''बेटी बचाओ, बेटी पढ़ाओ''

JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR

FACULTY OF HOMOEOPATHIC SCIENCE

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Teaching Methodology of physiology

Program : BHMS 1st year

Course : PHYSIOLOGY

Session : ACID BASE BALANCE

Academic Day starts with –

- Greeting with saying 'Namaste' by joining Hands together following by 2-3 Minutes Happy session, Celebrating birthday of any student of respective class and National Anthem

Lecture Starts with-

- **Review of previous Session-** In previous session as I had discussed about introduction of cell junction. Now tell me about gap junction?
- **Topic to be discussed today-** Today I will discuss about cell internal environment. I will start this topic from CELL ACID BASE BALANCE.

Acid-base balance is very important for the homeostasis of the body and almost all the physiological activitie depend upon the acid-base status of the body. Acids are constantly produced in the body. However, the acid production is balanced by the production of bases so that the acid-base status of the body is maintained. An acid is the **proton donor** (the substance that liberates hydrogen ion). A base is the **proton acceptor** (the substance that accepts hydrogen ion).

In spite of continuous production of acids in the body, the concentration of free hydrogen ion is kept almost constant at a pH of 7.4 with slight variations.

HYDROGEN ION AND pH

Hydrogen ion (H+) contains only a single proton (positively charged particle), which is not orbited by any electron. Therefore, it is the smallest ionic particle. However, it is highly reactive. Because of this, the H+ shows severe effects on the physiological activities of the body even at low concentrations. The normal H+ concentration in the extracellular fluid (ECF) is 38 to 42 nM/L. The pH is another term for H+ concentration that is generally used nowadays instead of 'hydrogen ion concentration'. The pH scale was introduced in order to simplify the mathematical handling of large numbers. Negative logarithm of H+ concentration is taken for calculating the pH as given below.

REGULATION OF ACID-BASE BALANCE

Body is under constant threat of acidosis because of the production of large amount of acids. Generally, two types of acids are produced in the body:

1. Volatile acids
2. Non-volatile acids.

1. *Volatile Acids*

Volatile acids are derived from CO2. Large quantity of CO2 is produced during the metabolism of carbohydrates and lipids. This CO2 is not a threat because it is almost totally removed through expired air by lungs.

2. *Non-volatile Acids*

Non-volatile acids are produced during the metabolism of other nutritive substances such as proteins. These acids are real threat to the acid-base status of the body. For example, sulfuric acid is produced during the metabolism of sulfur containing amino acids such as **cysteine** and **metheonine;** hydrochloric acid is produced during the metabolism of lysine, arginine and histidine.

Fortunately, body is provided with the best regulatory mechanisms to prevent the hazards of acid production.

Compensatory Mechanism

Whenever there is a change in pH beyond the normal range, some compensatory changes occur in the body to bring the pH back to normal level. The body has three different mechanisms to regulate acid-base status:

1. Acid-base buffer system, which binds free H+
2. Respiratory mechanism, which eliminates CO2
3. Renal mechanism, which excretes H+ and conserves the bases (HCO3–).

REGULATION OF ACID-BASE BALANCE BY ACID-BASE BUFFER SYSTEM

An acid-base buffer system is the combination of a weak acid **(protonated substance)** and a base – the salt **(unprotonated substance).** Buffer system is the one, which acts immediately to prevent the changes in pH. Buffer system maintains pH by binding with free H+.

Types of Buffer Systems

Body fluids have three types of buffer systems, which act under different conditions:

1. Bicarbonate buffer system
2. Phosphate buffer system
3. Protein buffer system.

1. *Bicarbonate Buffer System*

Bicarbonate buffer system is present in ECF (plasma). It consists of the protonated substance, carbonic acid (H2CO3) which is a weak acid and the unprotonated substance, HCO3 –, which is a weak base. HCO3– is in the form of salt, i.e. sodium bicarbonate (NaHCO3).

Mechanism of action of bicarbonate buffer system

Bicarbonate buffer system prevents the fall of pH in a fluid to which a strong acid like hydrochloric acid (HCl) is added. Normally, when HCl is mixed with a fluid, pH of that fluid decreases quickly because the strong HCl dissociates into H+ and Cl–. But, if bicarbonate buffer system (NaHCO3) is

added to the fluid with HCl, the pH is not altered much. This is because the H+ dissociated from HCl combines with HCO3 – of NaHCO3 and forms a weak H2CO3. This H2CO3 in turn dissociates into CO2 and H2O.

APPLIED PHYSIOLOGY – DISTURBANCES OF ACID-BASE STATUS

ACIDOSIS

Acidosis is the reduction in pH (increase in H+ concentration) below normal range.

Acidosis is produced by:

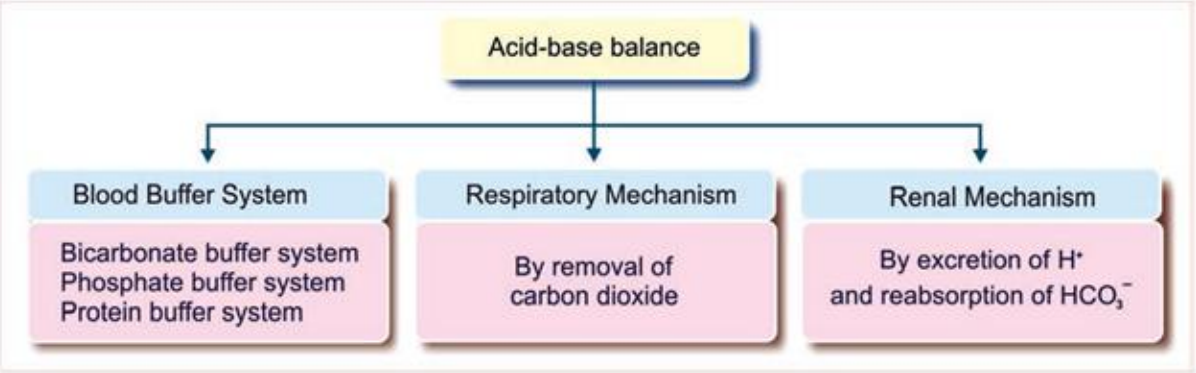
1. Increase in partial pressure of CO2 in the body fluids particularly in arterial blood
2. Decrease in HCO3 – concentration.

ALKALOSIS

Alkalosis is the increase in pH (decrease in H+ concentration) above the normal range (Table 5.2).

Alkalosis is produced by:

1. Decrease in partial pressure of CO2 in the arterial blood
2. Increase in HCO3 – concentration.



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- **Suggestions to secure good marks to answer in exam-**

➢ Give answer with complete labeled diagrams.

➢ Explain answer with key point answers

- **Questions to check understanding level of students-**
  - Write about gap junction?
  - What is osmosis?
- **Next Topic-**
  - carbohydrate

Academic Day ends with-

National song’ Vande Mataram’