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A review on anaemia- types, causes, symptoms and their treatments

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Abstract

Anaemia is defined as a decrease in the red blood cell mass. Accurate measurements require labeling of erythrocytes followed by in vivo quantification of the dilution of the labeled cells in the circulation. Obviously, this is an impractical method for the detection of anemia, and measurements of the hemoglobin concentration, the hematocrit, or red blood cell count are used. Each of these latter methods is complicated by the fact that they represent concentrations that can be altered by variations in the plasma volume without changes in the red blood cell mass. Usually this is usually not important in the clinical setting for the detection of anemia, but it should be considered by the physician. The World Health Organization has decided that anemia exists in adults whose hemoglobin values are lower than 13 g/dl in males and 12 g/dl in females. Children age 6 months to 6 years are considered anemic at hemoglobin levels below 11 g/dl; and between 6 and 14 years, below 12 g/dl. The disadvantage of these arbitrary criteria is that they include some normal individuals who fall below the

defined value. In the United States, slightly higher values are usually cited, and males with a hemoglobin below 13.5 g/dl and females with a hemoglobin below 12.5 g/dl probably should be considered anemic. Higher values are anticipated in individuals living at altitudes significantly above sea level. In conditions in which there is an increase in the plasma volume, such as the last trimester of pregnancy, lower hemoglobin values will be encountered even though the red cell mass is normal.

Keywords: Anaemia, causes, types, nutritional requirements, risk factors, diagnosis, treatment.

Introduction

Anaemia is a condition in which the number of red blood cells or the haemoglobin concentration within them is lower than normal. Haemoglobin is needed to carry oxygen and if you have too few or abnormal red blood cells, or not enough haemoglobin, there will be a decreased capacity of the blood to carry oxygen to the body's tissues.¹ This results in symptoms such as fatigue, weakness, dizziness and shortness of breath,

among others. The optimal haemoglobin concentration needed to meet physiologic needs varies by age, sex, elevation of residence, smoking habits and pregnancy status. The most common causes of anaemia include nutritional deficiencies, particularly iron deficiency, though deficiencies in folate, vitamins B12 and A are also important causes; haemoglobinopathies; and infectious diseases, such as malaria, tuberculosis, HIV and parasitic infections.²

Anaemia is a serious global public health problem that particularly affects young children and pregnant women. WHO estimates that 42% of children less than 5 years of age and 40% of pregnant women worldwide are anaemic.³



Symptoms

Anaemia can cause a range of symptoms including fatigue, weakness, dizziness and drowsiness. Children and pregnant women are especially vulnerable, with an increased risk of maternal and child mortality.⁴ The prevalence of anaemia remains high globally, particularly in low-income settings, where a significant proportion of young children and women of childbearing age can be assumed to be anaemic. Iron deficiency anaemia has also been shown to affect cognitive and physical development in children and reduce productivity in adults.⁵

Anaemia is an indicator of both poor nutrition and poor health. It is problematic on its own, but it can also impact other global nutritional concerns such as stunting and wasting, low birth weight and childhood overweight and obesity due to lack of energy to exercise. School performance in children and reduced work productivity in adults due to anaemia can have further social and economic impacts for the individual and family.

People with mild anemia may experience few or no symptoms.

Some forms of anemia cause specific telltale symptoms, including:

- Aplastic anemia: This can cause a fever, frequent infections, and skin rashes.
- Folic acid deficiency anemia: This can cause irritability, diarrhea, and a smooth tongue.
- Hemolytic anemia: This can cause jaundice, dark urine, a fever, and abdominal pain.
- Sickle cell anemia: This can cause painful swelling in the feet and hands, as well as fatigue and jaundice.

Causes and Types

The body needs RBCs to survive. They transport hemoglobin, a complex protein that attaches to iron molecules. These molecules carry oxygen from the lungs to the rest of the body.⁶

Various health conditions can result in low levels of RBCs.

There are many types of anemia and no single cause. In some people, it can be difficult to identify what is causing a low RBC count.⁷

The three main causes of anemia are:⁸

Blood loss

Iron-deficiency anemia is the most common type of anemia, and blood loss is often the cause. A shortage of iron in the blood leads to this form of the condition, and low iron levels frequently occur as a result of blood loss.

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When the body loses blood, it draws water from tissues beyond the bloodstream to help keep the blood vessels full. This additional water dilutes the blood, reducing the RBC count.

Blood loss can be acute and rapid or chronic. Some causes of rapid blood loss include surgery, childbirth, and trauma.

Chronic blood loss is more often responsible for anemia. It can result from a stomach ulcer, cancer, or another type of tumor.

Other causes of anemia due to blood loss include:

- gastrointestinal conditions, such as ulcers, hemorrhoids, cancer, or gastritis
- the use of nonsteroidal anti-inflammatory drugs, such as aspirin and ibuprofen
- heavy menstrual bleeding

Decreased or impaired RBCs

Bone marrow is soft, spongy tissue at the center of bones, and it plays an essential role in creating RBCs. The marrow produces stem cells, which develop into RBCs, white blood cells, and platelets.

A number of diseases can affect bone marrow, including leukemia. This is a type of cancer that triggers the production of excessive and abnormal white blood cells, disrupting the production of RBCs.

Problems with bone marrow can cause anemia. Aplastic anemia, for example, occurs when few or no stem cells are present in the marrow.

In some cases, anemia results when RBCs do not grow and mature as usual, as with thalassemia — a hereditary form of anemia.

Other types of anemia that occur due to decreased or impaired RBCs include:

Sickle cell anemia

This causes RBCs to be shaped like crescents. They may break down more quickly than healthy RBCs or become lodged in small blood vessels.

This blockage can reduce oxygen levels and cause pain further down in the bloodstream.

Iron-deficiency anemia

This involves the body producing too few RBCs due to a lack of iron in the body.

Iron-deficiency anemia may develop as a result of:

- a diet low in iron
- menstruation
- frequent blood donation
- endurance training
- certain digestive conditions, such as Crohn's disease
- medications that irritate the gut lining, such as ibuprofen

Vitamin-deficiency anemia

Vitamin B-12 and folate are both essential for the production of RBCs. If a person does not consume enough of either vitamin, their RBC count may be low. Some examples of vitamin-deficiency anemia include megaloblastic anemia and pernicious anemia.

Destruction of RBCs

These cells typically have a life span of 120 days in the bloodstream, but the body may destroy or remove them before they complete their natural life cycle.

One type of anemia that results from the destruction of RBCs is autoimmune hemolytic anemia. It occurs when the immune system mistakes RBCs for a foreign substance and attacks them.

Many factors can cause an excessive breakdown of RBCs, including:

- infections
- certain drugs, including some antibiotics
- severe hypertension
- vascular grafts and prosthetic heart valves

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- toxins produced by advanced kidney or liver disease
- an autoimmune attack, due to hemolytic disease, for example
- snake or spider venom

Daily Nutritional Requirements and Anemia

Daily requirements for vitamins and iron vary according to sex and age.⁹

Women need more iron and folate than men because of iron losses during their menstrual cycle and fetal development during pregnancy and breastfeeding.

Iron

According to the National Institutes of Health, the recommended daily iron intake for adult's ages 19 to 50 are as follows:

For men	8 mg
For women	18 mg
During pregnancy	27 mg
While breastfeeding	9 mg

Men and women over age 50 require only 8 milligrams (mg) of iron daily. A supplement may be needed if adequate iron levels can't be acquired through diet alone. Good sources of dietary iron include:

- chicken and beef liver
- dark turkey meat
- red meats, such as beef
- seafood
- fortified cereals
- oatmeal
- lentils
- beans
- spinach

Folate

Folate is the form of folic acid that occurs naturally in the body.

Males and females over the age of 14 require 400 micrograms of dietary folate equivalents (mcg/DFE) per day.

For women who are pregnant or breastfeeding, the recommended intake increases to 600 mcg/DFE and 500 mcg/DFE per day, respectively.

Examples of foods rich in folate are:

- beef liver
- lentils
- spinach
- great northern beans
- asparagus
- eggs

You can also add folic acid to your diet with fortified cereals and breads.

Vitamin B-12

The daily adult recommendation for vitamin B-12 is 2.4 mcg. Women and teens who are pregnant need 2.6 mcg per day, and those who are breastfeeding require 2.8 mcg daily.

Beef liver and clams are two of the best sources of vitamin B-12. Other good sources include:

- fish
- meat
- poultry
- eggs
- other dairy products

Vitamin B-12 is also available as a supplement for those who don't get enough from their diet alone.

Risk Factors

Anemia can occur in people of all ages, sexes, and ethnicities.¹⁰

The following factors increase the risk of developing a form of the condition:



- having been born prematurely
- being between 6 months and 2 years old



- menstruating
- being pregnant and giving birth
- having a diet low in vitamins, minerals, and iron
- regularly taking medications that inflame the stomach lining, such as ibuprofen
- having a family history of inherited anemia, such as sickle cell anemia or thalassemia
- having an intestinal disorder that affects the absorption of nutrients, such as Crohn's disease
- losing blood, due to surgery or trauma, for example
- having a chronic illness, such as AIDS, diabetes, kidney disease, cancer, rheumatoid arthritis, heart failure, or liver disease.

Diagnosis

A diagnosis of anemia begins with both your health history and your family health history, along with a physical exam.

A family history of certain types of anemia such as sickle cell anemia can be helpful. A history of exposure to toxic agents in the home or workplace might point to an environmental cause.¹¹

There are various ways to diagnose anemia, but the most common way involves a blood test called a complete blood count (CBC).¹²

This measures a number of components, including:

- hematocrit levels, which involves comparing the volume of RBCs with the total volume of blood
- hemoglobin levels
- an RBC count

A CBC can give an indication of overall health. It can also help the doctor decide whether to check for underlying conditions, such as leukemia or kidney disease.

If RBC, hemoglobin, and hematocrit levels fall below the normal range, a person is likely to have some form of anemia.

However, it is possible for a healthy person's levels to fall outside this range — a CBC is not conclusive, but it is a helpful starting point.

Additional tests

Based on the results of these tests, doctors may order additional tests such as:¹³

- an upper GI
- a barium enema
- chest X-rays
- a CT scan of your abdomen

Treatment

There is a range of treatments for anemia. Each aims to increase the number of RBCs, which, in turn, increases the amount of oxygen in the blood.¹⁴

Below, we outline treatments for several types of anemia:

- Iron-deficiency anemia: Iron supplements and dietary changes can help, and, when relevant, a doctor will identify and address the cause of excessive bleeding.
- Vitamin deficiency anemia: Treatments can include dietary supplements and vitamin B-12 shots.
- Thalassemia: Treatments include folic acid supplements, iron chelation, and, for some people, blood transfusions and bone marrow transplants.
- Anemia due to chronic disease: The doctor will focus on resolving the underlying condition.
- Aplastic anemia: Treatment involves blood transfusions or bone marrow transplants.
- Sickle cell anemia: Treatment typically involves oxygen therapy, pain relief medication, and intravenous fluids, but it can also include antibiotics, folic acid supplements, blood transfusions, and a cancer drug called hydroxyurea.
- Hemolytic anemia: The treatment plan may include immunosuppressant drugs, treatments for infections, and plasmapheresis, which filters the blood.

While iron deficiency anaemia is the most common form and is relatively easy to treat through dietary changes, other forms of anaemia require health interventions that may be less accessible. Accurate characterisation of anaemia is critical to understand the burden and epidemiology of this problem, for planning public health interventions, and for clinical care of people across the life course. WHO oversees several programmes across all WHO Regions to help reduce the prevalence of anaemia through treatment and prevention. These guidelines, policies and interventions aim to increase dietary diversity, improve infant feeding practices and improve the bioavailability and intake of micronutrients through fortification or supplementation with iron, folic acid and other vitamins and mineral.¹⁵ Social and behaviour change communication strategies are used to change nutrition-related behaviours. Interventions to address the underlying and basic causes of anaemia look at issues such as disease control, water, sanitation and hygiene, reproductive health and root causes such as poverty, lack of education and gender norms.

In 2016, WHO started a five-year project to review its global guidelines for haemoglobin cut-offs used to define anaemia with the aim to provide evidence-informed recommendations on assessing anaemia in individuals and populations.¹⁶

Conclusion

Anemia occurs when a low number of RBCs are circulating in the body. This reduces the person's oxygen levels and can lead to symptoms such as fatigue, pale skin, chest pain, and breathlessness.

There are over 400 types of anemia. Common causes are blood loss, reduced or impaired RBC production, and the destruction of RBCs.

The most common type is iron-deficiency anemia. It sometimes develops due to a diet lacking in nutrients, Crohn's disease, or the use of certain medications.

A doctor can use a CBC blood test to help detect anemia. Treatment varies, depending on the type, but it may include iron or vitamin supplements, medications, blood transfusions, and bone marrow transplants.

However, for some people with anemia, dietary changes can resolve the issue.

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