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The barrier and the intestinal microflora - the factors determining the state of human health

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Summary

Introduction and purpose: Protective function, immune and nutrition in the human body correspond to the intestinal barrier. As a result of excessive exposure to various factors often leads to damage or abnormalities in its functioning, which negatively affects the behavior of human health. The intestinal microflora is important in the process of metabolism, as well as the intestinal barrier plays an important role in establishing immunity and protection. The purpose of this article is to present the importance and the role played by the barrier and microflora in maintaining human health.

Description of knowledge: Use of alcohol, non-steroidal anti-inflammatory drugs, antibiotics, completed parasitic infections, viral and bacterial infections, chronic stress and diet deficient in fruits and vegetables cause damage to the intestinal barrier and microflora bacterial dysbiosis.

Conclusions: Damaged intestinal barrier is causing loss of control on the elements that penetrate into the bloodstream. Increased permeability of the intestinal barrier contributes to increased risk of developing various diseases.

Keywords:intestinal barrier, the intestinal flora, dysbiosis.

Introduction

The intestinal barrier is the anatomic structure that functions as a nutritional, immune, and protective in humans. The intestinal barrier of a system of interconnected components whose primary purpose is to prevent seepage into the blood, bacteria, fungi, toxins, and other harmful substances. The correct barrier function based on only passing only be distributed food particles (eg. The electrolytes, minerals monomers proteins, fats, carbohydrates, nutrients) in the specified amounts. The intestinal barrier includes: the secretory immunoglobulin A (sIgA), enterocytes, tight junctions, M cells, APCs, lymphocytes, Peyer's patches and the intestinal microflora [1].

Secretory immunoglobulin A (sIgA) is produced by plasma cells, mainly in the mucous membranes of the small intestine and colon. It is capable of neutralizing toxins and viral particles. Blocks bacterial receptors, so that their penetration into the epithelial cells is impossible. In addition, it prevents the absorption of antigens and molecules with allergenic potential and thus contributing to inhibit the allergic reaction [2].

To enterocytes of the small intestine epithelial cells whose main function is to create a mechanical barrier and absorption of nutrients. They are connected to each other by means of the peak complexes złączeniowych which include tight junctions (ang. Tight junction). Erythrocytes are subject to the renewal of which is to maintain a relatively constant level of reduced permeability of the intestinal epithelium [3]. These cells in the presence of commensal organisms cause them to create a favorable environment. However, when an inflammatory reaction occurs which is directed to the destruction of pathogens, their role is to present the antigen in order to activate cells located in the intestinal lamina propria [4].

Tight junctions seal the space between the epithelial cells of the mucosa. They consist of a complex of proteins such as przezbłonkowych okludyny proteins jams (ang. Junctional adhesion molecules). They are associated with mikrokosmykami, which, thanks to the fact that contain digestive enzymes and transport systems are involved in the absorption of nutrients and their metabolism. Furthermore, they have an effect to increase the absorbent surface of the intestine. Tight junctions are designed to provide adequate selectivity for the intestinal barrier. Their proper structure causes the body to get only those elements which are characterized by small size and low degree of damage [2, 5].

Peyer's patches (ang. PP Peyer's patches) are predominantly in the wall of the small intestine. They are specialized lymphatic pellets containing absorbent naive B lymphocytes, follicular dendritic cells (called. DC- dendritic header) and międzygrudkowe areas which contain T cells Their main task is the sampling and selection of antigens, therefore, the tufts have a thinner membrane layer mucous. B-lymphocyte Peyer's patches are the major site of generation of IgA antibodies [3,6].

Intestinal M cells mainly in the Peyer's patches. Although constitute only about 1% of the lining of the intestine their function of transporting the different molecules and microorganisms from the intestine into the deeper layers of the epithelium is essential for the immunological processes [7]. This process is called transcytosis. They are also able to recognize antigens. With them it is possible implication of various pathogenic bacteria in the human body which by itself prepared using the invasive proteins have the ability to tightly adhere to the surface of the cell membrane. The result is the colonization and induction of disease states [8].

APCs (called. Antigen presenting cells) are the main representative of the cellular system GALT (ang. Gut associated lymphoid tissue), which is a place immune response. More than 75% of lymphoid cells the whole immune system is located in the GALT. APCs present antigen effector cells. They have decision-making regarding the formation of inflammation or tolerance to a specific antigen. This is possible due to secretion of cytokines by the appropriate APC, and their corresponding differentiation [2, 9].

Intraepithelial lymphocytes (IEL- intraepithelial lymphocyte) are some of the most important cells of the immune system that are associated with the GALT. These include the T cell receptor TCRαβ and TCRγδ and CD8αα cells which fulfill a protective function in relation to the gastrointestinal tract, because it avoids the immunopathological reactions. IEL differ from other T cells, which are found in the human body that their activation is involved, another group of cells and receptors. They are only activated receptor CD2. It should be noted that the IEL also have CD103 receptor, with which it is possible to interact with E-cadherin enterocytes, which enables IEL colonization of the intestine. These lymphocytes secrete factors TNF-α and IFN-γ by which it is possible to assist in the transport of ions through the intestinal epithelium. IEL take mainly involved in fighting infections and pathogens stimulate the renewal of epithelial cells and the formation of IgA and maintaining tolerance to food antigens. In the small intestine and fat include natural cells IEL (unconscious) and induced cells IEL (iIEL). The first of them appear at birth and disappear with age, while the second they develop in later life. Furthermore iIEL are highly active in combating pathogens [2, 3, 10].

B cells are found in lymph follicles Peyer's patches. In cooperation with T cells they can produce sIgA. Resistance of the mucous membranes is also dependent on cell B1, which lie between the mucosa and the peritoneal cavity and are not permanently associated lymphoid tissue of the mucous membranes. These lymphocytes produce antibodies of IgM [11].

Intestinal microflora and its significance for human health

The intestinal microflora is referred to as a group of microorganisms which together form a complex ecosystem. It is unique to each person. It exhibits the characteristics of climax, which means that although it is stable under the influence of a certain factor is a change. The intestinal microflora is also called microbiota. It is located in the human gut and its weight in an adult is about 2 kg. Its formation begins in utero and continues until about 2 years of age. In this process, many factors are involved, which program the child's body and his health for the coming years [12]. In the case of children born in naturally dominated by microorganisms such as *Lactobacillus* and *Prevotella*. These microorganisms are characteristic of vaginal flora mother. However, in children born by caesarean section was observed advantage of the presence of a *Propionibacterium*, *Staphylococcus* and *Corynebacterium*, which occur mainly on the surface of the skin. The composition of intestinal microflora depends also on how to feed your baby. In breast-fed infants is more bacteria of the genus *Lactobacillus* and *Bifidobacterum*. However, in the case of administration to an infant milk material is dominated by bacteria of the genus *Clostridium* and *Bacteroides*. The process of shaping the intestinal microbiota is to achieve a relatively stable. Such stable intestinal microflora is often called physiological intestinal microflora, which typically predominate species of *Bacteroides*, *Eubacterium*, *Peptostreptococcus*, *Bifidobacterium, Streptococcus*, Lactobacillus, *Clostridium*, *Staphylococcus* [13].

The main role of the human intestinal microflora is to ensure the proper functioning of the entire human body. It depends on the proper functioning of such systems as the immune system, nervous and gastrointestinal tract [14]. The intestinal microbiota is involved in the breakdown of undigested food and toxins. It has an impact on the production of folic acid, B vitamins, vitamin K, and the absorption of iron, magnesium and calcium [8]. It is also responsible for normal peristaltic and fermentation processes that occur in the large intestine. Moreover, its purpose is to prevent infections and excessive multiplication of opportunistic microflora. A suitable amount of a health promoting bacteria inhibit the proliferation of a variety of different pathogens and causes the formation of resistance colonization [15].

The effects of damage to the intestinal barrier and the intestinal microflora to human health

The condition and operation of the intestinal barrier are dependent on many different factors. For those adverselyaffect the anatomical structure include: alcohol, poor diet, stress, certain medications, infections [16]. As a result of these factors can lead to the so-called. dysbiosis. It is defined as an adverse change in the qualitative and quantitative composition of the intestinal microflora. It is a risk factor, among others, diseases such as inflammatory bowel disease, celiac disease, irritable bowel syndrome, atopic dermatitis, or various allergic diseases. [8] The result is the emergence of dysbiosis rise to disturbances in the production zonuliny and okludyny, or proteins that form a transmembrane connection in intestinal epithelia. As a result, there is a decrease or interrupt the integrity of the gastrointestinal mucosa. In this case, antigens, harmful substances and allergens has facilitated enters the body and the ability to induce a range of disorders and diseases. One of the most dangerous toxins that can so enter the human body is endotoxin (lipopolysaccharide-LPS). It is part of the outer membrane of the cell cyjonobakterii and Gram-negative bacteria that are found in the gastrointestinal tract. Enters the body of endotoxin results in a wide range of adverse metabolic processes that are manifested increased fat storage, slow colonic transit and to decrease the rate of destruction of fatty acids in the muscle and in the liver, which encourages their accumulation in adipose tissue. Endotoxin also lead to chronic generalized inflammation, that could cause the onset of obesity, insulin resistance and type 2 diabetes [17]. Endotoxins also cause damage to the endothelium of blood vessels, both in the gastrointestinal tract as well as in peripheral vascular circulation. Stimulation of the vascular endothelial LPS endotoxin in the gastrointestinal tract leads to increase its permeability and allows penetration of bacteria that may enter the portal circulation of the liver (enterohepatic), and systemic. This can result in the occurrence of steatohepatitis and atherosclerosis [18]. The liver metabolizes products of digestion and absorption, and also regulates their proper use in the body, and therefore the penetration of harmful substances into the liver can increase the load on this body. If it lasts a long period of time can cause the appearance of a variety of disorders, and even temporary impairment of the work of this organ. Moreover, they can be initiated changes that take a chronic nature [19].

Fungi of Candida are part of the physiological microflora of the gut. With 200 species of fungi, 14 are considered to be pathogenic. In the case ofdysbiosis excess amounts of them to multiply uncontrollably. In contrast, damage to the intestinal barrier cause the toxins that are produced by the fungus enter the circulatory system and cause a variety of serious disturbances in the digestive tract, endocrine, urogenital tract, respiratory and central nervous system. Excessive growth of yeast also leads to nutritional deficiencies and, in particular vitamins and minerals. Furthermore, stimulation of the immune system by the normal microbiota is reduced, and damage to the intestinal barrier expands [20].

Brain and intestine communicate via brain-gut axis. Participation in this process have hormonal factors, neural and immune. Accordingly, the maintenance man may be partly determined by the composition of the microflora. They are surrounded by intestinal epithelium and neurons form the neuroendocrine system of the gastrointestinal tract. As a result, the bacteria, which are located in the gut have the possibility through the influence of neuronal processes in the brain. Serotonin, ie. happiness hormone is produced in the intestine [12]. Animal studies have shown that supplementation with probiotics, which aim is to restore the balance of microbiota and contributed to the increased production of tryptophan (a precursor of serotonin) [21]. However, studies by Ohlanda et al. proved that intestinal dysbiosis causes aggressive behawior [22].

Conclusions:

1. Factors exogenous and endogenous contribute to the development of dysbiosis and damage of the intestinal barrier. Followed by malabsorption of fats, vitamins, minerals and proteins, resulting in an increased risk of developing various diseases and health problems of physical and psychological nature.
2. Dysbiosis a risk factor for the development of autoimmune diseases as well as gastrointestinal diseases (e.g. inflammatory bowel disease). Furthermore, it can result in uncontrolled proliferation of yeasts.
3. Dysbiosis reduces or interrupts the integrity of the intestinal barrier, which is permeable to endotoxins, food allergens cells, bacteria and fungi.

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