

CORPUSCULAR ELEMENTS OF BLOOD

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Abstract: *Blood is a vital biological fluid responsible for oxygen and nutrient transport, immune defense, and homeostatic regulation. It consists of plasma (55–60%) and formed elements (40–45%), including erythrocytes (red blood cells), leukocytes (white blood cells), and thrombocytes (platelets). Hemoglobin within erythrocytes plays a key role in the transport of oxygen and carbon dioxide. Leukocytes protect the body against infections, while platelets are essential for blood clotting. Osmotic pressure, blood viscosity, and pH are critical factors in maintaining fluid balance and proper circulation. Understanding the composition and functions of blood, as well as disorders such as anemia, erythrocytosis, leukocytosis, leukopenia, thrombocytopenia, and hemolysis, is fundamental for medical diagnostics and treatment.*

Keywords: *Blood composition, plasma, erythrocytes, leukocytes, thrombocytes, hemoglobin, oxygen transport, carbon dioxide exchange, osmotic pressure, blood viscosity, homeostasis, anemia, blood disorders, immune defense, hemostasis.*

Introduction

Blood is one of the most vital biological fluids in the human body. It sustains life by transporting oxygen and nutrients to tissues, removing metabolic waste products, and supporting the immune system. The physical and chemical properties of blood ensure that it performs these essential functions to maintain homeostasis.

Composition of Blood

An average adult has about 5.2 liters of blood, which consists of two main components: plasma and formed elements.

Plasma makes up approximately 55–60% of total blood volume and contains water, proteins, electrolytes, and other dissolved substances.

Formed elements, accounting for 40–45%, include erythrocytes (red blood cells), leukocytes (white blood cells), and thrombocytes (platelets).

These elements are produced in hematopoietic organs, primarily the bone marrow, and play vital roles in maintaining physiological balance.

The specific density of whole blood ranges from 1.050 to 1.060 g/cm³, while plasma has a density of 1.025–1.034 g/cm³. Blood viscosity is about five times that of water, largely

due to the presence of proteins and erythrocytes. Loss of water through sweating, vomiting, or diarrhea increases viscosity, which can impair circulation and affect health.

Erythrocytes

Erythrocytes are biconcave disc-shaped cells that facilitate efficient gas exchange. Their structure increases surface area for oxygen and carbon dioxide transport. The average diameter of erythrocytes is 7.5–8.3 μm , with a thickness of about 2.1 μm at the edges.

The normal erythrocyte count is approximately $4.5\text{--}5.0 \times 10^{12}/\text{L}$ in men and slightly lower in women. A decrease in this count is known as erythropenia, while an increase is called erythrocytosis.

The major component of erythrocytes is hemoglobin, a complex protein consisting of globin (the protein part) and heme (the iron-containing part). Hemoglobin levels normally range from 130–160 g/L in men and 120–140 g/L in women. It not only transports gases but also acts as a buffer, helping to maintain the pH of blood.

A deficiency in hemoglobin leads to anemia, while elevated levels may indicate polycythemia.

Osmotic Pressure and Blood Balance

The osmotic pressure of blood averages 7.6–8.1 atm, about 60% of which is due to dissolved sodium chloride. Osmotic balance is essential for the exchange of water and electrolytes between the blood, intracellular, and interstitial fluids.

A 0.9% sodium chloride solution is isotonic to blood and maintains normal cell function.

In hypertonic solutions, erythrocytes lose water and shrink.

In hypotonic solutions, they swell and may rupture (hemolysis).

The kidneys and skin regulate osmotic pressure through urine excretion and perspiration.

Leukocytes

Leukocytes, or white blood cells, play a key role in immune defense. They contain a nucleus and vary in size from 8 to 20 μm . The normal leukocyte count in adults is $4.0\text{--}9.0 \times 10^9/\text{L}$.

An increase in count (leukocytosis) may result from infections, inflammation, or physical stress, whereas a decrease (leukopenia) weakens immune defense and may result from radiation exposure or certain diseases.

Leukocytes are classified into two main groups:

1. Granulocytes – neutrophils, eosinophils, and basophils (named for their staining properties).

2. Agranulocytes – lymphocytes and monocytes, which are crucial for adaptive immunity and phagocytosis.

The leukocyte formula, indicating the percentage of each type, is an important diagnostic tool for identifying infections and immune disorders.

Conclusion

Blood is a complex and vital fluid that maintains oxygen transport, immune protection, osmotic stability, and pH balance. Each corpuscular element—erythrocytes, leukocytes, and thrombocytes—performs essential roles that ensure proper physiological functioning. A clear understanding of blood composition and its disorders provides a foundation for diagnosing and treating a wide range of medical conditions, making it one of the most fundamental topics in human physiology.

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