| RA      | IL-10**     | GF                                       | no disease           | 84        |
|         | TGF-β1**    | Introducing Lactobacillus delbrueckii ex GF IL-10**- mice | reduced disease    | 85        |
|         | CD3**-IL-10p** | v/vs                             | increased severity   | 85        |
|         | CD11c**-IL-10p** | v/vs                             | less severity        | 84        |
|         | K/GN        | GF                                       | less severity        | 66        |
|         | K/GN        | Introducing SRS in ex-GF K/GN          | reduced disease      | 86        |
| T1D     | NOG         | GF                                       | severe disease to no difference* | 99, 100, 129, 30 |
|         | PEC female  | SPF natural colonization protection to SPS | no difference | 91        |
|         | NO5 male   | SPF natural colonization no difference  | 91        |
|         | MyD88**-NOG | GF                                       | severe disease      | 90        |
|         | MyD88**-NOG | v/vs                             | no disease           | 90        |
| Multiple sclerosis | EAE | GF                                       | no difference        | 90        |
|         | AAE         | Introducing EAE to GF EAE               | no difference        | 95        |
|         | EAE         | Introducing H. Fluor                    | no difference        | 96        |
|         | Established EAE | Introducing 3 strains of Lactobacillus | therapeutic effect   | 90        |
| APLRCD  | MII**       | GF                                       | no difference        | 101       |
|         | MyD88**-AII** | v/vs                             | no difference        | 101       |
| Systemic lupus erythematosus | MII /AII | GF                                       | no difference        | 102       |
|         | Antinuclear granulys | GF                                       | no difference        | 101       |
IV. RELATION BETWEEN IN BORN (INNATE) IMMUNE HOMEOSTASIS AND MICROBIOTA

Presenting cells of Antigen (APCs)

APCs are able defend against infections, for example lymphoid nodules that rooted in the wall of the gut these dendritic cells (DCs), and under the same conditions, create large quantity of IL-10 in a comparison with different type of DCs (splenic) (24-25).

Some reports present facts that show the main role that gut microbiota plays to regulate APCs development, less number of intestinal observed in animals GF and the colony that combines with E coli is enough to engage DCs with intestines furthermore, ATP microbes has lately been exposed to same sets of CX3CR1 and CD70 on the surfaces, after that they induce differentiated cells (Th17 cells) (8-12).

The macrophages of Intestinal characterize the main tissue population inside the body, whereas the gut macrophages numbers are either decreased in GF pigs or normal in GF mice on the other hand the systemic macrophages were reduced in GF of the pigs. in addition to that, the functions of macrophage like microbialicidal activities, phagocytosis and chemo-taxis have been shown cooperation with macrophages peritoneal to the GF of mice, GF of mice were also has no activation markers to macrophage like class II of his to compatibility (25-26).

Figure 2 indicate the spontaneous model of arthritics which express the mechanism steps between autoimmune arthritics, systematic immunity and microbiota.

Figure 2: autoimmune model shows the correlation between extra intestinal disease and the microbiota of gut (10)

V. THE COMMENSAL AND THE PROTECTIVE RESPONSE

Skin tissue that usually inhibited microbiota, as well as other tissues i.e., lung, and GI tract (the current review article) can be consider a pathogens gates to access the infected host, which means that these inhibited microbiota can be the first to meet and face the immune system, and this facing usually take place in conditional environment that regulated by means of endogenous microbiota (14-15).

This commensal between microbiota and the immune system precisely between the microorganism pathogens and the responses of the autoimmune system can reach to classify these microbes which can be clearly appears and described in figure 3. This dynamic interaction between immune cells and pathogens can lead to the outcomes of the pathogenesis to a certain infection (26).

This complex commensal will enable the immune system to adapt and develop itself to what is called “Adaptive Immunity” this adaptation usually happen when there is a difficulties to control microbiota pathogens by the immune system, this will preserve and maintain equilibrium between host and microbiota (symbiotic relationship) (27).
VI. CORRELATION OF IMMUNE SYSTEM WITH DIET

The immune system is managed and controlled by the inelegant sensitivity toward the host nutrition condition and its relation with microbiota inside the host. Currently there is a lot of evidences regarding the interaction between microflora (microbiota), immune system and nutrition, all these factors are correlated to the metabolism and the food derived of the diet with the presence and the concentration of microbiota, for example the metabolism of vitamin A will be complete in the gut due to the high concentration viability and presence of retinoic acid which control the responses of lymphocytes to the antigen and direct them to in a certain gastro intestinal pathways. In addition to the that the Ahr ligands that extracted from vegetables can participate in the responses of the immune system. The same concepts apply with vitamin E, C and D.

A simple diagram that shows the correlation between microbiota, vitamins, immune system, and nutrition in depicted in figure 3.

![Figure 3: Interaction between microbiota and the immune system](image1)

![Figure 4: The interaction between immune system, microbiota and diet](image2)
VII. CONCLUSION

- The influence of commensal on diseases and health via controlling of the functions of immune system has appeared as an important area in clinical and scientific field.
- Recently, the development in the sequencing of next-generation guides an uprising in culture-independent growth the characterization method to identify the microbiota in gut and their colonies.
- Now there are a lot of evidences that indicates the correlation between microbiota and the immune system and how this link can affect the autoimmunity of the system and reflect on the disease inside and outside gut.
- Environment and genetics can participate in the intensity of microbiota

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