

The Digestive System

Every moment of every day we have quadrillions (1,000,000,000,000,000) of processes going on in our body that we don't have to do anything about, pay any attention to, or even be aware of. Digestion is one of these processes. We don't really think much about our digestion unless something is not working right. Unfortunately, by the time we notice various symptoms appearing the problem can already be quite extensive. Good digestion is truly one of the main keys to good health. The digestive system is critical to all functioning in the body because it is here that food is broken down into tiny molecules which can travel through the body and into our cells giving them the raw materials they need to function. What this means to you is that your digestive system is what makes nutrients available to your body to keep it alive, active, regenerating and in good operating condition, or not.

To understand how the digestive system works let's think about the body as a living system, like a city, populated with lots of different kinds of individuals, businesses and organizations. Let's say the digestive system is like a huge farm that feeds the individuals of the city. If the farm is having problems due to drought, or too much rain, or an infestation of insects, disease or depleted soil than the crops are not growing well. If the crops are not growing well this effects the trucking business because they have less things to transport. This effects the grocers, restaurants and shop keepers because they have less to sell, this effects the producers because they have less raw materials to manufacture with. Ultimately, it effects all the individuals in the city because they don't have enough to eat which then effects their families and the places they work because they are too weak and unhealthy to come to work or to do a good job if they do manage to come. Most of the time we, in the city, don't think much about what is happening on the farm or with with the farmers. We just go to the store and get our groceries. If there's a problem with local farmers we might say, "Let's just import our food from some other farms somewhere else." With the body that is not really possible as it is a finite system so there isn't really a somewhere else for our cells to import their resources from. In the bigger world this is actually the case as well. There is a limit as to how many resources are available to the lager body of humanity. It's just hard to see it from our individual positions.

So you can see if our digestion is not working properly then it cannot break down the materials that come through it's system and so cannot provide the nutrients needed by the rest of the body. This means that it doesn't matter so much what kinds of different things you eat if the digestion is not working properly because the body cannot really access them anyway. It's like a famine has struck because of a flood. There may be crops in the field or food in the system but it is rotting or washing away in the flood waters and the body is not able to receive it or absorb the essential nutrients it needs to function and maintain health. If this goes on for very long you get a total system breakdown. The good news is that with a little thought and effort support can easily be given to the digestive system on a daily basis through herbs, diet and exercise to help it work well all the time.

To continue with our farm analogy, the processes of the human digestive system operate in a very similar way inside our body's as the processes in the soil work in relation to the plants. Soil is like the digestive system for plants. The soil, like our digestive system, is populated by millions of microorganisms. Bacteria, mycorrhizal fungi, viruses, and microbes live in the soil and break down the layers of humus and biomass into small molecules of minerals and nutrients that can be absorbed by the roots of the plants. Plant roots have small hairs on them, like the villi inside your intestines, that the molecules pass through to enter into the circulation system of the plant. If the soil is not healthy, if it does not have all of these populations of organisms in healthy balance, then these

processes do not occur properly and the plants can not receive what they need to live and grow. If the plants are not healthy and do not have the nutrients they need to be healthy they can not pass the nutrients on to us when we eat them. So, if the soil is not healthy we can not be healthy and neither can any other organisms that are dependent on plants for their sustenance. The same thing happens inside our bodies. If we do not have healthy, balanced populations of microorganisms living inside our digestive systems than our cells cannot receive what they need to grow and thrive and our whole body suffers.

How does digestion work?

Let's look a little closer at how the process of digestion works. Digestion begins in the mouth. Or, maybe it is more correct to say that it begins in the nose. The aroma of food entering the system through our sense of smell starts the salivary glands going. Eating something bitter or sour can also stimulate the salivary glands. Salivation lets the rest of the body know that food will soon be coming so it can prepare itself by getting the digestive juices flowing. Saliva is mostly made up of water but it also includes special enzymes used to break down starches and sugars. Chewing is an important part of this first step in the digestive process. Chewing breaks the food up into smaller pieces and mixes it with the enzymatic saliva turning into sort of an activated mush.

The next step is swallowing which moves the mushy food from your mouth to your stomach. This happens via the esophagus through a process called peristalsis. The esophagus is lined with muscles which contract rhythmically to push the food down this passageway and into the stomach. From the esophagus the food passes through a gate call the lower esophageal sphincter. In the stomach the food may be stored for a couple of hours as it mixes with the gastric juices to further break it down to a liquid. Digestive glands line the stomach. They produce hydrochloric acid and an enzyme that digests protein. A thick mucus layer coats the stomach and helps keep the acidic digestive juice from dissolving the tissue of the stomach itself. This lining does not allow for much absorption of nutrients though it does absorb some electrolytes, certain drugs (like aspirin) and alcohol.

The lower esophageal sphincter is a small ring-like muscle whose job it is to keep gastric juices from rising up into the esophagus. When the sphincter relaxes food can pass from the esophagus into the stomach. A common problem can arise when the sphincter remains relaxed and the digestive juices of the stomach move up into the esophagus. When this happens it is called heartburn or indigestion. Typically, heartburn is treated with antacids which neutralize the acids in your stomach. Antacids can alleviate the pain by decreasing the acidity of the stomach but, if taken frequently, actually will cause the stomach to either have not enough acid to digest properly or to produce more acid to compensate. Both of which can cause bigger problems.

Most digestive discomfort is experienced as a feeling of gaseous, bloated, fullness. This can be caused by overeating or factors like obesity or pregnancy which can actually displace the contents of the stomach by pushing them upwards. Also, smoking, alcohol, coffee, soft drinks, fried foods, etc., can weaken the sphincter muscle between the stomach and the esophagus. But, most commonly, it is poorly digested food in the stomach and intestine, that is fermenting and causing gas, that blows the stomach up and weakens the one-way valve. The pain of the gas can feel like burning that radiates upward and the discomfort can actually get worse if you lie down because this makes it easier for gastric juices to back up into the esophagus.

Some things that can help in this situation are digestive bitters taken 15 minutes before eating and again after if discomfort is experienced. Bitters help to stimulate all the digestive

processes before the food arrives so the system is better able to process the food when it does come along. Bitters also stimulate the liver and bile to help break down fatty foods which can cause indigestion. Digestive teas such as peppermint, fennel, ginger, chai, and most of the other aromatics (basil, lemon balm, chamomile, dill, cardamom, etc) can help relieve some of the discomfort and stimulate digestive processes. Licorice, aloe, slippery elm, and marshmallow, are very helpful if there is burning or irritation. A good tea to make would be to mix one teaspoon of slippery elm bark powder with one cup of chamomile tea. Chamomile tea specifically helps relax the nervous system, which is integral part of the digestive system. Drink this at least once a day for 12 weeks to help strengthen the protective lining of the stomach. Drinking aloe juice on a regular basis once or twice a day can also be very helpful. Or, digestive enzymes may be the solution. Eat fermented foods such as sauerkraut, yogurt, and kefir on a regular basis to keep the digestive system healthy and the enzymes flowing.

Now, back to the processes of the digestive system. The food that is now liquified by the stomach's action slowly empties into the small intestine through another valve called the pyloric sphincter valve. The small intestine is where the majority of digestion takes place. It is a hollow tube about 22 feet long and 2 inches wide. It is lined inside with a mucosal membrane covered with little hairs called villi that, like the hairs on the roots of the plants, are essential to absorbing the nutrients as they pass through the intestines. The food continues to be broken down with the help of digestive juices from the liver, gall bladder, and pancreas which are secreted into the intestines. The pancreas produces a wide array of enzymes to break down the carbohydrates, fats, and proteins in food. The liver produces bile which is stored in the gallbladder and is squeezed out through the bile ducts and into the small intestine during digestion. The bile acids dissolve fats into the watery contents of the intestine, much like detergents dissolve grease from a frying pan. After the fat is dissolved, it is digested by enzymes from the pancreas and from the lining of the intestine.

Most of the digested molecules of food, water and minerals, are absorbed through wall of the small intestine by the villi. The mucus membrane has many folds within it and as it winds around the hollow tube it constitutes a vast surface area through which liquid nutrients can be absorbed. The nutrients move through the villi to the cells of the intestinal wall. Materials cross through these cells into the bloodstream and get transported to other parts of the body for storage or further chemical change. Fat soluble vitamins are stored in the liver, water soluble vitamins move through the blood stream to the cells, sugars are used as energy, or stored as fats in fat cells and the liver, and whatever water is not needed passes into the urinary system. Undigested fiber and anything else that is left passes into the large intestine. All that remains at the end of the process is some water, indigestible food bits, bacteria, products of bacterial decomposition, and inorganic salts. The large intestine's job is mostly to absorb the remaining water, vitamins and electrolytes then to move whatever cannot be used out of the body.

The nervous system plays a large role in the process of digestion. In fact, it has been said that the huge neural network that moves through this system is like a second brain. There are two types of nerves in this network – extrinsic nerves and intrinsic nerves. Extrinsic nerves come from outside the digestive system. They connect the digestive organs to the brain and the spinal cord passing information back and forth. Two main chemicals are released into the digestive system by these nerves, acetylcholine and adrenaline.

Acetylcholine causes the muscle layer of the digestive organs to squeeze creating the action called peristalsis which pushes the food and juices through the digestive tract. Acetylcholine also causes the stomach and pancreas to produce more digestive juices. Adrenaline has the opposite effect. It relaxes the digestive muscles and decreases the flow of blood to these organs, which slows

or stops digestion. Because adrenaline activates the flight or fight response it causes all normal processing of the body to slow down or stop so that the energy can be diverted to the extremities where they will be needed to run or fight. Stress is one of the things that activates this adrenaline response. If stress continues over long periods digestive problems are likely to result because the digestive system is slowed or shut down all the time the stress is experienced.

The intrinsic nerves make up a very dense network of neurons, called the enteric nervous system, embedded in the walls of the esophagus, stomach, small intestine, and colon. The nerves are triggered to act when the walls of these organs are stretched by food. They release many different substances that can speed up or delay the movement of food and the production of juices by the digestive organs. This neural network is in constant communication with the rest of the body. It works with in close partnership with the immune system, endocrine system, and circulatory system and contains some 100 million neurons, more than in either the spinal cord or the peripheral nervous system. This multitude of neurons in the enteric nervous system enables us to "feel" the inner world of our gut and its contents. The enteric nervous system uses more than 30 neurotransmitters, just like the brain, and in fact 95 percent of the body's serotonin is found in the intestines.

Gut feelings have always been a guidance system for humans. Because the digestive system has this large neural network embedded within it, it directly effects and, is affected by, emotional and mental difficulties. This is why depression, anger, mental agitation and stress create pains in the stomach and digestive problems. It is also why having peaceful meals is beneficial to the digestion and to overall health. So, as we can see problems with the digestive system effect the whole body and all it's systems. This gut level intelligence can be seen as one aspect the body's innate Nature intelligence. It is an important place for us to hear our body talking to us and it is an important voice for us to listen to. And, within that gut intelligence residing in our intestines, there is a whole universe full of beings and activities going on. We are definitely not alone!

Intestinal Flora and Probiotics

The average human body, consists of about 10^{14} (100,000,000,000,000 or about one hundred trillion) cells. About ten times that number of microorganisms live in our intestines. There's an average of about 500 different bacterial species living right now inside our digestive systems. The metabolic activities performed by these bacteria are as complex and varied as those of the various organs in our bodies. It has been said that the amount of bacteria in just your colon could weigh as much as 3 pounds. The relationship between this massive population of flora and the human body is normally one of symbiosis. These microorganisms perform a host of useful functions, such as training the immune system, producing vitamins for the host (such as biotin and vitamin K), and producing hormones. Some types of intestinal flora have enzymes that human cells lack for breaking down certain sugars. Carbohydrates that humans cannot digest without bacterial help include certain starches, fiber, sugars like lactose and sugar alcohols.

Another important role of the beneficial flora is that they prevent harmful species of flora from dominating the population. Yeasts and harmful bacterial species such as *Clostridium difficile* (the overgrowth of which can cause colitis) are unable to grow excessively due to competition from helpful flora species which adhere to the mucosal lining of the intestine. Helpful bacteria prevent the growth of pathogenic species by competing for nutrition and attachment sites along the lining of the colon. Symbiotic bacteria are more at home in this ecological niche and are thus more successful in the competition.

When the body is healthy these microscopic residents are maintained in a state of balance. If this equilibrium is lost, harmful micro-organisms will grow at the expense of beneficial ones. This is known as a state of dysbiosis. Dysbiosis means an imbalance of the various groups of bacteria, yeasts and funguses living in your digestive system. Some of these microbes are capable of fermentation which gives rise to various physical symptoms. Some degree of fermentation normally takes place inside all of us, and there are usually no problem with this. But, if the fermenting populations become too large, the amount of fermentation going on increases dramatically. It is this fermentation process that causes gas. This increase in fermentation also results in a situation where alcohol, gas and toxins, are released into the bloodstream which can cause a lot of misery.

In a healthy person the intestinal flora are varied and in a dynamic balance but they can easily become imbalanced. The use of antibiotics can destroy intestinal flora, as can bouts of diarrhea, an abundance of sugar, alcohol or even too much fiber. Traditionally, fermented foods were eaten on a daily basis to keep digestion regular. Because these foods are already fermented they help to keep the internal fermenting populations out of work and their populations regulated. Kim chee, sauerkraut, miso, kefir, and yogurt are all examples of traditional foods from various cultures around the world that just happen to promote the health and populations of beneficial bacteria in the intestines. It is becoming more and more clear that food traditions around the world have something important to show us about staying healthy through the food we eat. Carminative teas can also be helpful if occasional gas is making life unpleasant. Fennel, chamomile, cardamom, cinnamon, ginger and thyme are herbs that help dispel gas. As well as catnip, caraway, lemongrass, and lemon balm.

Symptoms of gut fermentation include:

1. abdominal pain
2. altered stool frequency
3. altered stool form
4. altered stool passage
5. passing mucus with stool
6. bloating of the abdomen
7. itchy bottom
8. flatulence
9. indigestion
10. fatigue
11. headache
12. muscle pain
13. joint pain

Many of these symptoms are similar to those you will find to be the same as those from food allergies, irritable bowel syndrome, leaky gut syndrome and any number of other conditions.

Other things to look at for digestive problems:

Often, it is a LACK of stomach acid, not an excess, that creates symptoms of indigestion. Naturopathic physicians have found that supplementary digestive acid and enzyme supplements can improve digestion and thus eliminate symptoms of indigestion. Lack of stomach acid can also result in food allergies, nausea after taking supplements and rectal itching. It can be indicated by weak fingernails, anemia, chronic parasites, fungal infections, and acne.

Always protect the mucus membrane. It protects the stomach and intestinal walls from acids and enzymes which break down the food. When the membrane is compromised the intestinal walls can be damaged – holes can occur then stuff leaks into the blood that is not supposed to be there. This causes the immune system to become confused and overreactive. An over active and overstimulated immune system reacts to things it doesn't need to and depletes itself so it is not available when it needs to be. A lot of allergies are the physical symptoms of this situation.

Herbs to use for promoting healthy digestion:

When the mucus membrane is inflamed demulcent and mucilagenous herbs are soothing such as **comfrey, marshmallow, slippery elm, and licorice**. Add a little bit of these to your teas on a regular basis to support the mucous membranes throughout the body.

Vulnerary herbs that promote wound healing and cellular regeneration are also a good idea both when there are problems and on a regular basis to prevent problems. **Calendula, aloe, plantain, comfrey, yarrow** are some suggestions.

Anti-inflammatory herbs such as – **calendula, turmeric, licorice, chamomile, spearmint** can be helpful for cooling hot and inflamed conditions and indigestion.

Carminative herbs are usually those with volatile oils that help to dispel gas and relieve bloating these have been mentioned before but repetition never hurts and a few more can be added to the list **basil, coriander, cilantro, dill, caraway, ginger, cinnamon, cardamom, peppermint, lemon balm, chamomile, cumin, clove, marjoram**. Many of these are also antispasmodic which can help any cramping that may occur.

Bitter herbs are good for stimulating digestion so take them about 15 minutes before eating. They can be taken after eating also to stimulate the liver and to secrete bile to break down rich foods. Bitter greens like dandelion greens and many of the italian salad greens such endive, radicchio, kale, collards, and the spicy greens from the mustard family all work to help the digestive system in this way. Most of them are full of minerals and vitamins as well. **Artichoke, dandelion, burdock, turmeric, yarrow, wormwood** can be taken as tinctures (teas can be unpleasant for many people) alone or in blends with some of the other categories of herbs listed above.

For diarrhea tannic and, astringent herbs such as - **raspberry, blackberry, uva ursi** can help to slow things down. Mix these with things like a little bit of lemon balm, ginger or chamomile to help with cramps and spasms. It is important to stay hydrated and take in electrolytes when diarrhea occurs. A simple electrolyte drink can be made by mixing 4 oz of water with 1 teaspoon of honey and 1 tsp of lemon juice or apple cider vinegar with a pinch of salt.

For constipation herbs that stimulate the bowels such as yellow dock, burdock, and dandelion can be helpful. Mix these with something soothing like slippery elm, licorice or marshmallow and chamomile, lavender or lemon balm to relieve any tension that may be adding to the difficulty.

Once upon a time there was a popular nutritional principle called "the wisdom of the body," which meant that our bodies would tell us which foods we need. According to the wisdom of the body principle, if your body is deficient in a particular nutrient, your desire to eat food containing that nutrient increases. The signals of the body are related to the "gut feeling." Certain foods, certain amounts, and certain combinations leave you feeling pleasantly satisfied; others leave you uncomfortably full and bloated. Excessive gas, bloating, burping, headaches, lethargy, and sweats

are all signals that you are not eating wisely. The body's intelligence is the best doctor we have available to us. The more we learn to be aware of what our body is telling us the healthier we will be.

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