Baghdad University **Practical Clinical analysis**
College of Sciences for women **Lab-8 / 4st Class**
Biology Department **Dr. Rasha Majid Abd-ulameer**

Hematology

Blood is a bodily fluid in animals that delivers necessary substances such as nutrients and oxygen to the cells and transports metabolic waste products away from those same cells.
Blood accounts for 7 - 8 % of the human body weight, The average adult has a blood volume of roughly 5- 6 liters , which is composed of plasma and several kinds of cells. These blood cells consist of erythrocytes (red blood cells, RBCs), leukocytes (white blood cells), and thrombocytes (platelets). By volume, the red blood cells constitute about 45% of whole blood, the plasma about 54.3%, and white cells about 0.7%.
Blood pH is regulated to stay within the narrow range of 7.3 to 7.4 , making it slightly basic.

Blood include major contents:

1-Cells about 45.7 %

1- **Erythrocytes , red blood cells, RBCs is normally about 45% of whole blood.**

The normal values:

(Male) = 4.7 - 6.1 million RBCs.
(Female) = 4.2 - 5.4 million RBCs.

2- Leukocytes, White blood cells, WBCs is about 0.7 %.

The normal values:

(Male), (female) = 4,000 –11,000

3- Thrombocytes , platelets.

The normal values:

(Male), (female) = 200,000 –500,000.

2- Plasma about 54.3%: (serum, fibrinogen)

3- Other important components include:

- **Serum albumin**
- **Blood-clotting factors (to facilitate coagulation)**
- **Immunoglobulins (antibodies)**
- **lipoprotein particles**
- **Various other proteins**
- **Various electrolytes (mainly sodium and chloride)**

BLOOD TESTS:

Complete Blood Picture (CBP) involve { Hb, PCV,ESR, blood film}

1-Hemoglobin (Hb)

Is the protein contained in red blood cells that are responsible for delivery of oxygen to the tissues.

The amount of hemoglobin in whole blood is expressed in grams per deciliter (g/dl).

The normal Hb level for:

Males are 14 - 18 g/dl.
Females are 12 - 16 g/dl.
Children 10-12 years: 11.5 -14.5 g/dl.
Children 1 year: 11 - 13 g/dl.

When the hemoglobin level is low, the patient has *anemia*.
If the hemoglobin level is more than values, the patient has *Polycythemia*.

Done by these methods:

1- Sahli,s method.
2- Cyanmethemoglobin method.
3- by capillary tube method.

2- Pocket Cells Volume (PCV)

The hematocrit measures the volume of red blood cells compared to the total blood volume (red blood cells and plasma).

The normal values:

Men are 40 – 54 %.
Women are 36 – 48 %.
Children are 37 – 44 %.

Procedure

1- Collect the blood from fingertip (by lancet) in red end capillary tube (tube with heparin).
2- Close one end.
3- Centrifuged at 5000 rpm for 4-5 min.
4- Read the result by PCR Ruler.

3- Erythrocyte sedimentation rate (ESR)

It is commonly called a "sed rate. “It is a test that indirectly measures how much inflammation is in the body.

Normal Results

Adults (Westergren method):

- Men under 50 years old: less than 15 mm/hr.
- Men over 50 years old: less than 20 mm/hr.
- Women under 50 years old: less than 20 mm/hr.
- Women over 50 years old: less than 30 mm/hr.

Children (Westergren method):

- Newborn: 0 to 2 mm/hr.
- Newborn to puberty: 3 to 13 mm/hr.

Note: mm/hr. = millimeters per hour

Procedure

1 - 1.6 ML blood + 0.4 **ESR materials**.
2 - Putting vertical in Westergren pipette for 1 hr.
3 - Read the result.

ESR material: 3.8 % tri sodium citrate solution.

It is useful for detecting and monitoring:

- Autoimmune disorders
- Certain forms of arthritis
- Inflammatory diseases that cause vague symptoms
- Tissue death
- Tuberculosis

An increased ESR rate may be due to:

- Anemia
- Cancers such as lymphoma or multiple myeloma
- Kidney disease
- Pregnancy
- Thyroid disease

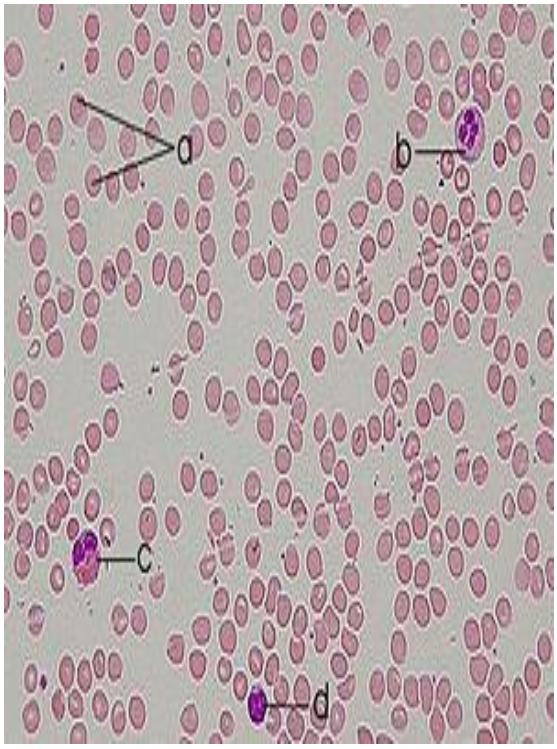

Figure (1): Human Blood smear:
a – Erythrocytes; b – Neutrophil;
c – Eosinophil; d – Lymphocyte

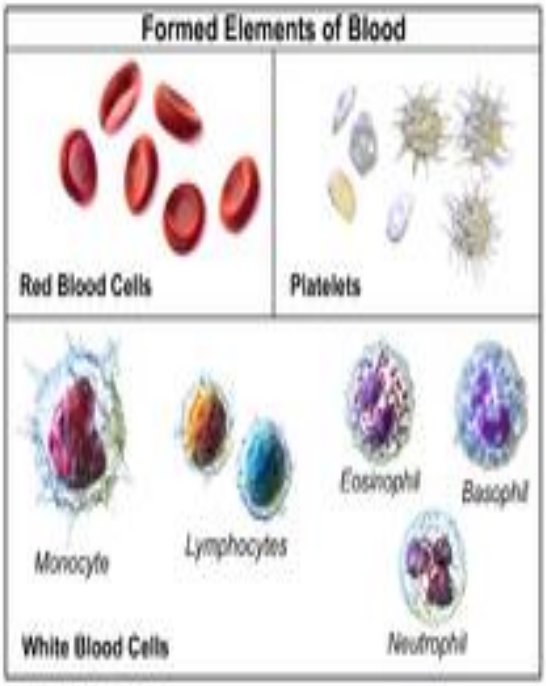

Figure (2): Elements of blood

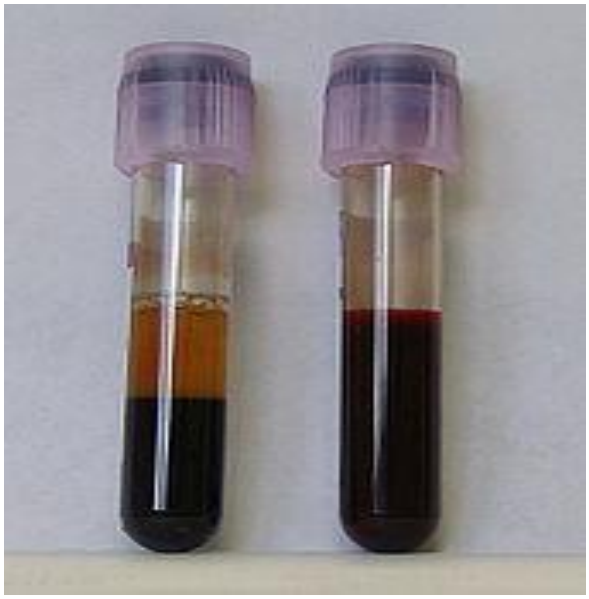

Figure (3): Left tube: after standing, the RBCs have settled at the bottom of the tube. Right tube: contains freshly drawn blood.

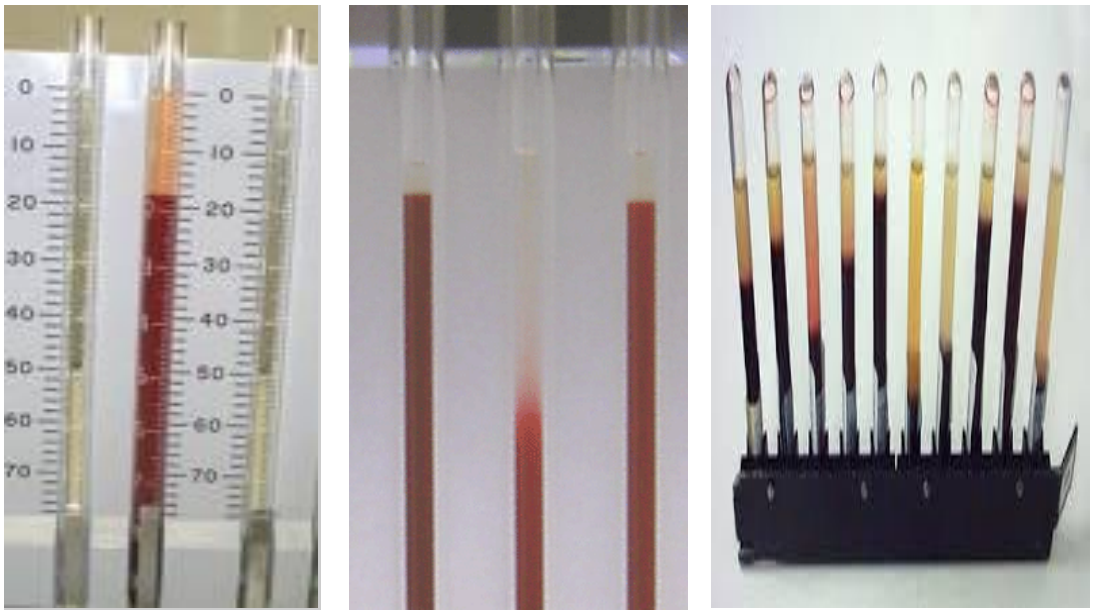

Figure (4): Erythrocyte sedimentation rate (ESR) (Westergren method)