



Physiology I
Lab 3
Second stage



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**Determination of Haematocrit
(Hct)
(Packed Cell Volume; PCV)**

Haematocrit is defined as: The percentage of volume of packed red blood cells in each sample of blood after centrifugation.

The haematocrit may also be referred to as **Packed Cell Volume (PCV)** or **erythrocyte volume fraction (EVF)**.

- **Purpose for doing the Hct:**

Blood is made up of red and white blood cells, platelets, and plasma.

A **decrease** in the number or size of red cells also **decreases** the amount of space they occupy, resulting in a lower hematocrit.

An **increase** in the number or size of red cells **increases** the amount of space they occupy, resulting in a higher hematocrit.

- **Relevance**

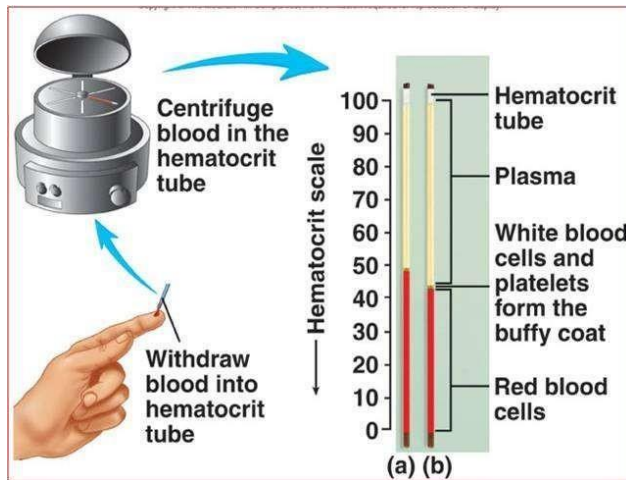
Measurement of hematocrit (Hct) or packed cell volume (PCV) is the most accurate and simplest of all tests in clinical hematology for detecting the presence and degree of anemia or polycythemia.

In comparison, hemoglobin estimation is less accurate, and RBC count far less accurate.

- **Methods:** Microhematocrit -Electronic cell counting

- **Material and instruments:**

1. Microhematocrit tube (capillary tube) which contains heparin (show a red ring at the end of the tube).
2. Microhematocrit centrifuge device.
3. Plastic seal to seal one end of a microhematocrit capillary tube.
4. Microhematocrit reader.



- **Procedure:**

1. Clean your finger with 70% alcohol and let dry.
2. Prick finger with lancet, near the tip but not too close to the nail.
Prick so that blood flows freely. Try squeezing up from your wrist if blood does not flow after pricking finger.
3. Place the tip of a capillary tube onto a drop of blood on your finger.
4. Call your instructor to seal the tube.
5. The instructor will spin the tubes in a centrifuge (5 minutes at 10000 rpm).
- 6-Using a special reading device (since the capillary tube

- **Observations:**

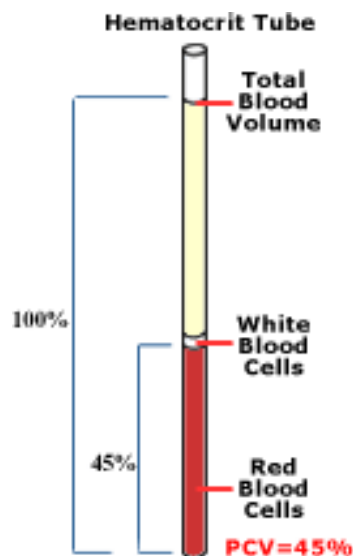
Note that the blood has been separated into 3 layers:

1-A tall **upper layer** of clear **plasma**—amber slightly yellow-coloured.

It should not be pink or red which would indicate haemolysis of red cells in the sample or within the body in haemolytic diseases.

2-A greyish-white, thin layer (about 1 mm thick), called “buffy layer”, consisting of platelets above and white blood cells below it.

3-A tall **bottom layer** of **red cells** which have been closely packed together.



- **Results:**

The percentage of the volume of blood occupied by the red cells constitutes haematocrit or packed cell volume.

$$\text{Hct \%} = \left\{ \frac{\text{Height of RBCs (mm)}}{\text{Height of RBCs and plasma (mm)}} \right\} \times 100$$

For example, if the height of packed red cells is 45 mm,
Then HCT= $45 / 100 \times 100 = 45$ percent.

- **Clinical implications:**

PCV is affected by the shape, & the number of the RBCs & the plasma volume.

- A High PCV indicates either increase in number of circulating RBCs or

decrease in plasma volume seen in cholera due to loss of water in the stool.

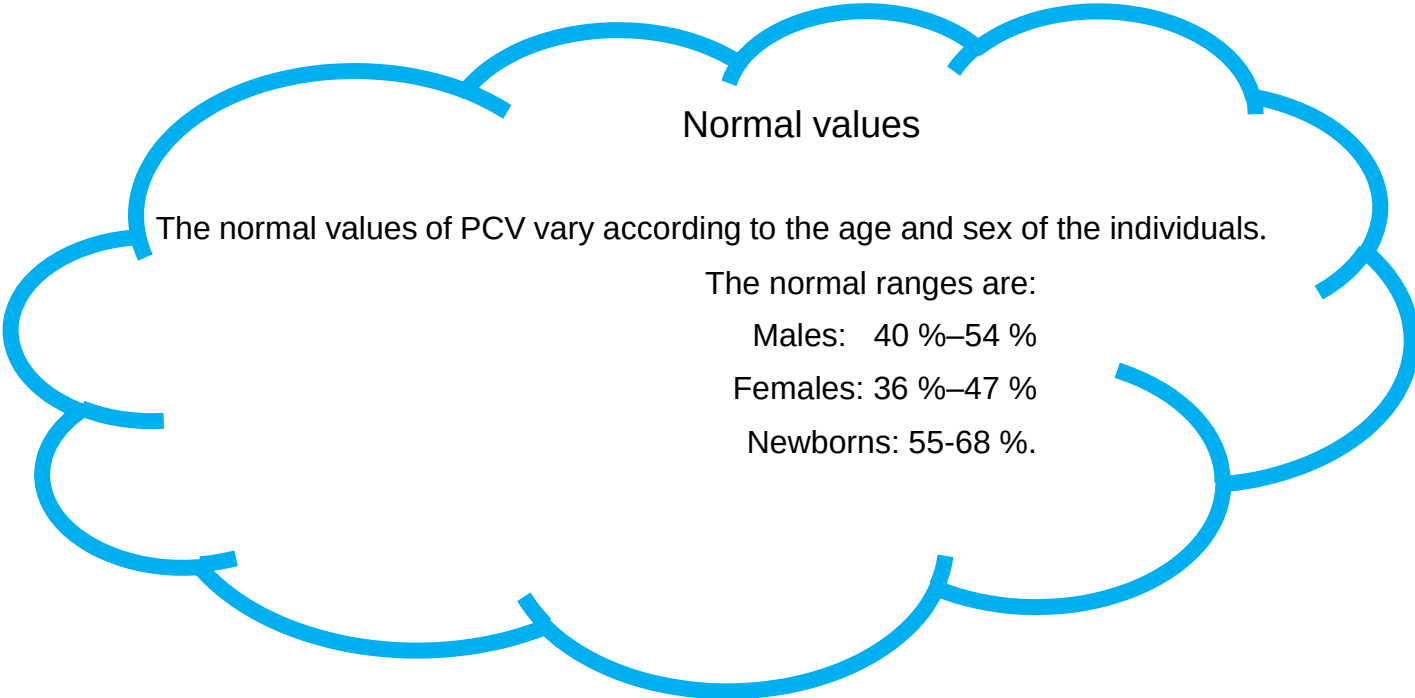
- A low PCV indicates either decrease in RBC or increase in plasma volume

A lower-than-normal hematocrit may indicate:

- An insufficient supply of healthy red blood cells (**anemia**)
- A large number of white blood cells due to **long-term illness, infection, leukemia, lymphoma** or other disorders of white blood cells.
 - **Acute kidney disease** (lower Erythropoietin production lead to less RBCs production by the bone marrow).
- **Pregnancy** may lead to women having additional fluid in blood. This could potentially lead to a small drop in haematocrit levels.

A higher-than-normal hematocrit may indicate:

- Abnormal increase in red blood cells (**erythrocytosis**)
- A disorder, such as **polycythemia vera** that causes your body to produce too many red blood cells (in polycythemia it may rise to as high as 70 %).
 - At **higher altitudes**, there is a lower oxygen supply in the air and thus hematocrit levels may increase over time.
- Low blood oxygen levels (**hypoxia**)
- **Lung or heart disease** — if the body senses low oxygen levels, it will make more red blood cells in an effort to increase the amount of oxygen in the blood.
- **Dehydration.**
- **Burn** (due to loss of plasma)



Normal values

The normal values of PCV vary according to the age and sex of the individuals.

The normal ranges are:

Males: 40 %–54 %

Females: 36 %–47 %

Newborns: 55-68 %.