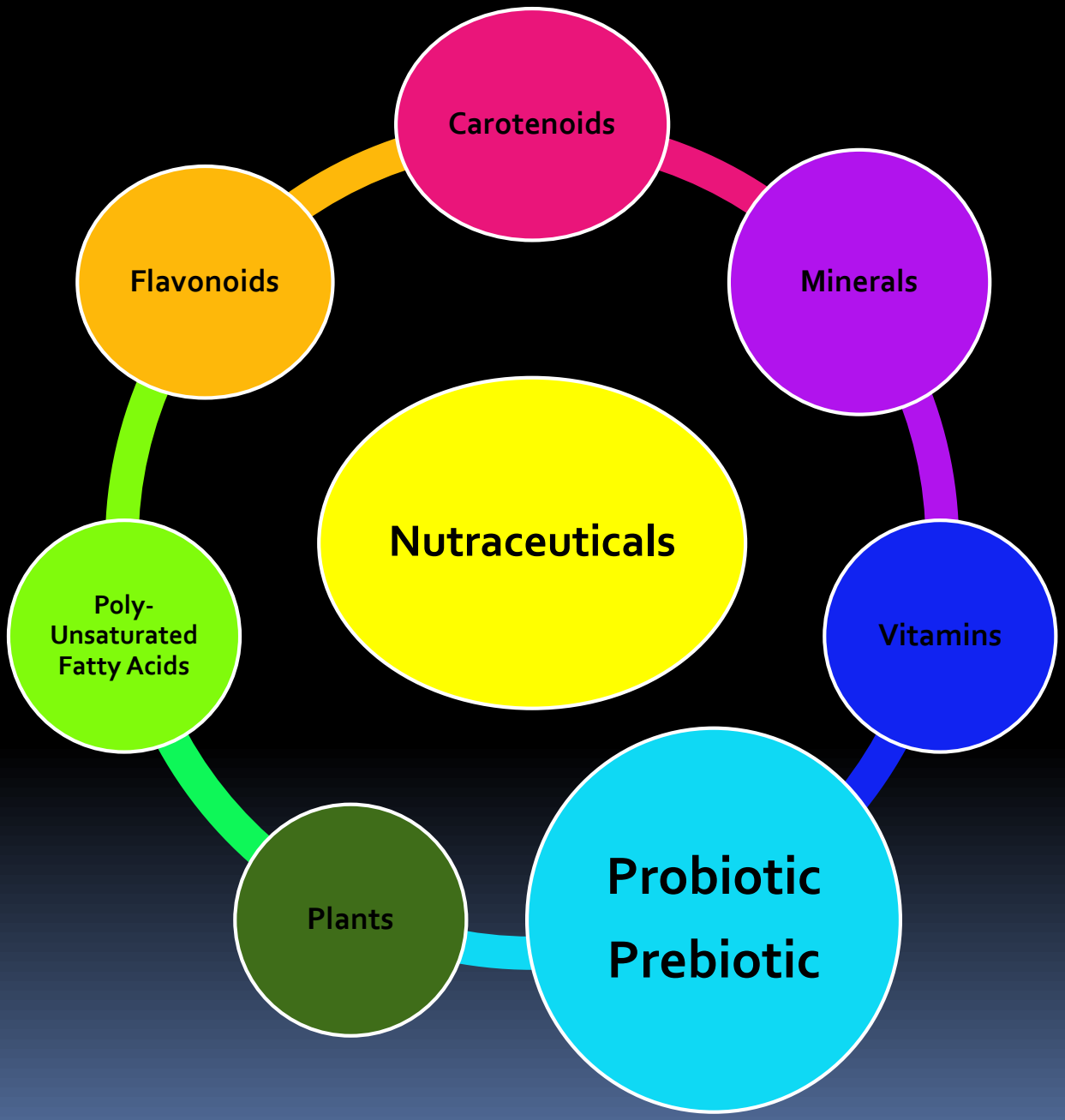
Carotenoids
Flavonoids
Minerals
Nutraceuticals
Poly-
Unsaturated
Fatty Acids
Vitamins
Plants
Probiotic
Prebiotic

PROBIOTICS & PREBIOTICS

- The number of microorganisms found in normal flora of human body is 10 times greater than the number of somatic cells of the body.
- Normal flora contains approximately 90 trillion microorganisms (gastrointestinal system, skin, lungs, urogenital system).
- Microorganisms are found most intensely in gastrointestinal tract; especially in the last part of small intestine and large bowel.

Normal Flora of Gastrointestinal Tract;

- Stomach; pH=1,5-2, 10 thousand microorganism/ml
- Duodenum; pH=6-7, 10 thousand microorganism/ml
- Jejunum; pH=7, 100 thousand microorganism/ml
- Distal ileum; pH=7,5, 100 Million microorganism/ml
- Bowel; pH=6,8-7,3, 100 Billion - 1 Trillion microorganism/ml

- There isn't any microorganisms in babies digestive tract during pregnancy/ fetal development.
- Flora development starts with birth.
- The way of labour and nutrition play an important role in the formation of the normal flora.
- Normal labour and breastfeeding provide quick development of flora and the flora formed in this way is rich in beneficial bacteria.
- As the intestinal flora of the baby occurs late in cesarean deliveries, they are more prone to diseases. Infant formulas and beverages used instead of breastmilk are also not as successful as breastmilk in the formation of healthy flora.

- There are still some bacteria species and strains which has not yet been identified in the flora.
- According to the current knowledge, more than 500 species of microorganisms are found in human intestinal flora.
- Not all humans have the same microbial species in flora, individual differences exist. Apart from individual differences, nutritional differentiations (the effect of socio-economic conditions, religious beliefs, regional habits, geographical factors on nutrition) also play role in the composition of the flora.

Probiotics

- Probiotics are viable microorganisms that support the growth and development of microflora located in digestive system.

The word «Probiotic» is of Greek origin with the meaning of «for life» and have long been used in various ways

Characteristics of Microorganisms that Show Probiotic Property

- Should be able to survive in the acidic conditions on the upper part of the gastrointestinal tract
- Should be able to colonise in the intestines
- Non-pathogenic, non-mutagenic, non-toxic and non-carcinogenic
- Antagonistic effect on carcinogenic compounds and pathogenic microorganisms
- Able to colonise easily
- Should be stable and stay viable during processing and storage of foods

Lactobacillus species

- *Lactobacillus cellobiosus,*
- *Lactobacillus delbrueckii,*
- *Lactobacillus brevis*
- *Lactobacillus acidophilus,*
- *Lactobacillus reuteri,*
- *Lactobacillus curvatus*
- *Lactobacillus fermetum,*
- *Lactobacillus plantarum,*
- *Lactobacillus jonhsonii*
- *Lactobacillus rhamnosus,*
- *Lactobacillus helveticus*
- *Lactobacillus salivarius,*
- *Lactobacillus gasser*

Bifidobacterium species

- *Bifidobacterium adolescentis,*
- *Bifidobacterium bifidum,*
- *Bifidobacterium breve,*
- *Bifidobacterium infantis,*
- *Bifidobacterium longum*
- *Bifidobacterium thermophilum*

Bacillus species

- *Bacillus subtilis,*
- *Bacillus pumilus,*
- *Bacillus lentus,*
- *Bacillus licheniformis*
- *Bacillus coagulans*

Pediococcus species

- *Pediococcus cerevisiae,*
- *Pediococcus acidilactici*
- *Pediococcus pentosaceus*

Streptococcus species

- *Streptococcus salivarius* ssp. *thermophilus*, *Streptococcus intermedius*

Bacteriodes species

- *Bacteriodes capillus,*
- *Bacteriodes suis,*
- *Bacteriodes ruminicola*
- *Bacteriodes amylophilus*

Propionibacterium species

- *Propionibacterium shermanii*, *Propionibacterium freudenreichii*

Leuconostoc species

- *Leuconostoc mesenteroides* ssp. *mesenteroides*

Molds and yeasts

- *Aspergillus niger,*
- *Aspergillus oryzae*

- *Saccharomyces cerevisiae,*
- *Candida torulopsis*

- When taken together with foods, probiotics can remain viable up to 1-4 hours in an enzymatic medium and at pH 2-3 range.
- Probiotics remain viable in the stomach because they are resistant to digestive enzymes and bile salts.
- Probiotic bacteria can colonise in the mucous medium secreted from the mucosa.

Probiotics act directly or indirectly on the physiology of intestine, thus they

- stimulate the immune system
- have potential effects on the maintenance of health and improve the health of the host
- reduce the risk of dieases

by affecting the mucosal surface of the upper respiratory tract and urogenital system (including the oral mucosa and digestive system).

- 3 different mechanisms are suggested for the mechanism of actions of probiotics.

1) Reduce the number of pathogenic and harmful bacteria

- To produce antimicrobial compounds
- To compete for nutrients
- To compete for colonisation regions

2) Changing the microbial metabolism (enzymatic activity)

- Producing enzymes that stimulate digestive system (e.g. lactase)
- Reducing the production of toxic enzymes, ammonia or amines.
- Improving the functions of the walls of intestines

3) Improving the immune system

- Increase the level of antibodies
- Increase the activity of macrophages

Health benefits of probiotics

- To balance intestinal flora
- To prevent diarrhea
- To increase the absorbtion of calcium
- To decrease cholesterol levels
- To support immune system

- Positive effects of supporting the intestinal flora by consumption of probiotic bacteria, on the health have long been known.
- Researchs regarding this findings clinically proved that probiotic consumption is necessary in order to live a healthier life, to increase body resistance and to fight with intestinal disorders and diseases.

Lactose Intolerance

- Lactose intolerance (to be unable to digest lactose), which is more common in Africa and Asia, is caused by the decrease of the lactase enzyme due to aging, digestive system disorders or intestinal mucosa corruption resulting from therapies such as use of antibiotics.

- In patients with lactose intolerance, the osmotic balance is disrupted and accumulation of fluid/liquid and electrolyte occur due to remaining undigested lactose; as a result of the fermantation of remaining lactose; hydrogen, methane and carbon dioxide gases are released.
- Excessive gas, bloating, nausea and diarrhea are the main symptoms of lactose intolerance.
- It is suggested that bacterial lactase, which provides digeston of lactose, is released as a result of breaking down of the probiotic bacteria in the small intestine by bile salts.

- It was also found that consumption of probiotic lactobacilli containing products reduced the activity of fecal bacterial enzymes such as beta-glucoronidase, nitroreductase and azonitroreductase.

- Clinical preparations of bifidobacteria and other probiotic bacteria have been shown to reduce or completely eliminate symptoms in patients with lactose intolerance.

Diarrhea

- Diarrhea occurs as a result of increased peristaltic movements of bowel (intestine), decreased absorption and / or increased secretion.

- Infections caused by *Escherichia coli, Salmonella, Clostridium difficile* and rotaviruses are considered as the main cause of the diarrhea.

Diarrhea

- In a study on the prevention of hospital diarrhea; Prophylactic use of Lactobacillus strains significantly reduced the risk of rotavirus gastroenteritis in children.
- Probiotic treatment shortens the duration of diarrhea in children infected with rotavirus and causes a decrease in fluid defecation.

- Decrease in antibiotic-associated diarrhea.
- Decrease in acute diarrhea in cancer patients undergoing radiotherapy and in enteral tube-fed patients

Helicobacter pylori infections

- It was established that *H. pylori* inhibits colonization and stimulates IL-8 secretion, *in vitro*.
- It was determined that infection decreased by 64% in individuals who consumed probiotic drinks.
- In a study with H. pylori-positive patients treated with triple antibiotic therapy, the patient group receiving yoghurt containing probiotic *Lactobacillus* and *Bifidobacterium* strains was found to be more successful (78-91%) in the treatment of infection than the group receiving only triple treatment.

Crohn’s disease

- Crohn's disease is characterized by transmural inflammation affecting the gastrointestinal tract. Conventional treatment is carried out by modifying the host immune response
- However, regulation of intestinal microflora is also accepted as a new treatment modality. The effect of a probiotic product to prevent recurrence of postoperative Crohn's disease lesions has been demonstrated in a placebo-controlled study.
- In the study for one year, significant reduction is seen in the recurrence rate of the lesions was determined in patients treated with an antibiotic-probiotic combination compared to the placebo group.

- Ulcerative colitis
- Irritable bowel syndrome (IBS) is characterized by abdominal pain and irregular defecation. Intestinal microflora in IBS patients was found to be different from healthy individuals and abnormal fermentation of food is seen in these patients. Treatment is provided by probiotic use.

Cancer

- One of the main causes of human cancers is carcinogenic substances taken from the environment. Bacteria in the intestinal tract play an important role in the inactivation of carcinogens, and in particular the prevention of the conversion of nitrosamines and bile sterols to cancer-inducing substances.

- Nutrition with fermented foods suppresses bacteria such as coliforms which are involved in the production of tumor initiators and pre-carcinogens, and has positive effects on intestinal microflora.
- Probiotic bacteria have been shown to reduce cancer risk by preventing possible mutagenic and genotoxic effects.

- Probiotic lactic acid bacteria have been mostly studied against colorectal cancers; other types of cancer such as breast and bladder cancers have also been studied.

- Strengthen the immune response of the host,
- Degradation of potentially carcinogenic compounds,
- Qualitative and/or quantitative differentiations in intestinal flora,
- Production of anti-mutagenic and anti-tumorigenic compounds in the colon,
- Alteration of metabolic activities in intestinal microflora (prevention of conversion of pre-carcinogens to carcinogens),
- Change in physicochemical conditions in the colon (improved intestinal permeability, prevention or delay of toxin absorption, enhanced intestinal barrier mechanisms),
- Effects on host physiology

- They lower serum cholesterol levels (an important risk factor for cardiovascular disease).
- They can stimulate natural barrier mechanisms in patients with atopic dermatitis and food allergy and are also effective in the treatment of diseases such as food allergy.

- Lactobacilli, which constitute the most important group of natural vaginal flora, prevent the colonization of pathogenic microorganisms by antibacterial compounds such as bacteriocin, lactic acid and hydrogen peroxide they produce.

- Decrease or absence of lactobacilli in the vagina cause growth of anaerobic pathogens that lead to bacterial vaginosis.

- Modification of vaginal microbial flora with probiotics is thought to be effective in protecting against HIV infections.

- The balance of the intestinal microflora of infants is of great importance in terms of diseases such as allergy, asthma, autism, and gastrointestinal disorders.
- Consumption of probiotic microorganisms has been shown to reduce diarrhea, respiratory and tooth decay infections in children, atopic dermatitis in infants and necrotizing enterocolitis in newborns.

- Feeding with infant formula supported with probiotic microorganisms during weaning has been showed to prevent common symptoms caused by switching to complex diet and reduce acute diarrhea and constipation rates.

- In addition, various probiotics and prebiotics have been clinically shown to increase calcium absorption and improve bone density levels in children.

- The composition of the intestinal microbial flora changes with respect to aging. It is generally accepted that the population of bifidobacteria after 55-60 years of age is significantly reduced by changes in diet or hormones, lifestyle effects and / or immunological, physiological reasons.
- Changes in microflora make individuals more susceptible to gastrointestinal problems or diseases caused by bacteria in the gut (eg cancer, or allergic diseases). It is thought that probiotic applications can be applied to individuals in this high-risk group, to protect especially against enteropathogens and urogenital pathogens.

- Probiotic bacteria are provided from three main sources;
- 1. From fermented dairy products
- 2. By adding the living cells of these bacteria to foods and beverages (fruit juices, chocolate, meat products etc.)
- 3. By preparing tablets, or capsules as pharmaceutical products prepared from living cells of probiotic bacteria.

- *Lactobacillus bulgaricus* and *Streptocuccus thermophilus* are used in the production of classical yoghurt. When yogurt is produced, it should contain 10^8 bacteria in 1 gram and should keep this feature during shelf life. Normal yogurt bacteria are not resistant to gastric acid, bile, pancreatic enzymes and lysozyme released from the small intestine, so they cannot survive; for that reason it is difficult for them to colonize even if it is temporarily. Therefore, they are not considered as true probiotic bacteria. Normal yogurt has weak probiotic properties.
- Recently, other bacteria with more probiotic properties have been used.
- Probiotics are usually lactic acid bacteria. For example*; L. casei, L. bulgaricus, L. plantarum, L. salivarus, L. rhamnosus, Bifidobacterium bifidum, B. lactis, B. longum, B. infantis, S. thermophilus*, etc.
- They are used in the production of yogurt, various fermented dairy products, as well as in the production of probiotic yogurt, probiotic dairy products. In the production of probiotic yogurt, it is added to the yoghurt culture bacteria.

Yoghurt

- Types of yoghurt produced using probiotic bacteria and starter cultures used in the production of these products:
- **Bifighurt :** *Bifidobacterium bifidum ve Streptococcus thermophilus*
- **Biogarde :** *Bifidobacterium bifidum, Lactobacillus acidophilus, Streptococcus thermophilus*
- **Bifidus Yoghurt :** *Bifidobacterium bifidum, Bifidobacterium longum, Lactobacillus bulgaricus, Streptococcus thermophilus*
- **Proghurt:** *Lactococcus lactis* ssp. *lactis*, *Lactococcus lactis* ssp.
- *cremoris*, *Lactobacillus acidophilus* ve *Bifidobacter bifidum*
- **Acidophilus Yoghurt:** *Lactobacillus acidophilus, Lactobacillus bulgaricus, Streptococcus thermopilus*
- **Biogurt:** *Lactobacillus acidophilus, Streptococcus thermophilus*
- **Arla:** *Lactobacillus casei, Lactobacillus asidophilus,*
- *Bifidobacterium bifidum*

- Kefir
- Kefir, which is widely known in the Caucasus and produced and consumed by the local people for many years, is one of our traditional fermented dairy products obtained by fermentation of ethyl alcohol and lactic acid using kefir grains.
- The sharp acidic taste of kefir is determined? by lactic acid, oxalic acid, small amounts of CO_2, alcohol as well as some aromatic compounds produced by lactic acid bacteria and yeast.
- It is a yeast flora that gives the typical flavor of kefir. Since kefir is made of milk, it contains all nutrients already found in the milk such as fat, lactose, mineral substances and vitamins. In fact, the synthesis of some vitamins and partial degradation of proteins and lactose during the formation of kefir, increases its nutritional value.
- The microorganisms found in the kefir provide easy digestion of this product, thus increasing the absorption of nutrients by the body.
- Kefir can be easily consumed by lactose intolerant people, especially because lactose in milk is converted to lactic acid.

- It was seen that these bacteria should be supported with prebiotics in order to show the properties of probiotics better.
- Prebiotics are non-digestible carbohydrate-derived compounds that promote the growth and development of probiotics, as well as increase their activity.

- Prebiotics are substances that reach the large intestine without being absorbed into the body through the digestive system and promote the growth and development of beneficial bacteria in the large intestine.
- Although some peptides, proteins and lipids have prebiotic properties, especially undigestable carbohydrates are considered as prebiotic source.

- Prebiotics are mainly oligosaccharides and they are considered as food components that positively effect human and animal health by promoting the growth or activity of one or a limited number of bacteria in the intestinal tract.

- A prebiotic;
- Must not be digested and absorbed in the digestive tract,
- Must be able to be used by beneficial bacteria found in the large intestine
- Must be able to affect intestinal flora to improve health.

- Some oligosaccharides and polysaccharides are naturally present and show prebiotic properties.
- Garlic, onion, artichoke, rosemary and chicory carry high amounts of oligosaccharides

- Prebiotics are naturally found in plants such as sunchoke, leek, wheat, soy, legumes, bananas, asparagus and tomatoes, as well as commercially synthesized by enzymatic hydrolysis of polysaccharides or synthesized from monosaccharides and / or disaccharides.

Prebiotics found in foods

- Inulin
- Laktulose
- Fructo-oligosaccharides
- Galacto-oligosaccharides
- Lactosucrose
- Gluco-oligosaccharides
- Raftiline
- Oligomate
- Xylo-oligosaccharides
- Palatinose
- Pyrodextrins
- Lactosucrose
- Sorbitol
- Isomalto-oligosaccharides
- Soyoligosaccharides
- Gentio-oligosaccharides

What is Synbiotic

- Products produced by using probiotics and prebiotics together are called synbiotic.

- With synbiotic intake;
- The lifespan of probiotic bacteria prolong
- They colonize better in the intestine.

- The purpose of synbiotic products is to obtain an beneficial agent for both the small intestine and the large intestine.
- *In vitro* studies have shown that synbiotic administration is more advantageous than prebiotic or probiotic alone.

Use of synbiotics

- Probiotics need to be taken regularly every day as they cause temporary colonization. By using regular probiotics, it is possible to control harmful bacteria in the intestine.

- It is thought that by colonization of colon with beneficial bacteria, taking probiotics or prebiotics regularly may prevent some diseases.

- It should be taken 10^8 CFU (colony-forming unit)/day daily and consumed regularly to maintain its effect.
- Any side effect, reliable and safe.
- Probiotics should not be given to patients who are hospitalized in the intensive care unit due to immunosuppressed multiorgan insufficiency and who have venous and urinary catheters because of the risk of Lactobacillemia.