What is dysbiosis?

Dysbiosis

There are hundreds of billions of micro-organisms, such as bacteria and fungi, of many different species, that reside in the lower part of our digestive tract. While some of these are beneficial to us, some are not.

In order for the intestine to be able to work properly, it needs to keep such micro-organisms, or microflora, in a healthy harmonious balance .

This balance can be disturbed by different causes, and some of the micro-organisms can become more dominant and others weaker. The term dysbiosis literally means 'dys' incorrect and 'biosis' life and it is the opposite of symbiosis, which means 'living in harmony.'

Dr. Eli Metchnikoff identified it in the early 20th century, and defined it essentially as an imbalance of microbial colonies. He also coined the expression that "Death begins in the gut!" to point out how a healthy intestine is essential for the body's general health. The balance of flora in the intestine can become quite altered, and when the number of undesirable bacteria becomes large enough to possibly lead to altered immune functions and increased risk of disease, it is called dysbiosis.

Digestion

The medical dictionary defines digestion as "the process of making food absorbable by mechanically and enzymatically breaking it down into simpler chemical compounds in the alimentary canal". Therefore, if digestion is faulty, the absorption of nutrients will be impaired and cause nutritional deficiencies, in spite of a good diet.

The digestive system in our body is made up of a series of organs joined together. Digestion starts in the mouth. Teeth, tongue, salivary glands and other muscles begin the process of breaking down the food. Saliva produced by these glands contains enzymes, including amylase, which begins the breakdown of food starches. Chewing our food well helps to improve the digestion of carbohydrates. The mouth, stomach, and small intestine are lined with the mucosa (or epithelium). This contains tiny glands that produce different digestive juices.

Once in the stomach, the food is broken down in smaller particle, and the food and liquids are mixed with the digestive juice produced by the stomach, the gastric juice. The stomach also produces the digestive enzymes pepsin and rennin, which break down proteins, and hydrochloric acid. The partly-dissolved food moves then into the first section of the small intestine, the duodenum. Here it meets the pancreatic juice, secreted by the pancreas, which contains different digestive enzymes, including tripsin, lypase, and amylase. Tripsin breaks down protein; lypase breaks down fats, and amylase, which, in the duodenum as in the mouth, works by turning starch into sugar.

The liver produces bile, another digestive juice. The bile is stored in the gallbladder between meals. At mealtime, it leaves the gallbladder and flows into the bile ducts and into the intestine, where it breaks down fats. After the fat is dissolved, it is digested by enzymes produced by the pancreas and by the lining of the intestine.

The small intestine is also called small bowel. It is the longest part of the digestive system.

It has three primary functions: it digests the food , it absorbs nutrients and prevents the entering of toxins and unwanted particles into the body. The inner wall of the small intestine, or mucosa, is lined with wrinkles, or microscopic finger-like structures called villi and microvilli. They increase the amount of surface area available for the absorption of nutrients. This huge organ system is the size of a tennis court when stretched end to end. The mucosal cells that line the villi are responsible for absorbing the nutrients from the intestinal lumen into the blood and they also produce important digestive enzymes. It is on these cells that the digestion of sugars and starches is completed.

Undigested waste products pass out through the colon and rectum.

The GI tract is also rich in neurotransmitters, hormones, chemical messengers, enzymes, and bacteria. The digestive system is the first line of defence in the body's immune system. It both identifies and eliminates viruses and unhealthy bacteria ingested with our food and water. It also helps remove not just food waste from the body, but also metabolic waste, heavy metals, and drug residues.

It also serves to get rid of toxic substances absorbed through the skin and lungs.

Microbes in the GI tract

The intestinal microflora is a complex ecosystem containing over 400 bacterial species. The bacteria in the intestines, in addition to a relatively small number of other micro-organisms, outnumber human cells 10-to-1. A normal, healthy intestinal tract contains almost 6 pounds of different types of micro-organisms. The microflora in the gastrointestinal tract is essential for the correct functioning of our digestive system. It performs different functions, such as the breakdown of complex carbohydrates, including dietary fibers, and the fermentation of indigestible carbohydrates, with production of short chain fatty acids and synthesis of vitamins. It also provides a mucosal barrier function (i.e. by inhibiting pathogen invasion and strengthening epithelial barrier integrity). (1) The term microbiota has been defined as the collective societies of bacteria assembled on the mucosal surfaces of an individual.

Mammals are born without any such micro-organisms. The colonization of gastrointestinal tract starts immediately at birth. (2) The first bacteria to colonize the gut originate from the birth canal and include aerobic and anaerobic bacteria, such as Escherichia coli, Clostridium spp., Streptococcus spp., Lactobacillus spp., Bacteroides spp., and Bifidobacterium spp.

All the components of the gastrointestinal ecosystem are necessary for the gut to develop its specific intestinal functions .(3) The good types of bacteria are called "probiotics" and they include Lactobacillus, Bifidobacterium, and Acidophilus. They perform a very important functions, one of which is to fight the bad bacteria, like pathogenic E. coli species and other killer germs.

Within the digestive tract, there is a constant battle being fought between the good bacteria and the bad bacteria, which we take in through the mouth from food, liquids, and contact with other people. According to Mitsuoka T, 1992: "Many microbes are being discovered which should not be located in the gastrointestinal tract and they often release poisonous chemicals such as amines, ammonia, hydrogen sulfide, indoles, phenols and secondary bile acids."

These microbes can damage the microvilli in the intestine and can be absorbed into the bloodstream, causing a variety of chronic and degenerative diseases. For example, the intestinal microbiota is one of the important factors associated with colorectal cancer. (5)

Several factors contribute to the development of an individual’s microbiome, and as a result,

susceptibility to several diseases. Such factors can even include the way a baby is delivered. (7) For example, infants born vaginally acquire the mother's vaginal and intestinal flora, including Bacteroides, Bifidobacterium, Lactobacillus, and Escherichia coli, while those born via caesarean section have increased levels of skin-associated bacteria including Staphylococcus.

Work published in Environmental Microbiology shows that important gut bacteria travels from mother to child through breast milk to colonize a child's own gut, helping his or her immune system to mature.

The microflora of the GI tract is critical in determining the host's susceptibility to GI infections, in preventing a colonization of undesirable bacteria or yeast, and keeping the PH of the intestine at a healthy level. For example, Clostridium coccoides are major producers of short chain fatty acids, in particular butyrate, and has been shown to protect against damaging inflammatory responses. (4)

Other short chain fatty acids, such as propionic acid, are beneficial at low concentrations, but have neurotoxic effects in high quantities and may play a role in the development of the symptoms of autism. (8)

The microflora in the gastrointestinal tract is involved in synthesis of vitamins (B and K), it participates in the digestion and absorption of nutrients, and inhibits pathogens. It keeps our immune system functioning properly, it helps prevent food allergies, and repairs the gut lining.

The largest portion of the immune system resides in the gut. Intestinal friendly flora bacteria makes up to 70 to 80 percent of a persons immune system. One of the most important immune proteins, called IgA, is produced in the intestine. The IgA globulin protects the lining of the entire GI tract. Certain probiotic bacteria increase the production of this immune component.

Probiotics are bacteria that help maintain the natural balance of organisms in the intestines, by reducing the growth of harmful bacteria, and therefore promoting a healthy digestive system. They crowd out pathogens like candida and harmful E. Coli. The normal human digestive tract contains about 400 types of probiotic bacteria. The largest group of probiotics in the intestine is lactic acid bacteria, of which Lactobacillus acidophilus is the best known. This can be found in yogurt with live cultures. Effective probiotic food sources include cultured dairy products like yogurt, buttermilk, sour cream, cottage cheese and kefir; cultured/fermented vegetables (cabbage, turnips, eggplant, cucumbers, onions, squash, and carrots), sauerkraut and sourdough breads. Probiotics are also available as dietary supplements. They can be helpful to replenish the good intestinal flora that was killed by antibiotics.

Research has suggested that probiotic bacteria can:

improve digestive function; improve tolerance to lactose; enhance immune function; help reduce the risk of certain acute common infectious diseases; help with side effects of antibiotic therapy. Some studies also report that certain probiotics can play a role in reducing the development of allergy in children, decrease Helicobacter pylori colonization of the stomach and manage relapse of some inflammatory bowel conditions.

New research out of Emory University School of Medicine in Atlanta, Georgia, has shown that natural gut bacteria are necessary to repair and maintain healthy intestinal cells and that gut microbes are capable of regrowing damaged or compromised tissue. In this new study, which was published in The EMBO Journal, the researchers tested certain strains of bacteria, such as those from the Lactobacillus genus, on both Drosophila fruit flies and mice. They discovered that some of these strains stimulate the production of the epithelial cells, which in turn causes the proliferation of intestinal stem cells.

What causes dysbiosis?

Different microbial communities reside in different parts of the intestine, depending on their function. Some of the micro -organisms are "friendly", but some are not, and they become especially undesirable when their number increases above a certain level.

Hawrelak JA, Myers SP. writes: "Alterations in the bowel flora and its activities are now believed to be contributing factors to many chronic and degenerative diseases. Irritable bowel syndrome, inflammatory bowel disease, rheumatoid arthritis, and ankylosing spondylitis have all been linked to alterations in the intestinal microflora. The intestinal dysbiosis hypothesis suggests a number of factors associated with modern Western living have a detrimental impact on the microflora of the gastrointestinal tract. Factors such as antibiotics, psychological and physical stress, and certain dietary components have been found to contribute to intestinal dysbiosis. If these causes can be eliminated or at least attenuated then treatments aimed at manipulating the microflora may be more successful."

We live in a world where heavy metals, prescription medications, environmental chemicals, and antibiotics leach into our food and water supply. These toxins can build up in our system, clogging the primary detox systems in the lymphatic system and the liver and disrupting the hormonal balance and the balance of the intestinal microbiota.

Different factors might contribute to such imbalance, such as poor digestion, toxins, use of antibiotic drugs, a diet particularly high in sugar, alcohol, stress, food additives, the use of birth control pill and of other hormones, especially immuno-suppressants, like steroids.

I will briefly examine a few studies on the effects of antibiotics, stress and diet on the intestinal flora.

Antibiotics

Antibiotics, also known as antibacterials, are types of medications that destroy bacteria, fungi and parasites or slow down their growth. The Greek word anti means "against", and the Greek word bios means "life". Some of them are penicillin-related antibiotics, such as ampicillin, amoxicillin and benzylpenicilllin and are are widely used today to treat a variety of infections.

There is growing concern that they are being overused by doctors and by the food industry.

One concern is the possibility of selection of antibiotic resistant strains of bacteria. One of the most common side-effects of antibiotics is diarrhoea. Researchers from Stanford University School of Medicine found that a rise in sugars in the gut following antibiotic treatment allows harmful bacteria to get a foothold. Harmful bacteria thrive on sugar. As soon as parasitic invaders have multiplied to sufficient numbers, they induce inflammation. While inflammation is not a good environment for restoring good bacteria, Clostridium difficile and salmonella thrive in it. Antibiotics also promote fungal-type dysbiosis, as it can be demonstrated by measuring levels of yeast metabolites in the urine. A common side effect is fungal infections of the mouth, digestive tract and vagina.

Stress

Researchers from Ohio State University (OSU) conducted a study, (published in the journal "Brain, Behavior, and Immunity"), that showed how stress directly affects the delicate bacterial balance in the intestines, causing dysbiosis. During the study, mice were exposed to a social stressor called social disruption, which increases circulating cytokines, which themselves induce enhanced reactivity in the

immune system.

Stressor exposure decreased the amount of Bacteroides, while increasing the amount of Clostridium, which often causes prolonged and severe diarrhoea. Lead researcher of the study Michael Bailey says, "These bacteria affect immune function, and may help explain why stress deregulates the immune response".

Neurochemicals produced upon psychological stress can also directly enhance the growth of pathogenic organisms: norepinephrine stimulates the growth of Y. Enterocolitica, P. Aeruginosa, and gram-negative bacteria such as E. coli. Stress also causes the release of inflammatory chemicals in the gut, such as substance P, and can activate gut inflammation when experienced in conjunction with another factor such as an infection. Elevated cortisol produces glucose, which leads to increased blood sugar levels. This affects yeast growth and alters gut flora. Altered gut flora leads to a weakened immune response as the balance of our intestinal bacteria is thrown off.

Diet

A healthy body starts with a healthy GI system. Our gastrointestinal tract is the connecting point between food and body and every bite of food we eat sends some type of message to our body. Enzyme deficiency, microbial imbalance, intestinal permeability and inflammation can create problems in our GI tracts.

Many studies have been conducted to see if there is a correlation between diet and the gut microbiota. One of such studies conducted on mice shows that dietary changes could explain 57% of the total structural variation in gut microbiota, whereas changes in genetics accounted for no more than 12% . (9)

Another study showed that a vegan and vegetarian diet, with high amounts of fiber, resulted in increased short chain fatty acid production by microbes which decrease the intestinal pH. This prevents the growth of potentially pathogenic bacteria such as E. coli and other members of Enterobacteriaceae . (10)

Another study showed that protein-rich diets increase the activity of bacterial enzymes such as ß-glucuronidase, azoreductase and nitroreductase, which produce toxic metabolites that trigger inflammatory responses. (11) The wrong food, and especially food low in fiber and rich in gluten, can also cause what is called "intestinal plaque", which is made of food particles and bacteria. Such bacteria produce an irritating acid, which, over the course of years, can cause inflammation of the mucosa, bloating, impaired absorption of nutrients, constipation. Gluten is sticky, and it tends to collect in between the villi. If it passes through the inflamed walls of the intestine, it can become embedded in different organs of the body or joints, and cause potentially serious health issues. Partly digested gluten can accumulate in different tissues, causing what is called "metabolic sediment" or "colloid matter" and can block the flow of the lymph and of the blood in capillaries.

The increase in sediments will very likely cause water retention and weight gain, the cells become more distant from each other and from the capillaries, and this will create problems of absorption of nutrients and oxygen from the blood into the cells, and difficulty for the cells to communicate with each other and to dispose of waste.

If this problem is not resolved, health issues become more and more severe. (13) Mental dullness, confusion, fatigue may be the initial effects, and may give way to more serious problems such as

asthma, Alzheimer's disease, Coelic disease, colitis, Crohn's disease, cystitis, eczema, emphysema, hepatitis, hypothyroidism, irritable bowel syndrome, lupus, multiple sclerosis,osteoarthritis, psoriasis, rheumatoid arthritis, sinusitis.

Leaky gut syndrome

A healthy intestinal lining allows only properly digested particles, such as fats, proteins and starches, to enter the bloodstream. The lining is composed of cells that fit tightly together and is host to a large number of bacteria, as well as many species of yeast and other organisms. It is meant to prevent unwanted particles or harmful bacteria from entering the organism's bloodstream and tissues, by providing physical and chemical barriers.

In case of prolonged dysbiosis, the mucosa will become inflamed, and unable to produce the proper digestive enzymes; its cells might have a reduced absorption surface; the gaps which normally exist between the mucosal cells lining the gut become larger, and allow harmful particles or micro-organisms (undigested food molecules, gluten, toxic waste, bacteria, viruses, parasites) to pass through, resulting in what is called "leaky gut syndrome".

The body will produce large number of cytokines in response to the presence of foreign particles in the blood and the tissues, and it might cause the immune system to become permanently over-active by forming antibodies against them.

This can lead to inflammation throughout the body and cause the liver to become overloaded trying to get rid of the toxins, and the adrenal glands can become overwhelmed trying to control the inflammation. Stress, lack of exercise, genetic predisposition, and exposure to toxins (like second-hand tobacco smoke) can all contribute to inflammation, but dietary choices play a big role as well.

Some of the symptoms are abdominal bloating, flatulence (as a result of the gases produced by the bacterial fermentation of undigested carbohydrates in the gut), food intolerance and health problems due to malabsorption of minerals. Inflammation in the gut can eventually lead to inflammation in the bones, heart, brain, or beyond, making osteoporosis, heart disease, Alzheimer’s, or other diseases you may have a genetic predisposition for, more likely as we age.

Dysbiosis and autoimmune disorders

In autoimmune disorders the immune system is reacting to something in normal body tissue which makes it appear foreign. Also if something foreign is permanently in the blood or the tissue spaces, the immune system may actually be targeting that, and the normal tissues just get in the way of the destructive enzymes. Autoimmunity also occurs when as a result of a vitamin D deficiency, the cells responsible for inflammation do not 'self-destruct' when they should. (13)

There are more than 80 different types of autoimmune disorders. According to an article found on Medline Plus,

"An autoimmune disorder may result in the destruction of one or more types of body tissue, abnormal growth of an organ and changes in organ function. Organs and tissues commonly affected by autoimmune disorders include: Blood vessels

Connective tissues Endocrine glands such as the thyroid or pancreas Joints Muscles Red blood cells Skin

A person may have more than one autoimmune disorder at the same time. Examples of autoimmune (or autoimmune-related) disorders include:

Addison's disease Celiac disease - sprue (gluten-sensitive enteropathy) Dermatomyositis Graves disease Hashimoto's thyroiditis Multiple sclerosis Myasthenia gravis Pernicious anemia Reactive arthritis Rheumatoid arthritis Sjogren syndrome Systemic lupus erythematosus Type I diabetes "

Rheumatoid arthritis, for example, causes stiff, swollen and painful joints in the hands and feet. It can develop at any age, typically in young and middle-aged adults and it affects nearly 1 percent of the world's population. It can also destroy bone and cartilage, and damage organs like the lungs and kidneys. Scientists aren't sure what causes rheumatoid arthritis, but they do know that it's an autoimmune disorder.

"It's been suspected for years and years, both in humans and in the animal model, that the development of autoimmune diseases like arthritis is dependent on the gut microbiota," says immunologist Diane Mathis of Harvard Medical School in Boston. Now, she says, those suspicions are beginning to be confirmed in humans.

According to researchers at Mayo Clinic and the University of Illinois at Urbana-Champaign, "The billions of bugs in our guts have a new found role: regulating the immune system and related autoimmune diseases, such as rheumatoid arthritis." Researchers participating in the Mayo Illinois Alliance for Technology Based Healthcare have concluded that "populations of specific gut bacteria may trigger the development of diseases like rheumatoid arthritis and possibly fuel disease progression in people genetically predisposed to this crippling and confounding condition."

The study is published in the April 2012 issue of PloS ONE. "A lot of people suspected that gut flora played a role in rheumatoid arthritis, but no one had been able to prove it because they couldn't say which came first — the bacteria or the genes," says senior author Veena Taneja, Ph.D., a Mayo Clinic immunologist. "Using genomic sequencing technologies, we have been able to show the gut microbiome may be used as a biomarker for predisposition."(14) As stated by Bryan White, (Ph.D., director of the University of Illinois' Microbiome Program in the Division of Biomedical Sciences and a member of the Institute for Genomic Biology), "the mucosal barrier in the gut prevents organisms -- even commensal or "good" bacteria -- from crossing the lumen of the gut into the human body. However, when commensal bacteria breach this barrier, they can trigger autoimmune responses. The body recognizes them as out of place, and in some way this triggers the body to attack itself." Such commensal bacteria will be able to cross the mucosal barrier if the lining is inflamed and the barrier does not work properly, such as in the presence of dysbiosis. The researchers came to the conclusion that "identification of pathogenic commensal bacteria would provide new understanding of disease pathogenesis, thereby leading to new approaches for therapy." In another study conducted on mice in 2009, immunologist Dan Littman of New York University and his team deciphered the gut-dwelling microorganism SFB, segmented filamentous bacteria's 1.57 million letters of DNA. "What has become clear in the last couple of years is that individual bacteria can specifically influence particular branches of the immune system," says Dr. Littman. Littman wondered if rheumatoid arthritis in humans might be due to specific gut microbes. His team tested fecal samples (which reflect the population of gut bacteria) from 114 residents of the New York City area. Some of the subjects in the study were healthy, some had had RA for years, some had arthritic psoriasys, some had been diagnosed recently. In this last group, a bacterium named Prevotella copri was present in 75 percent of patients' intestines. P. copri only appeared in 37 percent of patients living with either rheumatoid or psoriatic arthritis and 21% of healthy controls; this showed that the bacterium and the disease tend to occur together. "The findings,"

immunologist Diane Mathis of Harvard Medical School in Boston says, "open the possibility of new therapies to prevent or treat rheumatoid arthritis. Current treatments for the disease include drugs with scary side effects—Remicade, for instance, seems to increase the risk of developing certain cancers and serious infections. Perhaps P. copri could be attacked with antibiotics, Littman says, or crowded out with probiotic pills full of good bacteria. Either way, patients may someday be able to relieve their joint pain by focusing on their guts."

Cleansing and detoxing

Inflammation in the body may be caused by the presence of a continuing infection, or by unwanted particles that are constantly being released in the bloodstream and settle in the body's tissues, or that are present in such a large quantity that the body cannot get rid of them. In the effort of fighting against the unwanted particles, certain enzymes, such as collagenase, will attack the body's own tissue.

Dysbiosis causes inflammation by disrupting the gut's mucosa and causing a leaky gut. Harmful micro-organisms, such as Candida Albicans, can take a hold in the intestine and colonize organs and tissues. Some of such micro-organisms produce toxins that can be absorbed systemically and cause

diseases such as Lupus, multiple sclerosis, rheumatoid arthritis. By restoring the correct balance in the gut's micro-flora we can give the gut a chance to heal. The first thing we need to do is investigate possible food intolerance with the help of an avoidance and challenge test. During this test, the most common problem foods (wheat, eggs, yeast and dairy products) are excluded from the diet for two weeks, together with other possible problem foods, such as sugar, salt, alcohol, coffee, red meat, animal fat and artificial food additives. Wheat, eggs, yeast and dairies are reintroduced one at the time for the following four weeks to see which ones, if any, trigger any symptoms. Also it is important to investigate possible toxic exposure, such as smoke, mercury, pesticides, various chemicals, paint fumes etc. If there is a history of toxic exposure, there will be a need to remove as many possible toxins from the food and the environment and to boost liver function. It will be important to also conduct an anti-dysbiosis treatment, after food testing. This will be necessary also if there is a history of antibiotics. For a natural auto-immunity treatment, it is necessary to incorporate anti-oxidant and anti- inflammatory therapy, together with the investigation of food intolerances, the correction of nutritional deficiencies and the treatment of dysbiosis in order to promote intestinal healing. A natural gut healing program will include the use of a restrictive diet, natural antimicrobials and acid resistant, human strain probiotics (such as lactobacilli, or acidophilus) in order to reduce dysbiosis. It will be aimed at reducing the undesirable bacteria, parasites and yeast, to repopulate the intestine with friendly bacteria and to repair the walls of the gut. Most carbohydrates should be avoided, especially sugar, and antimicrobial foods should be added, including raw garlic and onions, peppermint, curry spices and extra-virgin olive oil. Other helpful products are grapefruit seed extract, oregano oil and castor oil (antifungal), artemisia annua and uva ursi (anti-parasitic), anti-inflammatory agents such as slippery elm, cabbage juice, aloe vera , licorice, and intestinal tissue regenerators, such as comfrey tea, butyric acid and N-acetine-glucosamine. (13) Learning how to deal with difficult situations without being overwhelmed by stress, and minimizing the sources of stress as much as possible, are also a very important steps toward healing.

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