Acid-Base Balance Encyclopedia Article

Acid-Base Balance

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Acid-Base Balance

According to definition, an acid is a substance that can donate, or make available, a hydrogen ion to another molecule. The balance of acidic and basic compounds in the body is vitally important for the proper functioning of most physiological processes. Examples of these processes are the delivery of oxygen to cells, the use of oxygen by the cells, and the hormonal regulation of metabolic operations.

Waste products of **metabolism**, such as carbon dioxide (CO_2), hydrogen ions (H^+), sulphuric acid, and phosphoric acid will alter the pH--the concentration of hydrogen ions--in body fluids if not 'buffered,' or counteracted, by interaction with more acidic compounds in **organs** like the **lungs** and the **kidneys**.

The higher a person's metabolic rate is, the faster the ability to break down complex components into more basic energy-generating components, the more acid enters and lowers the pH of the **blood**. The body is equipped with mechanisms to cope with the fluctuations in acid production and so to maintain the pH at a fairly constant level. The main buffering system in the body is the bicarbonate/carbonic acid system in the **extracellular fluid**. This is the fluid that is outside of cells. Via reversible chemical reactions, the bicarbonate/carbonic acid system can neutralize acidic or basic compounds. Within cells, in the intracellular fluid, proteins are important in maintaining the acid-base balance. The chemical structure of protein molecules can be such that they can bind acidic or basic compounds. Yet another means of buffering, in both extracellular and intracellular fluids, particularly in the urinary tract, is via a compound called phosphate (PO_{4^-}).

These and other buffering mechanisms can fail. When this occurs, the acid-base balance is not maintained. **Acidosis** is the condition caused by the removal of bicarbonate or by an increase in carbonic acid in the blood. The result is an increased hydrogen ion concentration and, hence, the lowering of the pH of the blood. Diabetes, starvation, or a high **fat** diet can lead to acidosis. Conversely, a condition called **alkalosis** occurs when bicarbonate increases. In alkalosis, the blood pH rises, which can cause vomiting, **nausea** and **headache**.

Athletes can alter their **breathing** just prior to competition in order to create alkalosis, which will aid in the absorption of the **lactic acid** generated by muscle activity, or to minimize alkalosis, which can compromise endurance activities.