Digestion

Our Health and Temperance message for today is on digestion—in particular, that of fruits, vegetables, animal protein, and fats.

Digestion is the breakdown of large insoluble food molecules into small water–soluble food molecules so that they can be absorbed into the watery blood plasma. These smaller substances are absorbed through the small intestine into the blood stream. Digestion is a form of catabolism that is often divided into two processes based on how food is broken down: mechanical and chemical digestion. The term mechanical digestion refers to the physical breakdown of large pieces of food into smaller pieces which can subsequently be accessed by digestive enzymes. In chemical digestion, enzymes break down food into the small molecules the body can use.

In the human digestive system, food enters the mouth and mechanical digestion of the food starts by the action of mastication (chewing), a form of mechanical digestion, and the wetting contact of saliva. Saliva, a liquid secreted by the salivary glands, contains salivary amylase, an enzyme which starts the digestion of starch in the food; the saliva also contains mucus, which lubricates the food, and hydrogen carbonate, which provides the ideal conditions of pH (alkaline) for amylase to work. After undergoing mastication and starch digestion, the food will be in the form of a small, round slurry mass called a bolus. It will then travel down the esophagus and into the stomach by the action of peristalsis. Gastric juice in the stomach starts protein digestion. Gastric juice mainly contains hydrochloric acid and pepsin. As the first two chemicals may damage the stomach wall, mucus is secreted by the stomach, providing a slimy layer that acts as a shield against the damaging effects of the chemicals. At the same time protein digestion is occurring, mechanical mixing occurs by peristalsis, which is waves of muscular contractions that move along the stomach wall. This allows the mass of food to further mix with the digestive enzymes.

After some time (typically 1–2 hours in humans), the resulting thick liquid is called chyme. When the pyloric sphincter valve opens, chyme enters the duodenum where it mixes with digestive enzymes from the pancreas and bile juice from the liver and then passes through the small intestine, in which digestion continues. When the chyme is fully digested, it is absorbed into the blood. 95% of nutrient absorption occurs in the small intestine. Water and minerals are reabsorbed back into the blood in the colon (large intestine).

In the compilation of Ellen G. White writings, “Counsels on Diet and Foods”, on page 112, we read, “It is not well to eat fruit and vegetables at the same meal. If the digestion is feeble, the use of both will often cause distress, and inability to put forth mental effort. It is better to have the fruit at one meal, and the vegetables at another.”

In “Letter 312” of 1908, she also wrote that, “Fruit and vegetables taken at one meal produce acidity of the stomach; then impurity of the blood results, and the mind is not clear because the digestion is imperfect.”

And, again, in “Letters and Manuscripts”, Volume 16, Letter 145 of 1901, she wrote, “If fruit is eaten, it may be best not to eat vegetables, for fruit and vegetables often quarrel in the stomach.”

A review of digestive enzymes could become very complicated and confusing. But, we will only discuss this at a concept level to avoid this confusion.

There are only three families of enzymes available to digest foods:

1. Saliva that moistens food in the mouth and begins the digestion of grains,
2. A family of enzymes that primarily digest fruit, and

3. A family of enzymes that are used to digest vegetables.

Saliva is compatible with the fruit digesting enzymes. Saliva is also compatible with the vegetable digesting enzymes. But, the fruit digesting enzymes and the vegetable digesting enzymes are incompatible—producing gas, bloating and burping.

The vegetable digesting enzymes require the presence of another chemical—a catalyst—in order to properly function. That catalyst is stomach acid—primarily hydrochloric acid. A catalyst is a substance present in small amounts relative to the reactants—the enzyme—that modifies and especially increases the rate of the chemical reaction without being consumed in the process. Only a little amount is required to be present to activate the vegetable digesting enzymes.

How is the body to digest proteins—especially animal flesh proteins? Saliva is not suitable. Fruit digesting enzymes are not capable. Vegetable digesting enzymes lack the ability.

The digestive system reaches for the only thing left—the catalyst that enables the vegetable digesting enzymes—the stomach acid, hydrochloric acid. And this it needs in much higher quantities than necessary for vegetable digestion.

Now the stomach has to protect itself from the effects of much higher stomach acid levels. Cells in the stomach produce bicarbonate, a base, to buffer the fluid, ensuring that it does not become too acidic. These cells also produce mucus, which forms a viscous physical barrier to prevent gastric acid from damaging the stomach. Remember from our discussion regarding bread making, that when an acid and a base combine, they produce gas and a chemical salt which is an irritant to the digestive system.

How does this affect the pH of the blood? pH stands for “potential of hydrogen.” Your blood has a normal pH range of 7.35 to 7.45. This means that blood is naturally slightly alkaline. If your blood pH remains lower than 7.0 pH (physiological acidosis) or higher than 7.8 (alkalosis)—you die!

In comparison, your stomach acid has a pH of around 1.5 to 3.5. This makes it strongly acidic.

The parietal cell which makes the stomach acid also releases alkaline bicarbonate into the bloodstream in the process, which causes a temporary rise of pH in the blood, known as an alkaline tide. Alkaline tide refers to a condition, normally encountered after eating a meal of flesh meat, where during the production of hydrochloric acid by parietal cells in the stomach, the parietal cells secrete bicarbonate ions across their basolateral membranes and into the blood, causing a temporary increase in pH. The alkaline tide following a meal lasts until the acids in food absorbed in the small intestine reunite with the bicarbonate that was produced when the food was in the stomach. Thus, alkaline tide is self–limited and normally lasts less than two hours.

The alkaline tide has also been shown to be a causative agent of calcium oxalate urinary stones in cats, and potentially in other species.

In Leviticus 7:22–23: “And the Lord spoke to Moses, saying, [23] “Speak to the children of Israel, saying: ‘You shall not eat any fat, of ox or sheep or goat.”

Reading from Leviticus 1:1, “Now the Lord called to Moses, and spoke to him from the tabernacle of meeting, saying,” . . . and continuing in chapter 3, verse 17, “ ‘This shall be a perpetual statute throughout your generations in all your dwellings: you shall eat neither fat nor blood.’ ”

“A plain diet, free from spices, and flesh meats, and grease of all kinds, would prove a blessing to you . . .” *Counsels on Diet and Foods, page 83 (Ellen G. White)*

Your appetites are morbid, and because you do not relish a plain, simple diet, composed of unbolted wheat flour, vegetables and fruits prepared without spices or grease, you are continually transgressing the laws which God has established in your system.

While you do this, you must suffer the penalty; for to every transgression is affixed a penalty. Yet you wonder at your continued poor health. Be assured that God will not work a miracle to save you from the result of your own course of action....—*Testimonies for the Church 2:67–70, 1868*

Digestion of some fats can begin in the mouth where lingual lipase (lip' ās') breaks down some short chain lipids into diglycerides. However fats are mainly digested in the small intestine. The presence of fat in the small intestine produces hormones that stimulate the release of pancreatic lipase (lip' ās') from the pancreas and bile from the liver which helps in the emulsification of fats for absorption of fatty acids. Complete digestion of one molecule of fat (a triglyceride) results a mixture of fatty acids, mono– and di–glycerides, as well as some undigested triglycerides, but no free glycerol molecules.

Eat carefully; digest healthfully.