Dr. Rath Health Foundation

PROBIOTICS

Dr. Rath
RESEARCH INSTITUTE

Probiotics

First Edition

Distribution:
Dr. Rath Education Services B.V.
Postbus 656, NL-6400 AR Heerlen
E-Mail: info@rath-eduserv.com
Internet: www.rath-eduserv.com

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Introduction

The incidence rate of chronic degenerative diseases of civilization, such as obesity, irritable bowel syndrome, inflammatory bowel disease, allergies and cancer, increases significantly in industrialized countries.

Although it has been known for a long time that there is a close interaction between the intestinal flora (intestinal microbiota), the immune system and a variety of metabolic processes of the host, i.e. the human, only in recent years has the meaning of the loss of intestinal microbiota in the pathogenesis of various diseases been increasingly discussed.

Currently, probiotics are said to restore and maintain the health of an organism.

In Cellular Medicine probiotics already play an important role in supporting health.

The aim of this brochure is to present the importance of intestinal microbiota for the health of the whole organism. Furthermore, preventive and therapeutic effects of probiotics are identified.

intestinal microbiota (also called "gut microbiota"), formerly known as intestinal flora, is the total of all micro-organisms in the gut.

Characteristics and Development of Microbiota

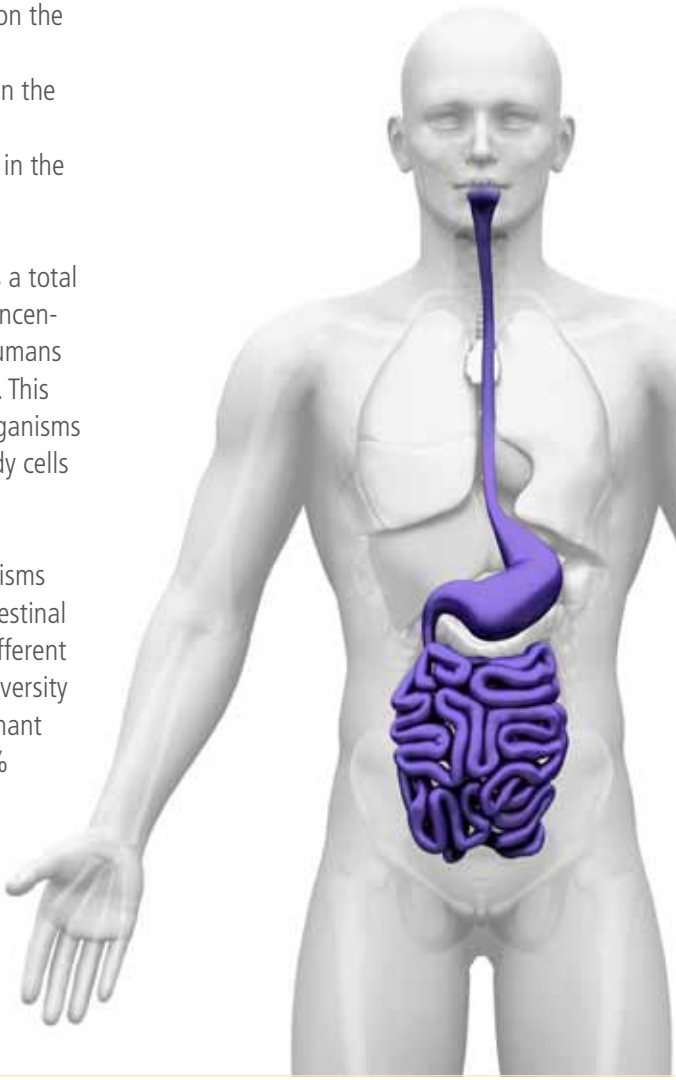
Humans are a habitat for microorganisms. Thus, the entire surface of the human body is colonized by bacteria:

- 70,000,000,000,000 bacteria are living in the colon of a human
- 300,000,000 bacteria are living on the skin of a human
- 100,000,000 bacteria are living in the oral cavity of a human
- 100,000 bacteria per day invade in the lower respiratory tract

The human large intestine contains a total of up to 10^{14} germs, the highest concentration of microorganisms, while humans only have a total of 10^{13} body cells. This means that the number of microorganisms in the gut exceeds those of the body cells by a factor of 10.

The totality of all living microorganisms in the gut is summarized as the intestinal microbiota. With more than 400 different types of bacteria it shows a high diversity of species, whereas 30 to 40 dominant species (types) make up about 99% of the bacterial cell mass. The main representatives are Bacteroides, Lactobacillus, Bifidobacterium, Eubacterium, Streptococcus, Clostridium, Escherichia and Staphylococcus. The species can be divided into tribes, called phyla.

The following tribes especially are found in the human gut: Firmicutes, Actinobacteria, Proteobacteria, Bacteroidetes.

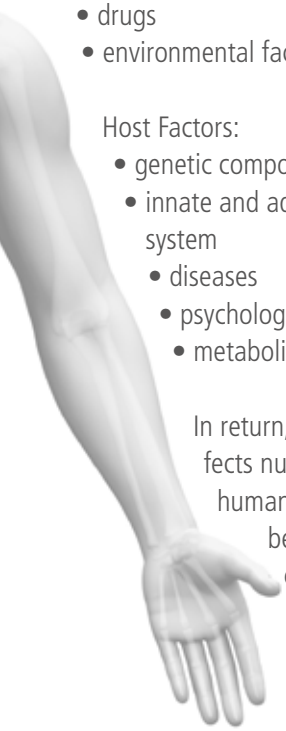


Every person has a unique microbiota because there are large individual differences in the composition of the microorganisms. The microbiota can vary depending on many factors throughout life. These factors include:

Exogenous Factors:
- birth path (vaginal birth, caesarean section)
- nutrition habits
- lifestyle
- hygiene
- pathogenic microorganisms
- drugs
- environmental factors

Host Factors:
- genetic composition of humans
- innate and adaptive immune system
- diseases
- psychological stress
- metabolism

In return, the microbiota affects numerous factors in the human organism, which will be discussed in the next chapter.



microorganisms = microscopic living organisms, these include bacteria, algae, and protozoa

bacteria = lowest, single-cell microorganisms

pathogen = from the Greek "pathos" (suffering, disease) and "genesis" (production, birth); pathogenic microorganisms have the ability to make organisms sick

Physiological Role of Microbiota

The intestinal microbiota of humans is a highly complex and dynamic ecosystem of microorganisms. It has an influence on various metabolic processes and immune reactions in the human organism. It is, for example, involved in decomposition, transformation and utilization of a variety of substances, which cannot be metabolized by the human body. These include:

- decomposition of non-digestible dietary components (fibres)
- activation of bioactive substances (phyto-chemicals)
- inactivation of food ingredients that limit the utilization of nutrients
- production of vitamins (folic acid, vitamin K, vitamin B12)
- absorption of nutrients (monosaccharides, short chain fatty acids, vitamins)

By breaking down the indigestible food components and the subsequent absorption of the decomposition products, the microbiota supports the balance of the energy management and the nutritional supply. In addition, the decomposition products have an influence on the bowel movement.

An important task of the microbiota is to prevent miscolonisation of the intestine with pathogenic bacteria and associated harmful effects. To this end, it possesses several mechanisms:

- production of short-chain fatty acids that acidify the intestinal environment ➛ promotion of the growth of bacteria with beneficial properties and preventing the colonisation of pathogenic bacteria
- consumption of nutrients and trace elements, which pathogenic bacteria need to survive ➛ limitation of growth, proliferation and activity of pathogens

[1] *The intestinal barrier – also called gut barrier - is a functional unit consisting of the intestinal immune system, the intestinal epithelium, enteric nervous system, secretion products and intestinal mucosa. It serves both as a barrier between bowel interior and body interior as well as the transport of nutrients and water. It also prevents the penetration of pathogenic bacteria into the organism.*

[2] *Oral tolerance is the process in which the digestive system learns to recognize the ingested food as nutrients in order to avoid allergic reaction.*

- occupation of docking sites for pathogenic bacteria in the intestinal epithelium ➛ prevention of the colonisation of pathogens in the gut
- neutralization of toxic and carcinogenic metabolites
- Production of highly effective antibacterial agents, whereby survival and settlement of other bacteria in their immediate surroundings becomes impossible

The participation of microorganisms in the development of intestinal epithelial cells (cells of the intestinal wall) is another important role of the gut microbiota. This allows optimal nutrient absorption and development of the intestinal barrier[1], which is of great importance for colon health.

The microbiota also contributes to the maturation and maintenance of the innate and adaptive immune system. Microorganisms activate, for example, the oral tolerance[2] against food ingredients or ensure the distinction between pathogenic and non-pathogenic germs.

The functions of the gut microbiota are by far not completely described and still not fully explored. It is only intended to show the enormous potential the microbiota has.

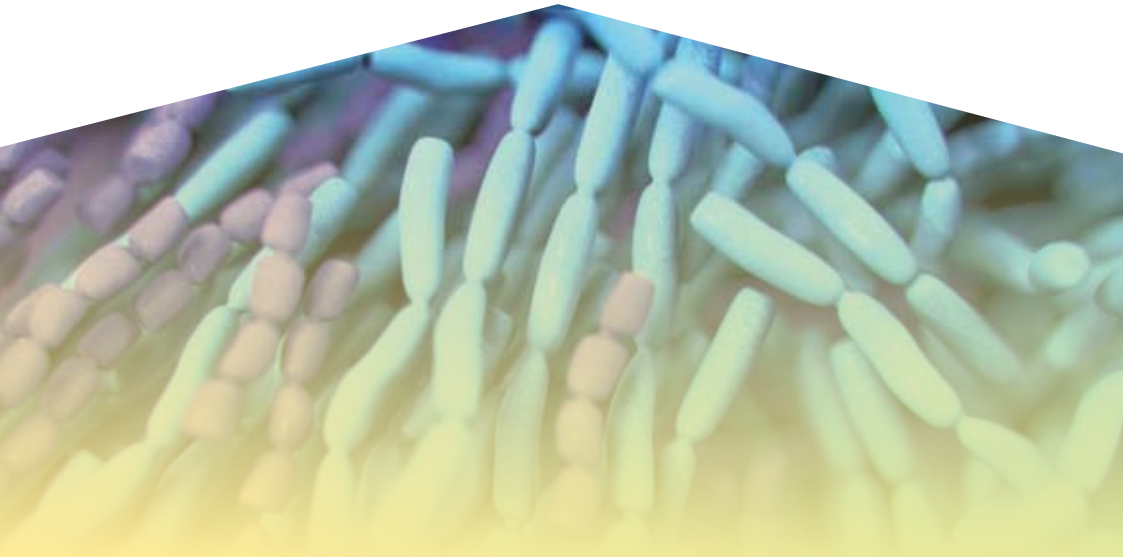
The use of probiotics can support the functions of the microbiota, thus contributing significantly to health. Below are further details about probiotics and their health significance.

What are Probiotics, and why we need them

The term probiotic (plural: probiotics) comes from "pro" (Latin "for") and "bios" (Greek "life") and means literally "for life". According to the WHO/FAO definition (2001), probiotics are viable microorganisms that have a protective effect on the health of the host when orally ingested in sufficient quantities.

The classic probiotic microorganisms include Lactobacilli, Bifidobacteria, Streptococci, Enterococci and Lactococci. Their effect is strain specific, i.e. the proven positive effects of a particular bacterial strain cannot be transmitted, per se, to other probiotic microorganisms.

The aim of the intake of probiotics is to influence the balance of the microbiota, especially in the colon, towards bacteria with beneficial effects and thus the displacement of bacteria with negative effects. Moreover, the influence of the immune system by probiotics is significant.



WHO = World Health Organisation

FAO = Food and Agriculture Organisation of the United Nations

Preventive Efficacy of Probiotics

Colonization of pathogenic bacteria in the digestive tract can lead to numerous diseases. Probiotic bacterial strains are a suitable means for prevention They not only contribute to the maintenance and recovery of a protective microbiota, but also to the repair of the connective structures of the intestinal wall damaged by pathogenic germs. Simultaneously, they support the immune system situated in the gut. This leads to the strengthening of the intestinal barrier function and consequently to an effective protection of the whole organism.

The large intestine is considered to be a checkpoint for the energy balance of the body. Here again, probiotics have an influence as they affect the absorption of nutrients and even provide energy substrates.

Probiotics communicate via nerve and hormone signals with the regulation centre for appetite and energy balance in the central nervous system (brain and spinal cord) and with other cells that are involved in the energy balance of the body. The complex interactions probiotics have with body cells lead to an improved saturation control and to weight regulation.

One of the main functions of the microbiota is the development of the immune system. Approximately 60% of the entire body's defense mechanism, i.e. of the **g**ut-**a**ssociated **l**ymphoid **t**issue (GALT) is located in the intestine.

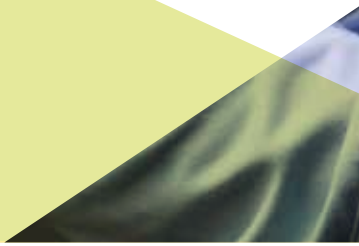
The intestinal barrier function has a significant beneficial influence on inflammatory processes throughout the entire body and triggered by the immune system. This function can be strengthened by the use of probiotics. Consequently, probiotics are suitable for the prevention of inflammatory processes, such as in in allergies.

Furthermore, probiotics support other physiological functions of the intestinal microbiota. These include:

- influence on intestinal activity
- degradation or inactivation of toxic, inflammatory and mutagenic substances
- inhibition of infectious pathogens by competition over nutrients and production of antibiotic-like substances
- activation of tolerance mechanisms

In addition to the preventive efficacy of probiotics, a series of experiments showed that the ingestion of certain probiotic strains is also effective against several diseases. The possible therapeutic use of probiotics in various diseases is demonstrated in the following chapter.

mutagenic substances = substances that alter genetic material of the host and thus can trigger cancer



Therapeutic Efficacy of Probiotics

For a number of diseases antibiotics are often the preferred means in conventional medicine. Since the use of antibiotics (and other drugs) is often accompanied by adverse side effects, the use of probiotics is particularly noteworthy.

Previously positive effects of probiotics application were observed in cell culture, animal and human studies in the following diseases:

- Infectious Diseases and Diarrhoea
- Irritable Bowel Syndrome
- Cancer
- Inflammatory Bowel Disease (IBD))
- Allergies
- Metabolic Disorders

Infectious Diseases and Diarrhoea
Specific probiotics have a high health-promoting potential in diarrhoea and infections.

Studies suggest that lactobacilli and bifidobacteria have a positive influence on the course of respiratory infections. Here a reduction in the severity and duration of the infection was documented.

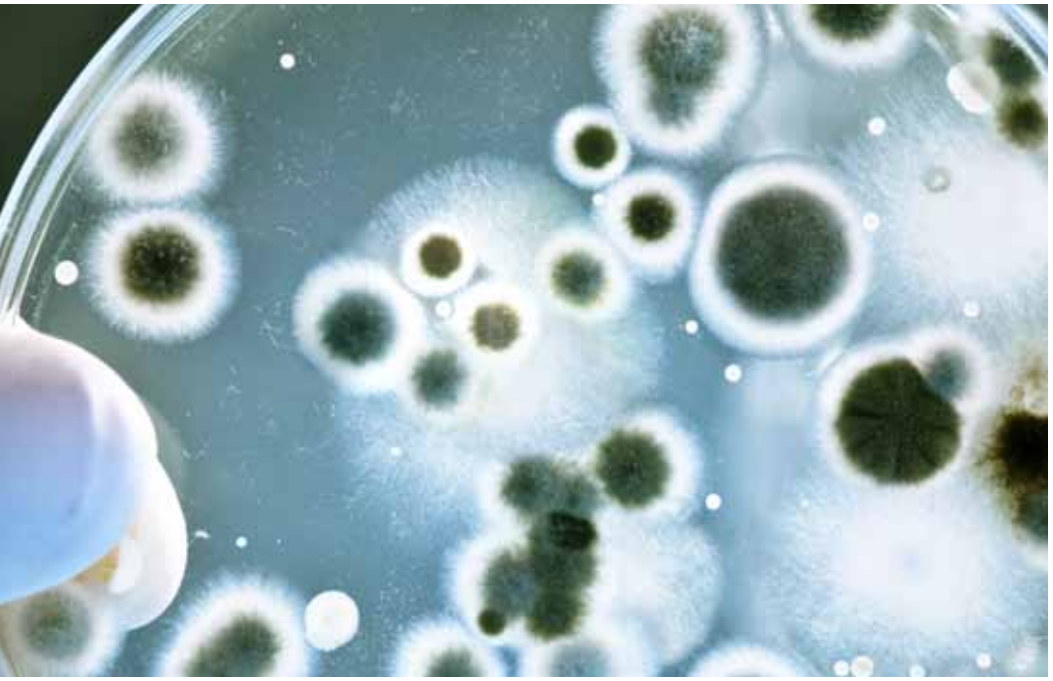
For diarrhoea caused by antibiotic intake (antibiotic associated diarrhoea) a weakening of the symptoms can be recorded. Thus the combined intake of antibiotics and probiotics can be recommended. The reason: bacteria that are destroyed as a result of antibiotic treatment release, when substances damaging to the epithelium are dying. Probiotics (particularly lactobacilli) bind these toxic products or degrade them. They also settle in the microbiota, thus displacing pathogens.

Even in other diarrhoeal diseases (bacterial, viral, Travellers' Diarrhoea) positive effects caused by the use of probiotics became obvious during clinical studies.

Irritable Bowel Syndrome

In irritable bowel syndrome (caused by an intestinal infection or psychological stress), the use of specific bifidobacteria for reduction of the symptoms appears effective. The following effects are shown:

- increase in intestinal motility and thus acceleration of the passage time of the chyme through the digestive tract
- normalization of the disturbed bowel function and of the fluid and electrolyte uptake
- effect on the gas production



Other probiotic bacterial strains, such as Lactobacillus or Streptococcus, have been shown to be therapeutically effective:

- by reducing pains, bloating and constipation
- by normalizing the number and consistency of stools

Through triggering synergistic effects a combination of different bacterial strains may be especially helpful in recovery.

Cancer
The anti-cancer effects are caused, on the one hand, by inactivation or reduced activation of mutagenic and other carcinogenic substances and, on the other hand, by increasing the immune function. Here, Lactobacillus subspecies, and Streptococcus thermophilus especially, show a protective effect.

The following observations were made in studies:

- reduction of free radicals ➛ reduction of DNA damage
- reduction of cancer-promoting bacteria and enzymes in the colon (especially in colorectal cancer)
- reduction of the activation and/or absorption of carcinogens
- increased activity of enzymes with anti-cancer properties
- binding of carcinogenic substances to the cell wall of probiotic bacteria ➛ inhibition of the harmful effects
- increased production of protective short-chain fatty acids ➛ inhibition of the growth and increase of the killing of tumor cells

Inflammatory Bowel Disease (IBD)
In IBD, in particular in ulcerative colitis, a chronic inflammation of the mucous membrane in the large intestine, the intake of the bacterium E. coli Nissle has an effect on the disease symptoms. This also applies to Lactobacillus and Bifidobacterium strains.

The relaxation of the symptoms is caused by the aforementioned beneficial properties of probiotics, such as inhibition of pathogenic bacteria, improvement of the barrier function of the intestinal mucosa, and influence on the immune system.

Patients with IBD have a significantly lower concentration of a specific short chain fatty acid (butyric acid). This can be increased by the activity of the administered probiotics in the colon. Consequently, the development of inflammatory substances is prevented.

Allergies
The therapeutic efficacy of probiotics in allergic diseases is due to their ability to:

- stimulate mucus production and sequestration (secretion)
- activate antimicrobial structures
- influence and train the immune system

In this way, the symptoms of a food allergy, house dust allergy, of hay fever or asthma, for example, can be stopped by the use of probiotics.

Metabolic Disorders (Disturbance of the Metabolism)
There is a discussion that the shift in the microbiota composition has a significant effect on the metabolism and other functions of the body. The function of the intestinal barrier seems to play a crucial role. The use of probiotics in the treatment of people who are overweight or obese, and the associated sequelae, such as type 2 diabetes, cardiovascular diseases and dyslipidemia, appears to be supportive.

There are a number of other diseases or states for which the use of probiotics has been tested for treatment. These include among others:

- respiratory disease (pneumonia, flu infection)
- (chronic) inflammatory diseases (arthritis, rheumatism)
- food intolerances (lactose intolerance)
- depression
- autoimmune diseases
- surgical procedures (liver transplantation, bowel surgery)
- critical states (trauma, pancreatitis, transplantation, sepsis)

Further studies are needed to closely investigate the effect mechanisms of various bacteria cultures and show their health-promoting potential.

Conclusion

This brochure shows the enormous role played by microbiota and its influence on numerous processes in the organism. Without bacteria, humans would not be able to resist numerous influences of the environment, nutrition, pathogens, drugs, etc.

For a healthy organism, the intestinal colonization with certain bacteria is as indispensable as the optimal supply of micronutrients. Probiotics can therefore promote the physiological functions of the microbiota.

In the treatment of mild to serious diseases the use of probiotics also supports the healing process, while conventional medicine often reaches its limits.

So far just a few probiotic strains are adequately researched, or described only within cell culture or animal studies. Therefore, there is a need for further research for a better understanding of the complex bacterial structures in the gut.

Nevertheless, it can be stated that because of their already proven effects, probiotics are a useful contribution to a health-promoting balanced, nutritious diet.

Literature Search

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Dr. Rath Research Institute

The Dr. Rath Institute in Cellular Medicine is located in Silicon Valley, California. The Institute is staffed with experts handpicked from the fields of medicine, biochemistry, and nutrition. Here, world-class scientists conduct innovative research utilizing the principle of nutrient synergy, and investigate the role of nutrients in preventing and treating a host of diseases.

The team at the Dr. Rath Research Institute develops new scientific concepts based on the discoveries of Dr. Rath in the fields of cardiovascular diseases, cancer, infections, and other diseases. The team's scientific work has been published by various media worldwide.

www.drrathresearch.org

Dr. Rath Health Foundation

Sourethweg 9
6422 PC Heerlen
The Netherlands

Tel.: 0031-457-111 223
Fax: 0031-457-111 229

E-Mail: info@dr-rath-foundation.org
Internet: www.dr-rath-foundation.org

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