

## What is anemia?

Anemia is a medical term that describes low amounts of red blood cells or hemoglobin in the body.

## What is a red blood cell?

Blood contains 3 types of cells: red blood cells (RBC), white blood cells (WBC), and platelets. Red blood cells are the most common type of blood cell, and are responsible for delivering oxygen to all parts of the body.

Red blood cells, like white cells and platelets, are continuously made in the bone marrow. When released into the bloodstream, the average lifespan of a red cell is 120 days.

Young red cells are called '*reticulocytes*'. When there is a normal amount of red cells in the blood, only about 1% of them are reticulocytes.

## What is hemoglobin?

The majority of the red blood cell is made up of hemoglobin. Hemoglobin is made up of 4 protein chains called '*globin*' chains, and each globin chain carries iron. In the lungs, oxygen binds to the iron in the red blood cell. The red cell then travels through the bloodstream to the rest of the body and delivers the oxygen to provide energy.

There are different types of hemoglobin. They are named after Greek letters: alpha, beta, delta, and gamma are the most common. In normal individuals, the following pattern occurs:

- At birth, the majority (~70%) of hemoglobin is HbF, or fetal hemoglobin, and is made up of 2 alpha chains and 2 gamma chains ( $\alpha_2\gamma_2$ ).
- Between birth to 6 months old, there is increasing production of beta chains by the bone marrow.
- By 1 year old, the vast majority (>97%) of hemoglobin is HbA, which is made up of 2 alpha chains and 2 beta chains ( $\alpha_2\beta_2$ ). About 2% is HbA2 (which is 2 alpha chains and 2 delta chains,  $\alpha_2\delta_2$ ), and there are minor amounts of HbF.

## What are the signs and symptoms of anemia?

This depends on how fast the anemia occurred, how severe (low) it is, and its cause.

If the anemia develops slowly over months to years, symptoms can be hard to recognize, but may include:

- Looking pale
- Fatigue or weakness
- Difficulty exercising or keeping up with peers
- Poor concentration
- Headaches
- Behavioral or school difficulties

If the anemia develops more rapidly, over days to weeks, then symptoms are usually more pronounced, and may include:

- Difficulty breathing, especially during activity or exercise
- Looking pale or blue
- Lethargy or extreme tiredness
- Palpitations or chest pain

Depending on the cause of the anemia, other signs may be present.

## What causes anemia?

There are many different causes of anemia. In children, the most common cause of anemia is iron deficiency anemia due to low amounts of iron in the child's diet.

Other causes are described below:

- Defect in the production of the protein (globin) chain, called *thalassemia*
- Chronic illness, like kidney disease or hormone imbalance
- Lead poisoning
- Nutritional deficiency, such as vitamin B12, folic acid, or copper
- Blood loss (in women, blood loss from menstruation can lead to anemia)
- Failure or disease of the bone marrow
- Destruction of the red blood cells, called '*hemolysis*'
- As a side effect of certain medications

## How is anemia diagnosed?

Anemia is diagnosed on blood test called a '*complete blood count*' or CBC. The CBC will report low hemoglobin and low RBC count.

Normal hemoglobin levels vary by age and gender.

The other important parameters to look at on the CBC are the size and color of the red blood cells, the concentration of red blood cells, and what the cells look like under the microscope.

It is also important to ensure that the other cells in the blood, namely the white blood cells and platelets, are normal.

Depending on the medical evaluation and CBC, special tests may be needed.

## What is the outlook for children with anemia?

This depends on the cause. Iron deficiency anemia that is due to low iron in the diet usually improves within a few months of starting treatment.

If the anemia is due to a different cause, it may last years or even be lifelong.

## How is anemia treated?

This depends on the cause. Iron deficiency anemia due to low iron intake is treated with dietary changes and oral iron supplements.

Anemia due to more serious diseases may be treated with:

- Medication
- Blood transfusion
- Surgery, such as removal of the spleen
- Bone marrow transplant

## How can I help?

It is vital to ensure that your child is living a healthy lifestyle. This includes providing them with a well-balanced diet and ensuring that they engage in regular daily physical activity.

It is important for you to understand your child's condition, so please ask your healthcare provider for any information that may help you and your child.

## When to seek help

- Your child is pale, has low energy, or difficulty breathing.
- There is blood in the urine or stool, or prolonged bleeding of any kind.
- Your child has persistent headaches, difficulty concentrating, or is having difficulty at school
- Your child looks yellow in the eyes or skin