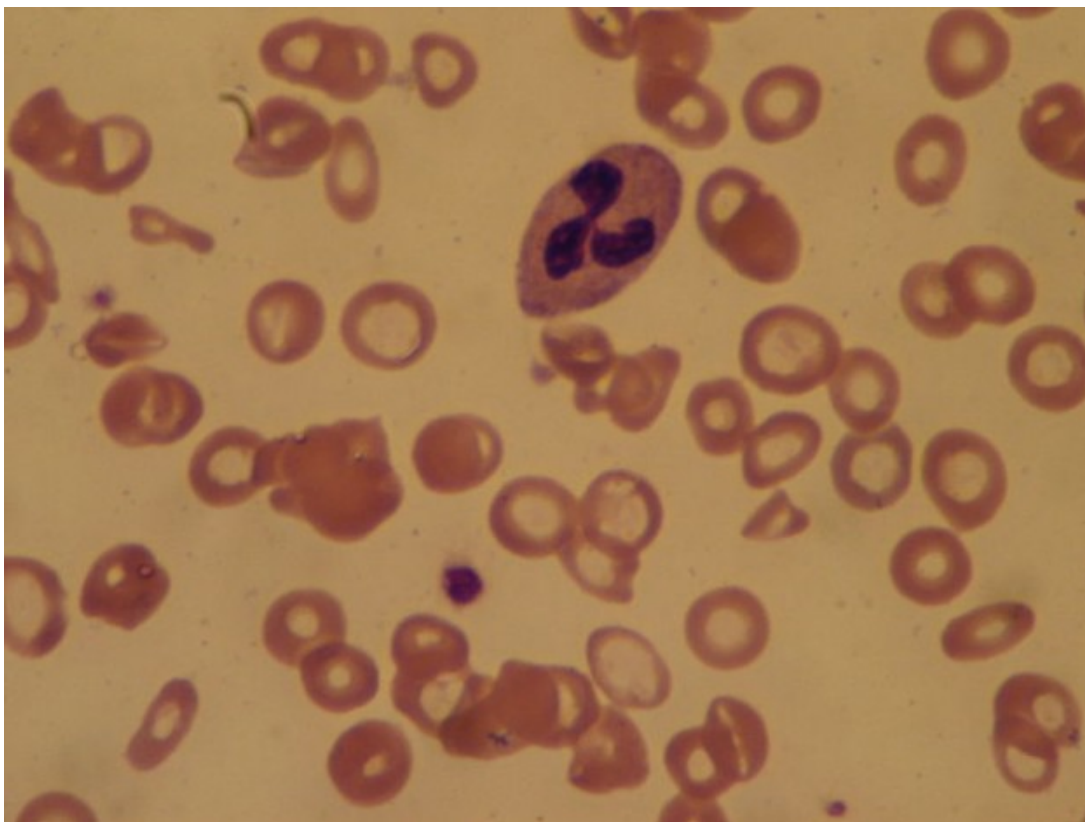


Microcytic Anemia: Iron Deficiency Anemia (Ferropenic)

[See online here](#)

In practice, anemia often appears in the blood count, accompanying many acute and chronic diseases. Clarification is definitely recommended because already a lowered hemoglobin value alone can be the 1st important hint for an undetected underlying disease.



Definition of Iron Deficiency Anemia

Iron deficiency is the most common cause of **anemia** worldwide. Iron deficiency anemia, like the name of the disease, is anemia caused by substantially decreased iron reservoirs.

You can read more on hemolytic anemia [here](#).

Distribution of iron in the body, normal iron studies (labs), and iron regulation

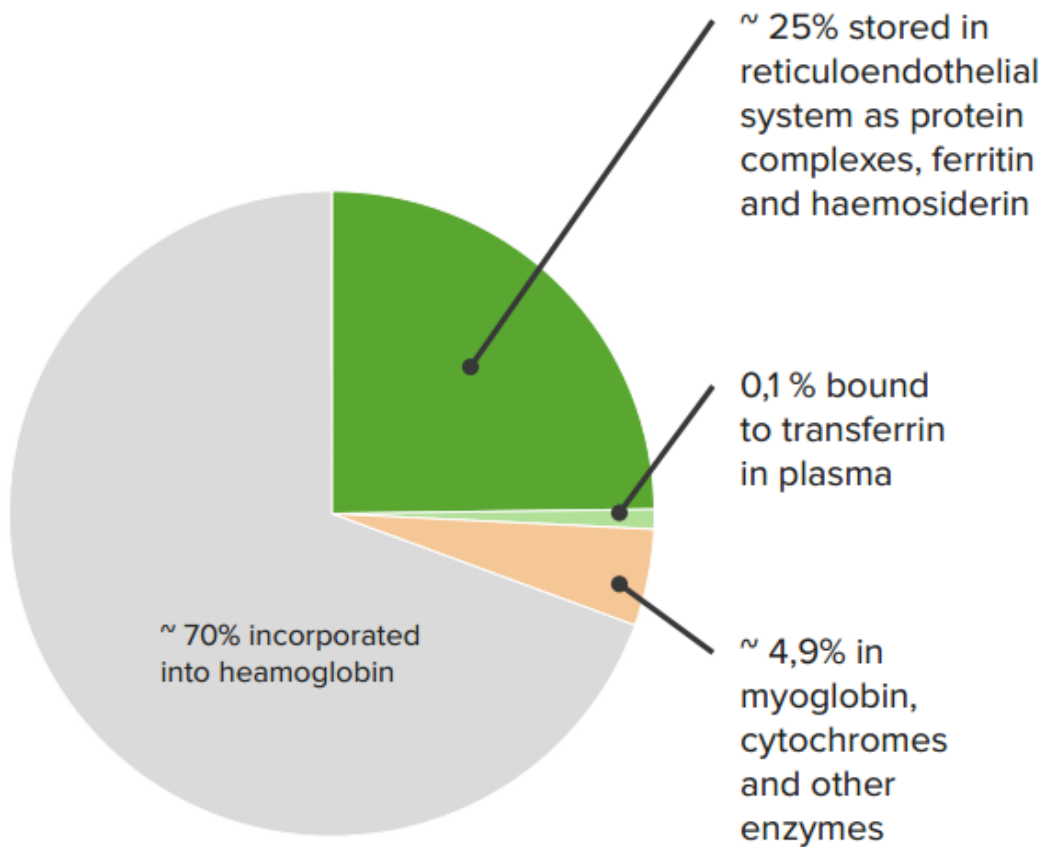


Image: Distribution of iron in the body. By Lecturio

There are 4-5 g of iron in the body. There is no mechanism for regulating the excretion of iron. Iron can be toxic in excess and so the absorption of iron is controlled.

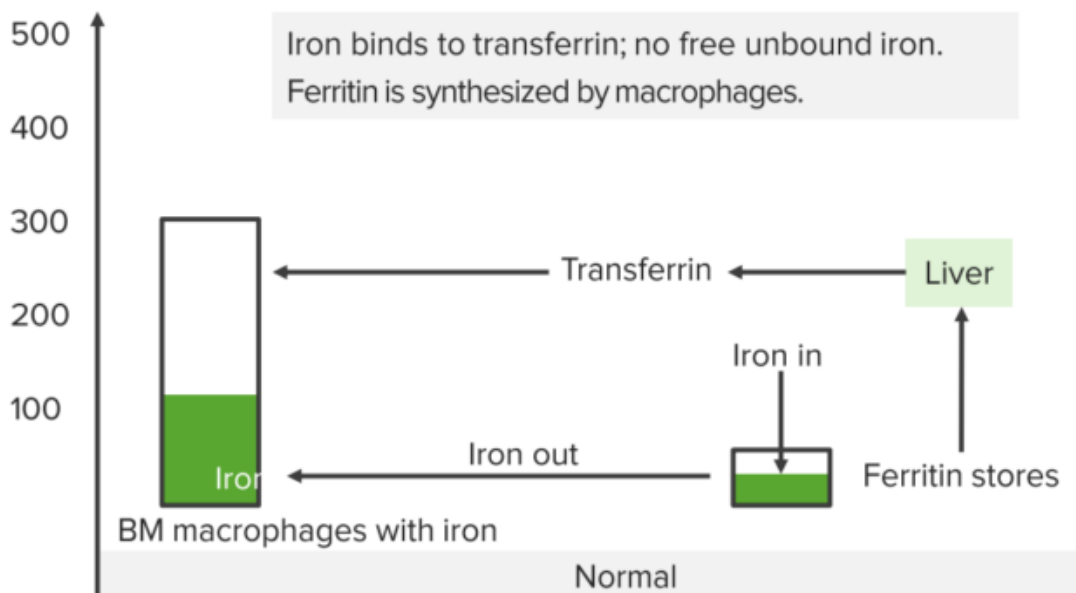


Image: Normal iron studies (labs). By Lecturio

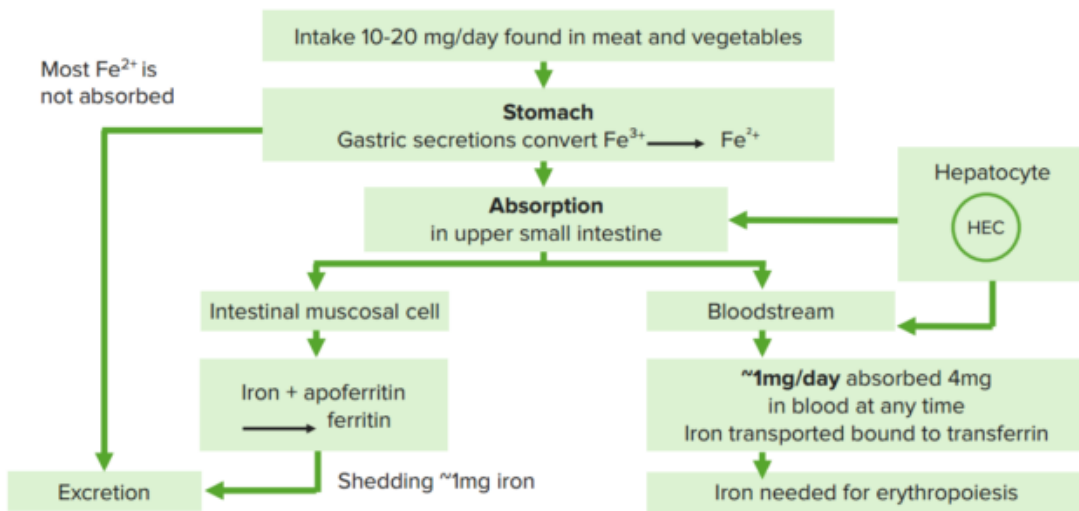


Image: Iron regulation. By Lecturio

Heme biosynthesis within the immature red cell

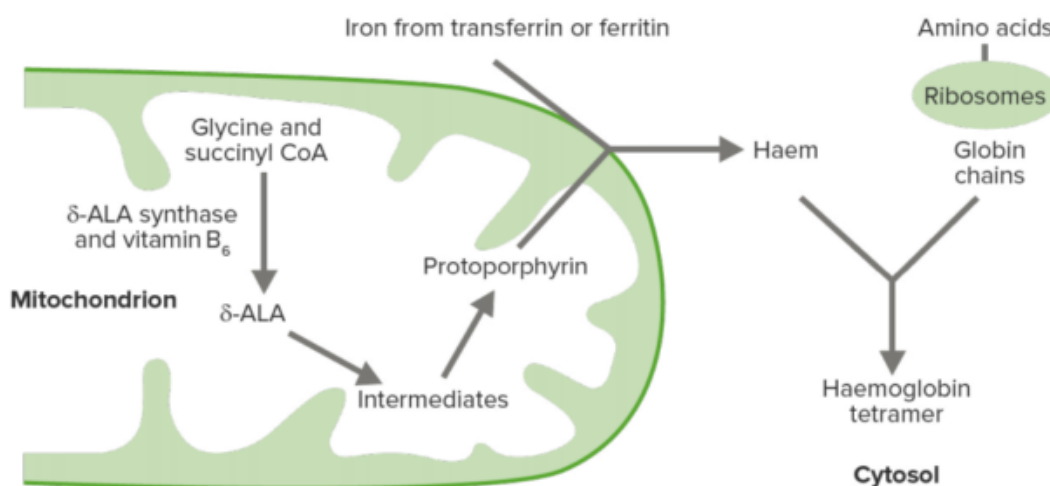


Image: Heme biosynthesis within the immature red cell. Glycine and succinyl coenzyme A (CoA) combine to form δ-aminolevulinic acid (δ-ALA), a reaction controlled by δ-ALA synthase and the coenzyme vitamin B₆. δ-ALA is converted to protoporphyrin, which combines with ferrous iron to form heme. The heme molecule combines with a globin chain. Hemoglobin is formed by a tetramer of these heme-globin complexes. By Lecturio

Etiology and Epidemiology of the Iron Deficiency Anemia

The production of erythrocytes and hemoglobin is largely dependent on the availability of **erythropoietin** (epo) and **iron**.

The most frequent reasons for critically lowered iron values are chronic bleeding – either through increased menstrual bleeding (**hypermenorrhoea**) or pathological bleeding caused by a **gastric ulcer**, pregnancy without sufficient substitution of iron, or a parasitic infestation (**parasitic disease**).

Possible rare causes for an iron deficiency anemia are **disruption of the resorption** or **malnutrition**.

With the dissemination of 35%, the iron-deficiency anemia represents the most common cause of anemia. Roughly 5-10% of menstruating women suffer from iron deficiency anemia. Comparatively, men are rarely affected by anemia.

Note: Chronic blood loss, depleting iron stores (gastrointestinal (GI) bleeding — ulcer, diverticulosis, colon cancer; gynecological (GYN) bleeding — menorrhagia)!

Symptoms of Iron Deficiency Anemia

An iron deficiency anemia has the same symptoms than any other anemia:



[Image:](#) Angular cheilitis as marked by the oval.
By James Heilman, MD, [License:](#) CC BY-SA 3.0

- [Tachycardia](#)
- Fatigue
- Weakness
- Lack of concentration
- Diminished strength

Further clinical symptoms are dry skin, possible headache, and hair loss.

Nail dystrophy, glossitis (Hunter-Glossitis), and **atrophies** in the area of the mouth (**angular cheilitis**), throat and the esophagus, are typical symptoms for the **Plummer-Vinson syndrome**. A particular symptom is pronounced sensitivity to cold.

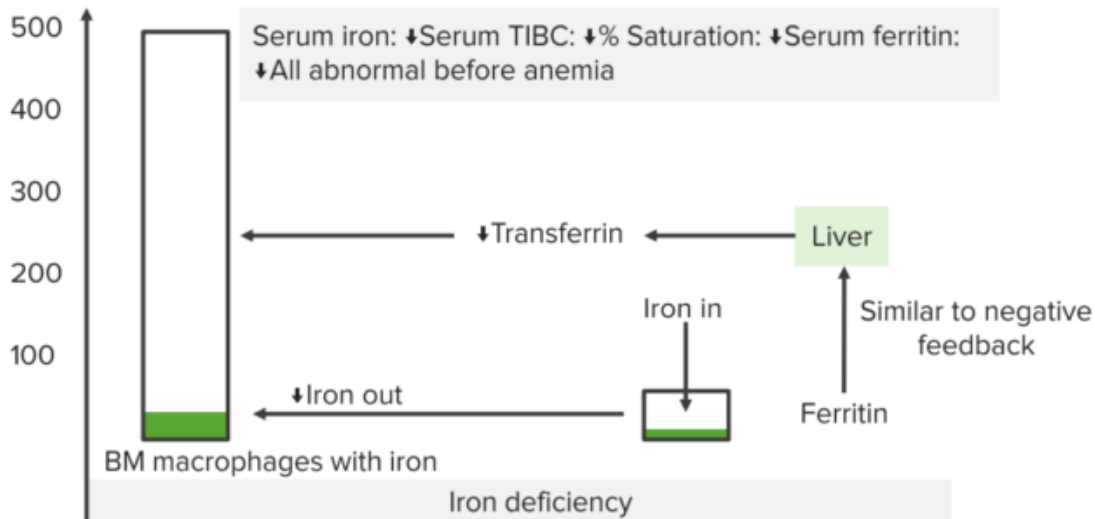


Image: Iron studies (labs) in iron deficiency anemia. By Lecturio

Diagnosics and Differential Diagnosis of Iron Deficiency Anemia

A complete blood count (CBC) is important for adequately diagnosing iron deficiency anemia. Normally, a **hypochromasia** is displayed in the laboratory diagnostics in combination with a **microcytosis** and a **reduced value of serum ferritin** (< 15 µg/L). The **hematocrit** is lowered.

Depending on the severity of the anemia, the **number of erythrocytes** can also be reduced. For further clarification, it is necessary to measure the reactive increased value of transferrin, as well as the concentration of hemoglobin of the **reticulocytes** (lowered, < 28 pg).

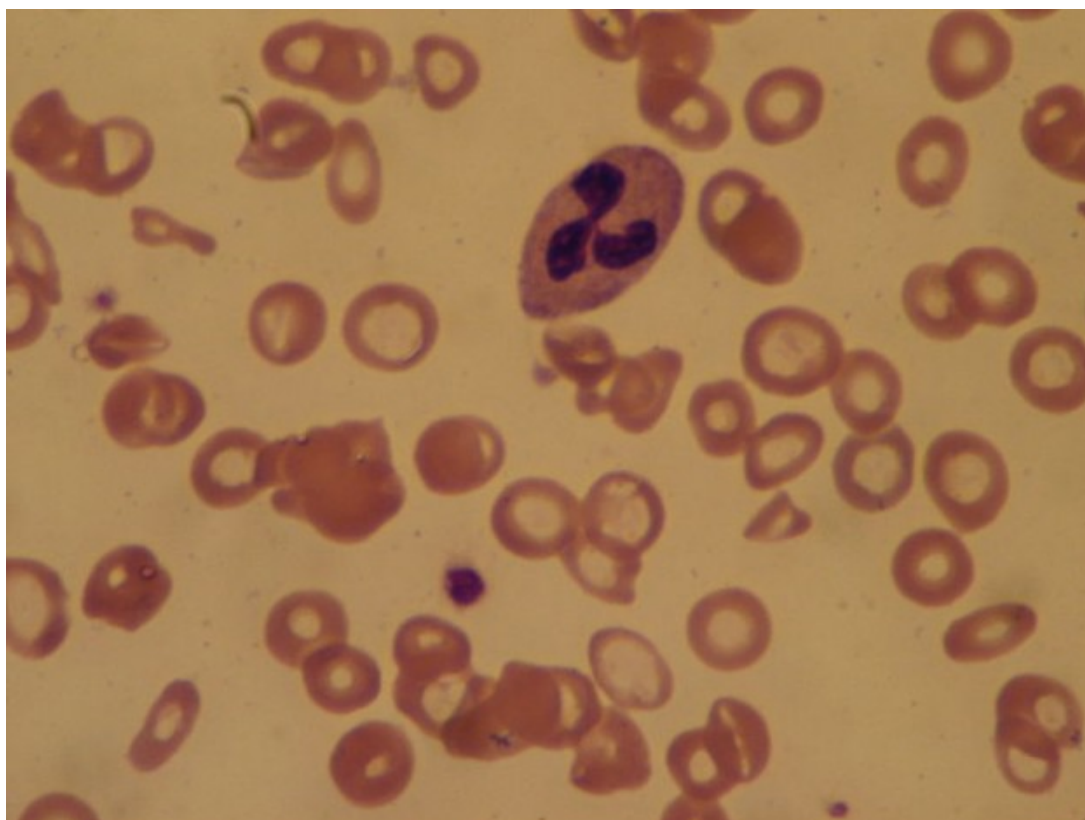


Image: Blood smear of a patient with iron deficiency anemia at 40x enhancement. By Roberto J. Galindo, [License:](#) CC BY-SA 3.0

The diagnosis of iron-deficiency anemia is not always easy. For instance, a **folate deficiency** occurring simultaneously can compensate the microcytosis and, therefore, falsify an important laboratory parameter for iron deficiency anemia.

It is important to consider that because of counterproductive diagnosis, a possible disease may not be diagnosed, leading to the anemia and the actual cause being overlooked. Officially, not applying the required therapy only counts as malpractice, but for the patient, this can have serious consequences in reality.

In case the result is uncertain, it is important to consider **thalassemia**.

Note: Laboratory values are decreased hemoglobin (Hgb), hematocrit (Hct), red blood cell (RBC) count; decreased mean corpuscular volume (MCV), mean cell hemoglobin concentration (MCHC); increased red cell distribution width (RDW); decreased ferritin, serum iron, and transferrin saturation; increased total iron-binding capacity (TIBC)!

Therapy of Iron Deficiency Anemia

If the suspected iron deficiency anemia is confirmed and the diagnosis for a different underlying disease (like, for instance, a **duodenal ulcer** or a **colon carcinoma**) turns out to be negative, the primary therapeutic target corrects the negative iron balance through the substitution of iron.

The following rules should be kept in mind:

1. If possible, iron should be **applied orally**. Only in case of a strong incompatibility and special indication, parenteral iron should be substituted.
2. The recommended **daily dose** is **between 50-150 mg**. Resorption is highest on an empty stomach. In case this is not tolerated by the patient, the iron should be

taken during meals.

3. A rule of thumb for the application duration of the substitution of iron is that, after normalization of the value of hemoglobin, monitor the progress! The substitution of iron should be resumed for the same time it took for the hemoglobin value to normalize. Normally, the patient should **substitute iron for several months**. In case the duration of the substitution is too short, it leads, in all likelihood, to empty iron reservoirs, ultimately leading to anemia.
4. In case the value of hemoglobin does not increase during the regular follow-up, both the **therapy and the diagnosis should be checked**. Other causes which have not been taken into account so far should be researched.

Side effects of the therapy of iron deficiency anemia

The most common side effects are stomach problems with nausea and obstipation, but also diarrhea. Often, the stool turns darker or black, which is harmless as long as there are no other symptoms.

Course and Follow-up of Iron Deficiency Anemia

Only a few days after the initial substitution of iron, the increasing **erythropoiesis** becomes obvious in the blood smear through **reticulocytosis**. As a result of the substitution, the expected increase of the hemoglobin is roughly around 0.1 g/dL per day. In case this is not confirmed by the follow-up, there is either a continued loss of iron or the substitution of iron itself is defective or incorrect.

To exclude the latter, the **compliance** of the patient should be checked. If on checking there are no hints for defective compliance, the diagnosis or the choice of **therapy (enteral/parenteral)** should be questioned.

Note: The **causes** for an iron deficiency anemia are hypermenorrhea, pathological – mostly intestinal bleeding, and disorder of absorption as well as malnutrition. Important **symptoms** are B-symptoms like fatigue and weakness, as well as the typical symptoms of the Plummer-Vinson' syndrome. The specific sign is a sensitivity to cold. In the case of an iron deficiency anemia, the **treatment of the cause** has the highest priority. The **therapy** of iron deficiency anemia is a combination of treating the underlying disease, as well as the substitution of iron.

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