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SYMBIOTICS: COMBINATIONS, ADVANTAGES OF PREBIOTICS AND PROBIOTICS

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Abstract

A serious and significant contribution to world science was the theory of aging of Ilya Ilyich Mechnikov. Mechnikov tried to create a «theory of right life», believing that old age and death occur as a result of self-poisoning of the body by microbial and other poisons that produce putrefactive bacteria in the intestine. The scientist noticed that long-lived people of different nationalities have long included sour milk in their diet. For example, the Turks made a special drink from sour milk - yagur; Kalmyks, Tatars and Kyrgyz drank sour mare's milk; the Arabs preferred the fermented milk of mares. The Slavs, by the way, are considered to be the inventors of plain yogurt, sour cream, and fermented milk.

Mechnikov proposed to combat aging by consuming fermented milk products, such as yogurt, enriched with a culture of Lactobacillus bulgaricus. Modern dairy companies still produce «Mechnikov's plain yogurt» according to his recipe. He is the founder of the concept of probiotics.

Probiotics are sometimes confused with prebiotics. It's not the same thing, although both are vital to health. They help our body improve digestion and strengthen the immune system.

Keywords: milk, synbiotics, prebiotics, probiotics, gastrointestinal tract, yeasts.

Consumption of fermented milk products containing probiotics helps protect the body from many diseases. Most probiotic bacteria belong to two genera: lactobacilli (Latin Lactobacillus) and bifidobacteria (Latin Bifidobacterium), as well as many other species of probiotic bacteria (non-pathogenic species of E. coli, non-pathogenic species of Bacillus (B. subtilisus), non-pathogen (E. faecium, E. salivarius), lactic acid streptococcus Str. Thermophilus, yeast Saccharomyces boulardii). Each genus of bacteria contains a significant number of species, each species has different strains.

This is important to remember because different strains can be different for different organs of our body. For example, the Shirota strain of Lactobacillus casei supports the immune system and helps move food through the intestines, the Bulgaricus strain of Lactobacillus delbrueckii is useful for people who are unable to digest the lactose contained in milk and dairy products. To date, a wide range of consumers available in a sufficient range of probiotic products: kefir, yogurt, fermented milk, cheese, yogurt, matzoni, kefir, ricotta and other dairy products, as well as pharmaceuticals and dietary supplements (may be in the form of bars, cereals, powders, capsules, etc.).

Probiotics, eubiotics - living microorganisms that can positively affect human health, normalize the composition and functions of the microflora of the gastrointestinal tract (most often bifidobacteria and lactobacilli, capable of antagonism against pathogenic and opportunistic microbes). These are also substances of microbial or non-microbial origin, which, when administered naturally, promote homeostasis by normalizing the microflora in the body; means of maintaining the balance of intestinal microflora at the optimal level and its correction.

According to Fuller, probiotics are living microbiological food additives that infect harmful microorganisms, restoring the microbial balance of the intestine.

Probiotics contain potentially beneficial bacteria or yeast, most often lactic acid bacteria.

Lactic acid bacteria have been used in the food industry for many years because they can convert sugar (including lactose) and other carbohydrates into lactic acid. This not only provides the characteristic sour taste of lactic acid products such as kefir, but also serves as a preservative, lowering the pH and creating less opportunities for the growth of other organisms.

The new generation of probiotics is based on genetically modified (recombinant) strains of microorganisms with specified properties.

The term "probiotics" was first proposed in 1954 by F. Vergio, who compared different compounds with antimicrobial and positive effects on the intestinal microflora. In particular, they promote the breakdown of milk sugar in case of lactose intolerance, prevention of diarrhea, increase the content in the colon of enzymes that stimulate the immune system.

Later, Lilly & Stillwell (1965) proposed the term probiotics to mean living microorganisms that enhance the growth of other microorganisms.

The main groups of probiotics include:

- Probiotics based on living microorganisms;
- Probiotics based on metabolites or structural components of the normal microflora;
- Probiotics based on compounds of microbial or other origin, which stimulate the growth and activity of bifidobacteria and lactobacilli - representatives of the normal microflora;
- Probiotics based on a complex of living microorganisms, their structural components, metabolites in various combinations and compounds that stimulate the growth of normal microflora;
- Probiotics based on genetically engineered strains of microorganisms, their structural components and metabolites with specified characteristics;
- Probiotic foods based on living microorganisms, their metabolites, other compounds of microbial, plant or animal origin, able to maintain and restore health through the correction of the microbial ecology of the body.

Probiotics must meet the following requirements:

- positively affect the host's body;
- do not cause side effects with prolonged use;
- have a colonization potential, ie stored in the digestive tract until the maximum positive effect (be resistant to low pH, bile acids, antimicrobial substances produced by pathogenic microflora);
- have stable clinical efficacy.

Hypothetically, any physiologically active substances can be considered prebiotic food components if they meet certain requirements.

Probiotic bacterial cultures are designed to help the body restore the damaged intestinal flora. They are recommended by doctors and nutritionists after a course of antibiotics, or as part of the treatment of diseases such as candidiasis. Many probiotics are present in natural sources, such as Lactobacillus in yogurt / kefir and sauerkraut.

To explain the reasons for the use of probiotics, it should be assumed that a healthy body has its own microbial ecosystem, known as the intestinal flora. It can be out of balance with a wide range of circumstances, including the use of antibiotics and other medications, excess alcohol, stress, disease, toxins, and even the use of antibacterial soap. In such cases, the beneficial bacteria can be destroyed or significantly reduced in number, which allows harmful bacteria to grow freely, having a detrimental effect on human health.

Probiotics can be purchased at the supermarket or health food store, as well as online. When choosing probiotics, pay attention to the manufacturer. The longer a manufacturing company exists, the more likely it is that its products are controlled, studied, and its reputation will matter to such a company. Examine the label. The more information on the label, the better. The manufacturer must guarantee a certain number of microorganisms in the product until the end of its shelf life, and this must be stated on the label. Many manufacturers do not indicate on their probiotic labels which strains of bacteria the product contains. If you plan to take probiotics, call the manufacturer and find out which strains of bacteria the product contains and which studies have been conducted to prove their health benefits.

Do not forget to properly store antibiotics in accordance with the conditions specified in the instructions or on the label. When buying a sour milk product at the point of sale, it is necessary to check its expiration date, and also that the packaging of your chosen product is not damaged or opened, the product must be sufficiently cooled (temperature not higher than + 6ºC).

The term «prebiotics» was first introduced by R. Gibson and is used to define substances or dietary supplements that are not hydrolyzed or absorbed in the small intestine. They are a selective substrate of one or more species of bifidobacteria and lactobacilli (BL-flora) to stimulate their growth and / or metabolic activity, thereby improving the composition of the microflora of the large intestine. Prebiotics are a typical carbohydrate that is the basis for probiotics. The beneficial effects of prebiotics begin directly in the large intestine, where it stimulates the growth and activity of beneficial living microorganisms (probiotics), ensuring their stability and thus protecting the body from harmful substances. Probiotics and prebiotics can be consumed separately, but together they give a faster positive effect.

They are designed to stimulate the immune system, promoting the development of beneficial bacteria in the gut, as well as preventing the growth of pathogenic microorganisms. Prebiotics prevent the formation of constipation and inflammatory bowel disease, they help reduce flatulence and promote intestinal flow, restore normal intestinal microflora, stimulate the synthesis of vitamins B and K, and help absorb certain minerals such as calcium and magnesium.

One of the most classic prebiotics used to create functional products is inulin, which is found in large quantities in plant products such as Jerusalem artichoke and chicory root. The largest number of prebiotics has a carbohydrate nature - it is fructooligosaccharides, isomaltooligosaccharides, lactulose, galactooligosaccharides, dietary fiber, stable types of starch, inulin and others.

Among the prebiotics, the most well-known are poly- and oligofructans, soybean oligosaccharides, galactooligosaccharides isolated from natural sources or obtained by biotechnological or synthetic methods.

In the food market there is a fairly large supply of puree-forming concentrates belonging to the prebiotics.

Prebiotics include mono-, oligo- and polysaccharides (oligofructose, inulin, galacto-oligosaccharides, lactulose, lactitol, calcium pantothenate, paraaminobenzoic acid, dietary fiber (fiber), cellulose, rice extracts, algae, yeast, yeast). zucchini, garlic, sorbitol, xylitol, xylobiose, raffinose, pectins, chitosan, dextrin, glutamic acid, arginine, valine, vitamins A, E, C, glutathione, carotenoids, selenium, eicosapentaenoic acid, etc.).

Prebiotics contain:

- in food (maximum content in fresh dairy products, corn, cereals, bread, onions, garlic, peas, beans, whole grains, asparagus, bananas, artichokes, other fruits and vegetables);
- in numerous versions of fiber and bran;
- inulin (in Jerusalem artichokes, dandelions, artichokes, chicory roots, etc.);
- in pharmaceuticals and dietary supplements.

Lactulose and lactose have a positive effect on the formation of healthy intestinal microflora; inulin removes toxins from the body, strengthens the immune system; cellulose also removes harmful substances from the body and promotes the reproduction of beneficial bacteria.

Everyone who encounters bowel disorders should understand the difference between probiotics and prebiotics. For prophylactic purposes it is better to take prebiotics and probiotics of natural origin, for therapeutic purposes (in the presence of diseases) - probiotics and prebiotics in the form of pharmaceuticals and dietary supplements on the advice of a doctor.

Synbiotics are drugs obtained as a result of a rational combination of probiotics and prebiotics.

More than a century ago, Ilya Mechnikov postulated that lactic acid bacteria have a positive effect on health and promote longevity. Since then, the concept of probiotics and prebiotics has developed extensively,

and today the search for clinical trials in PubMed shows about 1,500 publications on probiotics, almost 350 - prebiotics. Although these studies are heterogeneous in the strains of the probiotics tested, as well as in the populations studied, the data obtained confirm that the positive effects are measurable with many different end results.

According to the recommendations of the World Gastroenterology Organization (WGO), probiotics are living microorganisms that, when introduced into the host in adequate quantities, have a beneficial effect on the consumer, normalizing the composition and function of the microflora of the gastrointestinal tract. Most commonly, probiotics are used by bacteria of the genera Lactobacillus and Bifidobacterium, the yeast Saccharomyces boulardii, as well as some strains of E. coli and Bacillus species.

Clostridium butyricum has recently been registered in the European Union as a food product.

These microorganisms play the role of the immune system in the intestinal mucosa. They do not allow pathogens or harmful microorganisms to grow and develop.

Prebiotics are nutrients that are mainly composed of non-starch polysaccharides and oligosaccharides that are not digested in the gastrointestinal tract of the host and have a beneficial effect on its health by affecting its own beneficial microorganisms. The most famous probiotics are inulin, oligofructose, galacto-oligosaccharides, lactulose, breast milk oligosaccharides.

The purpose of using pre- and probiotics is to affect the intestinal environment, inhabited by billions of symbiotic microorganisms, to improve human health. Both probiotics and prebiotics have proven their positive effects not only in the gastrointestinal tract, but also outside it.

Recently, there has been a growing body of research on the effects of synbiotics on human health, products that contain both probiotics and prebiotics.

Mechanisms of action of probiotics and prebiotics

Prebiotics affect the ratio of microorganisms in the gastrointestinal tract, increasing the number of beneficial anaerobic bacteria and reducing the size of the population of potential pathogens. The effects of probiotics on the intestinal ecosystem are to affect the immune mechanisms in the mucosa, interactions with symbiotic or potentially pathogenic microorganisms, the production of metabolic products such as short-chain fatty acids, communication with host cells through chemical signals (table).

These mechanisms can provide antagonism with potential pathogens, improve the environment of the gastrointestinal tract, strengthen the gastrointestinal barrier, and form feedback on inflammation and the immune response to antigens. It is believed that these effects determine the positive effects of probiotics, which are observed in clinical practice.

Requirements for products containing probiotics and prebiotics, and safety issues

Requirements for products containing probiotics and / or prebiotics vary depending on the rules of the regulatory body of each region. Most often, probiotics and prebiotics are produced in the form of food supplements or food products. From a scientific point of view, an acceptable characterization of a probiotic product should contain at least the following data:

- typical and species identification according to the modern nomenclature;
- purpose of the strain;
- the content of microorganisms in the product;
- the recommended dose;
- description of physiological effects caused by the use of the product;
- safety precautions;
- recommended storage conditions;
- contact details for further dynamic monitoring.

Most probiotics used today come either from fermented foods or from microorganisms that colonize the human digestive tract and have been used for decades. Because lactobacilli predominate in fermented foods and are natural colonizing microorganisms in the human body, experts consider their pathogenic potential to be quite low. Bifidobacterium strains have the same level of safety. Most products are designed for a relatively healthy population, so use them in people with compromised immune function or serious diseases with extreme caution.

Traditional lactic acid bacteria, which have long been associated with food fermentation, are generally considered safe when taken orally in adequate doses as food additives or food ingredients.

The gastrointestinal tract is inhabited by many microbes that exceed the number of eukaryotes in our body, at the genetic level, the intestinal microbiome surpasses the human genome by a factor of 100. Therefore, it is not surprising that the intestinal microflora has a pronounced impact on our health and well-being. extends far beyond the intestines. And it is not surprising that an important target of functional food ingredients is the intestinal microflora.

The main types of products that have a positive effect on the composition and activity of the intestinal microflora are foods containing probiotics and prebiotics. The properties of probiotics and prebiotics are discussed in more detail in the following sections. But, in general, probiotics have been identified by an FAO / WHO expert group. living microorganisms, which when administered in sufficient quantities, benefit the health of the host. Prebiotics have been identified as indigestible food ingredients that, when consumed in sufficient quantities, selectively stimulate the growth and / or activity of one or a limited number of microbes in the colon, leading to documented health benefits after being modified. With probiotics, there is an emphasis on viability and dose intake. Prebiotics, on the other hand, have a positive effect on selected microbes. Since both types of components have the intestine as a functional purpose, it is obvious that the two can be mixed and can enhance the effect of each other. Thereby creating symbiotics: a mixture of probiotics and prebiotics that has a beneficial effect on the host, improving the survival and implantation of live microbial supplements in the gastrointestinal tract, by selectively stimulating the growth and activation of the metabolism of one or a limited number of healthy bacteria. I, and thus

improving the welfare of the host. Synbiotics, however, is much more than just a mixture of up and profits. As the name implies, synergies must exist between the two components and therefore not just any mixture will be symbiotic.

The development of new synbiotics usually requires a long-term screening process. During screening, combinations of selected prebiotic substances and probiotic strains are tested both in vitro and in vivo to find the most active and synergistic pairs.

As a rule, the first step in a large-scale symbiotic screening process depends on the cultivation of the culture. All selected combinations of pre- and probiotics are grown under optimal or near-optimal cultivation conditions, when tested prebiotics are the main source of carbon for the probiotic strain. Evaluation of the optimal use of prebiotic substances of probiotic bacteria and comparison of bacterial growth rates allows the first choice of the most promising synbiotic pairs for further analysis.

To mimic the conditions in the colon in simple form, symbiotic drugs can be incubated with fecal strains. These batches of fermentation can be simple bottles or containers with some pH control.

Probiotic strains should be able to survive through the gastrointestinal tract, while prebiotic substances should not be degraded or absorbed in order to promote the symbiotic effect in the colon. Thus, both components must withstand highly acidic (pH 1-2) conditions in the stomach and the degrading effects of both bile and digestive enzymes when passing through the small intestine. The survival of oral components in the colon is difficult to learn in human trials due to both ethical and technological issues in the sample collection, although ileostomy patients can be used for this type of research. Therefore, models that mimic the passage of the stomach are needed. These models also serve as the main candidate for reducing the stage in the product development stage to animal testing.

Crittenden et al. presented a simple gastric model that was used in symbiotic studies. It consists of tubes that mimic the first acidic stomach and then the more neutral duodenum with bile. They sift 40 strains of Bifidobacterium for their ability to both ferment resistant starch and to survive passage through the upper gastrointestinal tract. Only one strain, B. lactis B94, met both criteria and proved to be potential probiotic strains for yogurt symbiotics.

More sophisticated models simulating the entire gastrointestinal tract from mouth to rectum in six separate experiments were used to study the effects of symbiotic compounds on human intestinal microbiota. Acidophilic lactobacilli were administered in a second vessel with the reagent in milk-based products from fruit oligosaccharides for seven days. Changes in the intestinal microflora were observed in vessels that mimic different parts of the human colon. It was found that the introduction of combination antibiotics to stimulate the growth of bifidobacteria, and also caused an increase in the concentration of butyrate in all three vessels. These results indicate that symbiotics have had a positive effect on the environment of the microflora of the large intestine, changing it to a more favorable in relation to beneficial microbes and inhibits the growth of harmful microbes.

To study the complex interactions between the host organism, intestinal microbes and synbiotics in more realistic than in vitro models of pigs, dogs, rats and mice are used as models for human gastrointestinal tract functions. However, conventional animal models can be important for assessing the symbiotic effects on humans, intestinal microflora and the environment. To overcome this problem, in particular, bacterial-free rats and mice have been associated with human microbiota, this approach makes a valuable contribution to the study of the effects of synbiotics.

As the native microflora of rats and humans differ significantly in their composition and activity, symbiotic combinations have been studied in gnotobiont rats and rats associated with human fecal microbiota. The synbiotic effect of L. rhamnosus and cellobiose (10%) on serum lipids has been reported in normal rats.

Once the functionality and synergistic characteristics of the synbiotic combinations have been evaluated using laboratory methods and animal tests, it is possible to proceed to the final stage of product development. In general, clinical trials in humans should follow certain rules:

- The test report should be ethically acceptable by the local administrative committee.
- Results must be double blind from both organizers and participants before the trial is completed.
- Participants should be selected in such a way that their current state of health fits the focus of the study.
- Sufficient participants must be gathered to meet the statistical criteria, otherwise cross-sectional research is necessary to reduce the bias caused by the small research team.
- A complete comparison of the effects of all studied substances is necessary, ie three studies are needed: control of symbiotics, prebiotics and probiotics.

The first three categories mentioned above have been obtained in clinical trials, but unfortunately the last two categories are not so well taken into account. This problem is highlighted by presenting ten human clinical trials conducted on healthy individuals, of which six trials are only 30 participants or less, and of which only two are separate groups for pre-, pro-, and symbiotic and control. Because these trials are final assessment points for candidate symbiotics, more single-group trials for a given prebiotic and probiotic alone together with group symbiotics are needed to fully confirm the effects of these combinations.

In addition, the effectiveness and safety of a functional food ingredient is essential. Because symbiotics are a combination of prebiotics and probiotics, we first consider safety considerations for these two components separately. In the future, specific safety considerations will be considered when combining them into symbiotics.

Prebiotics have long been part of the human diet. Fructose-type ingredients are natural components of edible plants. In addition, some new prebiotics, such as polydextrose, have been used as food ingredients for decades.

A practical concern with the use of prebiotics is their tolerability, which varies greatly between different prebiotic compounds. In addition, susceptibility to side effects varies among members of the general population. Typically, excessive consumption of prebiotics can lead to gastrointestinal symptoms such as bloating and relaxation. Intestinal tolerance to indigestible compounds depends mainly on its osmotic and fermentative effects. Osmotic diarrhea is caused by a particularly high cavity concentration of low molecular weight compounds such as polyols. On the other hand, highly fermented prebiotics can lead to the formation of gases that cause bloating and flatulence. Excessive fermentation in the proximal part of the colon can also reduce carbohydrates for microbes in the distal part of the colon. Thus, microbes can turn to protein fermentation in the more distal parts of the colon and produce harmful metabolites such as indole, phenols and ammonia.

The most common types of microbes used as probiotics, and therefore in symbiotics, are Bifidobacterium and Lactobacillus. Profits from other genera are also used, but they are less common or may not be relevant to the dairy industry and therefore will not be considered here. One of the main safety considerations for probiotics is the presence or transmission of antibiotic resistance.

Most members of the genera Lactobacillus and Bifidobacterium are generally considered safe; these are mainly based on empirical observations:

- Lactobacilli have a long history of safe use, especially in fermented dairy products.

- bifidobacteria, and to a lesser extent lactobacilli are a major component of the normal human intestinal microflora.

- Despite high levels in the gut, lactobacilli and bifidobacteria are extremely rarely associated with the disease.

All microbes, which, in theory, have the ability to grow in conditions that are in the human body, can, in principle, colonize sites in the human body, and thus can be pathogenic microorganisms. Bacteria with this ability include lactobacilli and bifidobacteria. However, members of these two genera are generally not considered pathogens. The incidence of bacteremia caused by these organisms is extremely low; for lactobacilli 0.2% of all positive blood cultures and bifidobacteria even less. Lactobacillus bacteremia is not apparently associated with the consumption of income of the general healthy population, but is primarily associated with subjects with severe background diseases. Cases of probiotic lactobacilli infection have been reported, but they are even more rare, the infections are caused by endogenous lactobacilli, and they also occur in patients with severe forms of the disease. Therefore, apparently, is not a problem for the general healthy population. For patients with severe underlying diseases, the risks and benefits of using probiotics should be considered.

Since the prebiotic part is a symbiotic combination by definition should improve the transient colonization of the probiotic part. The safety considerations for synbiotics do not therefore seem to differ from the safety considerations for the components that make up symbiotics; that is, probiotics and prebiotics, although more structured research on the subject would be welcome.

The functional advantages of symbiotics include:

Improving gastrointestinal health is the focus area of natural health for the use of symbiotics in foods. Different gastrointestinal tract branches and types of diseases have been studied. Interventional studies with combinations of prebiotics and probiotics are still focused on infectious diseases of the upper gastrointestinal tract, as well as chronic diseases of the lower gastrointestinal tract.

Susceptibility to infection increases in patients who have undergone abdominal surgery, transplantation, or otherwise critically ill. The effectiveness of symbiotics to reduce the incidence of infection has been evaluated in several studies, and combinations of mixtures of both pre- and probiotics have been used both before and after surgery for a week or two at most. In many cases, even short-term preventive treatment was protective; However, it is not clear why some of these studies failed. Therefore, further research is needed before recommendations can be made.

In conclusion, we note that the use of symbiotics is effective in reducing susceptibility to infections. However, mediation mechanisms especially for infections living in places other than the gastrointestinal tract remain completely unresolved.

Other gastrointestinal disorders than infectious diseases, the main focus of pre- and probiotic studies was on inflammatory and functional bowel diseases and colon cancer.

Inflammatory bowel disease is a severe chronic disease that has in recent years become more common with also an earlier onset of exacerbation of the disease before the age of 20 years. The disease can be divided into two categories depending on the type and location of inflammation of the gastrointestinal tract; namely Crohn's disease, which mainly affects the upper gastrointestinal tract, and nonspecific ulcerative colitis, which mainly affects the lower gastrointestinal tract. The cause of these diseases is not known, but the breakdown of the balance of intestinal immune responses and intestinal microbiota are thought to play a key role. No medication is known. Patients are usually treated with immunosuppressants and when it does not respond to medication by surgically removing the areas. In both patients with Crohn's disease and nonspecific ulcerative colitis, a combination of both lactobacilli (Crohn's disease) or bifidobacteria (ulcerative colitis) with a mixture of fibers or inulin were used. The duration of the study ranged from one month to six months. According to reports of anti-inflammatory effects of bifidobacteria in in vitro studies, the use of bifidobacteria was found to reduce the expression of selected markers of inflammation also in vivo in both clinical trials. Perhaps longer studies are needed to show clinical efficacy.

Irritable bowel syndrome is a functional disorder characterized by severe abdominal pain, flatulence, bloating, and either constipation or diarrhea or a combination of those with no or mild inflammatory symptoms. Although it is not a life-threatening condition it

is completely incapable. Like IBD, the etiology of IBS is unknown, but causal changes in the intestinal microflora and gastrointestinal infections are being intensively studied. Barker et al. used a combination of lactobacilli and bifidobacteria in a randomized double-blind study to study the effects of synbiotics on patients. no clinical improvement was found due to the intervention. However, symptoms in both the placebo group and the treatment group improved during the study period, making evaluation of efficacy difficult.

A number of pediatric patients with short bowel syndrome have been studied. Enterocolitis is inconsistently reduced. However, other clinical benefits, such as maintaining a normal microflora during frequent antibiotic treatment and improved nutrition, have been described.

The effectiveness of symbiotics in colon cancer has been mainly studied in animals, and the results are mostly promising. In humans, the development of colon cancer is a slow process, but diet has been proposed as a protection that promotes improvement. How the effects are transmitted is not known, but again the role of intestinal microflora is involved. Based on the limited data available on symbiotics, positive results in animal trials can be considered indirectly as a prebiotic component rather than a combination of prebiotics with probiotics. However, currently only a limited number of studies using appropriate controls can be used to evaluate efficacy on symbiotics. There is only one clinical study attempting to evaluate the efficacy of symbiotics to reduce the risk of colon cancer. A significant improvement in the microbiological composition is described by the combination of L. rhamnosus and B. lactis with inulin-FOS, but the impact on the risk of colon cancer awaits final analysis of the process.

Hepatic encephalopathy is a complex metabolic disorder, the pathophysiology of which has not been fully studied. Accumulation of ammonia in the blood was thought to play an important role in the pathogenesis. Rumor has it that ammonia is formed in the colon by intestinal microbes through the degradation of amines, amino acids, purines and urea. Oxidation of the intestinal lumen alters the overall metabolism of bacteria, and becomes less conducive to urease-producing bacteria and promotes acid-fast, low-urease-producing species such as lactobacilli and bifidobacteria.

Both lactulose and lactitol are known to reduce intestinal ammonia production by lowering the pH of the colon. Oxidation also increases the relative amount of unaccounted for diffusing ammonia ions by reducing the absorption of ammonia through the epithelium. The absorption of ammonia through the intestinal epithelium is also reduced by reducing the residence time of intestinal contents in the gastrointestinal tract by non-absorbable disaccharides such as lactitol. In addition to disaccharides and antibiotics, probiotics have also been proposed as therapy for treatment.

Liu and his colleagues have shown that synbiotics or fermentable fiber can be used as an alternative treatment for lactulose in minimal hepatic encephalopathy in patients with cirrhosis. Treatment with a combination of prebiotics (b-glucan, inulin, pectin and resistant starch, 2.5 g) production of probiotics (Pediococcus pentosus, Leuconostoc mesenteroides, Lactobacillus paracasei and lactobacilli plantarum, 110 CFU) modified microbial fecal. Escherichia coli, Fusobacterium SPP. and Staphylococcus aureus levels were reduced, while Lactobacillus species were increased, and this was accompanied by a decrease in blood ammonia levels. As a similar effect was observed with the prebiotic combination alone, so the likelihood that the prebiotic is a major component is effective. The results, however, show that treatment with various prebiotics and synbiotics may have potential in addition to traditional therapy with lactulose and lactite. In addition, the authors suggested that oral supplements of synbiotics may reduce translocations of pathogenic intestinal flora in patients with liver cirrhosis.

Dairy products are a rich source of many nutrients; most notable are calcium and vitamin D. In addition, some fermented dairy products, like cheese, are a valuable source of vitamin K. In addition, fermented milk products form an excellent matrix for supplements with functional ingredients. This has made, in particular, fermented dairy products, the leading functional foods and is reflected in the co-inclusion of prebiotics and probiotics, as well as their combinations, in dairy products.

Prebiotics are usually added to fermented dairy products to improve their quality. A number of products containing both prebiotics and probiotics are currently on the market. However, the symbiotic interaction between the two components has not been studied and, as mentioned above, simple mixing of the two does not guarantee a synbiotic effect. In the field of creating health benefits, so much work remains to be done. Fermented milk products remain the most likely consumer goods for supplements with synbiotics. Although beyond the scope of this book, it is likely that synbiotics will also be used in other, non-dairy products, such as liquid products with high water activity and products with low water activity. In particular, in the latter prebiotic component can perform several functions; prebiotic substrate, filler (to ensure low-calorie product), and protector-probiotic. In this non-dairy category, symbiotics can find application in pet foods.

In addition to providing a source of energy for the fermentation of probiotic components of symbiotics, prebiotics have been suggested to play a protective role. They can provide stabilized nutritional nutrition, have a beneficial effect on the water activity of dry foods. Adding prebiotics to probiotic yogurts has indeed been noted to improve the storage stability of the probiotic.

Prebiotics have also been investigated as probiotic disinfectants (lactobacilli rhamnosus during spray drying. storage at 25 ° C and at 37 ° C also the stability during storage of polydextrose decreased in comparison with the reconstituted skim milk.Chapel and co-authors, however, observed the reduced survival of probiotics during freeze-drying of symbiotics with yogurt.

Alternatively, protection of the probiotic from the prebiotic can be used in the encapsulation technique. Many probiotic encapsulation methods rely on the use of carbohydrates as a carrier for the coating material. For example, stable starch has been used as a carrier, but can at the same time provide a targeted prebiotic advantage. In particular, some strains of bifidobacteria

have been observed to have an affinity for resistant starch. This proximity brings the prebiotic in close proximity to the target probiotic and may increase the efficacy and even dose of the prebiotic required.

Conclusions

Most clinical trials conducted to date with symbiotics do not meet the strict criteria established to determine the effectiveness of mixtures, active ingredients. Thus, most of the current data do not give the desired results, there are synergy effects of both components. However, the positive health benefits of both prebiotics and probiotics separately are increasing. This promises to find real synergistic interactions of synbiotics both in the treatment and prevention of diseases and in the maintenance of general well-being.

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ТЕПЛОТЕХНІЧНИЙ АНАЛІЗ КОМПОЗИЦІЙНИХ ПАЛИВ НА ОСНОВІ ФРЕЗЕРНОГО ТОРФУ

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THERMAL ENGINEERING ANALYSIS OF COMPOSITE FUELS BASED ON MILLING PEAT

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Анотація

Представлено результати калориметричних досліджень теплотехнічних характеристик композиційних палив на основі фрезерного торфу в суміші з відходами органічного походження і розглянуто доцільність їх використання в теплоенергетиці. Запропоновано емпіричну формулу для розрахунку нижчої робочої теплоти згоряння композиційних палив у залежності від масового вмісту їх складових. Такі композиційні палива поряд з вирішенням паливної проблеми, можуть допомогти у розв'язанні проблеми утилізації різних органічних відходів, запобігаючи забрудненню довкілля цими відходами.

Abstract

The results of calorimetric researches of thermal technical characteristics of composite fuels on the basis of milling peat in a mix with wastes of an organic origin are presented and expediency of their use in heat power is considered. An empirical formula for calculating the lower operating heat of combustion of composite fuels depending on the mass content of their components is proposed. Such composite fuels, along with solving the fuel problem, can help solve the problem of recycling various organic wastes, preventing environmental pollution by these wastes.

Ключові слова: фрезерний торф, теплотехнічні характеристики, бомбова калориметрія.

Keywords: milling peat, thermal characteristics, bomb calorimetry.

Вступ. Ефективне використання всіх видів енергоресурсів є однією з найважливіших загальнодержавних задач в Україні. Її вирішення базується на удосконаленні технологічних процесів, впровадженні енергозберігаючих технологій, нової техніки і альтернативних палив.

Одним з шляхів економії традиційних палив (природний газ, нафта, кам´яне вугілля) є використання в паливному балансі країни місцевих видів палива (буре вугілля, деревина, торф та біомаса різного походження).

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