

Packed cell volume (PCV) or hematocrit (HCT) value

The PCV or Hct is the volume of RBCs per unit volume of the whole blood. When blood, mixed with anticoagulant, is centrifuged for a certain time and at a certain speed, the blood in the tube will separate into three layers (as in figure); a bottom layer mainly composed of RBCs, middle very thin layer of white blood cells and platelets, and top layer mainly of plasma. The volume of the packed RBCs expressed as a percentage of the whole column of blood is the PCV. The number of RBCs, and the plasma volume affect the PCV. Clinically, it is used to detect anemia, polycythemia, hemoconcentration, and hemodilution.

Introduction and principle:

Anticoagulated whole blood is centrifuged for maximum red blood cell packing. The space occupied by the red blood cells is measured and expressed as a percentage of the whole blood volume. So **PCV** is the volume of RBCs per unit volume of whole blood.

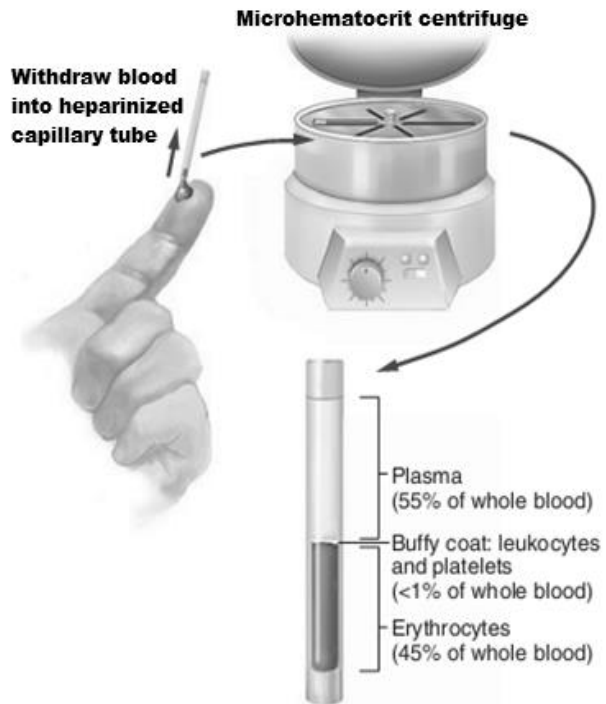
Normal range in the adult male 40-54%.

Normal range in the adult female 36-47%.

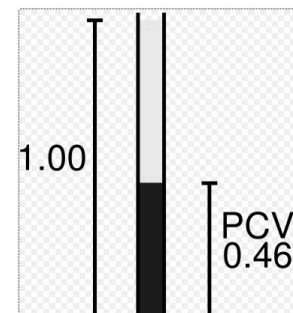
Hb concentration:

- i. Newborns : 18–22 g/dl
- ii. At 3 months : 14–16 g/dl
- iii. 3 months–1 yr : 13–15 g/dl
- iv. Adult males : 14.5 g/dl (13.5–17 g/dl)
- v. Adult females : 12.5 g/dl (11.5–15.5 g/dl).

Notes: A raised hematocrit reflects hemoconcentration. True increased red cell mass can be assumed when the haematocrit is over 60% in males and 56% in females. Individuals with a high haematocrit may be associated with an increase in thrombotic events and cardiovascular mortality.



Hematocrit (Hct) or Packed Cell Volume (PCV):



Methods: [1] Microhaematocrit method. [2] Electronic cell counting method.

Microhaematocrit method:

Material and instruments:

Microhaematocrit tube (capillary tube) 75 mm in length and 1 mm in diameter which contains heparin and shows a red ring at the end of the tube.

1. Microhaematocrit centrifuge device.
2. Plastic seal to seal one end of microhaematocrit capillary tube.
3. Microhaematocrit reader.

Procedure:

1. Blood is drawn into the tube by capillary phenomenon. By holding the tube in a horizontal manner and allow 2/3 to 3/4 to be filled with blood. Air bubbles denote poor technique but do not affect the results of the test.
2. Seal the dry end of the tube by plastic seal.
3. The sealed tube is then placed in the radial grooves of the microhaematocrit centrifuge where the sealed end to the outside and centrifuge for 5 minutes.
4. When looking at a centrifuged haematocrit tube, you can see three distinct layers. A top layer of clear slightly milky plasma, a thin buffy coat layer (consisting of WBC and platelets), and a dark packed RBCs layer
5. Obtain the result using the **Microhaematocrit tube Reading Device (Ruler)** by adjusting the movable line of the ruler to touch the top of the RBCs in the tube to find the percentage of packed cells to the whole column of the sample.

Medical applications

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

- **PCV increases** either relatively due to **reduced plasma volume** as in dehydration as in alcohol, diuretic therapy, burn, or watery diarrhea in cholera, or absolutely due to **increased red blood cells mass** either primarily as in polycythemia, or secondarily due to chronic lung disease, smoking, high altitude, or some tumours.
- **PCV decreases** either due to **increased plasma volume** as in over hydration or **decreased red blood cells mass** as in anemia, pregnancy, acute kidney & liver disease.....etc.

