

Iron study patterns

Deficiency, inflammation, mixed findings, and overload

Serum iron reflects circulating iron, while ferritin helps assess storage iron. Inflammation can trap iron in storage and raise ferritin, leaving little iron available for red cell production.

Total iron-binding capacity (TIBC) reflects transferrin, the main iron transport protein.

Transferrin saturation (TSAT) is the percentage of that capacity occupied by iron.

$$\text{TSAT (\%)} = \text{serum iron} \div \text{TIBC} \times 100$$

Use the same concentration units for iron and TIBC.

Iron 30 µg/dL ÷ TIBC 300 µg/dL × 100 = **10% TSAT**. µg/dL = micrograms per deciliter. Low availability occurs in both deficiency and inflammation.

Typical adult patterns

↓ decreased; ↑ increased; N within the applicable reference interval. Compare with the laboratory's reference intervals; these are patterns, not diagnostic cutoffs.

Pattern	Serum iron	TIBC / transferrin	TSAT	Ferritin
Iron deficiency	↓	↑	↓	↓
Anemia of inflammation	↓	↓ or N	↓	N or ↑
Mixed deficiency + inflammation	↓	Variable; often N or ↓	↓	↓, N, or ↑
Iron overload	Often ↑	N or ↓	Usually ↑	Usually ↑

Why inflammation changes the panel

A low ferritin supports depleted stores. Normal or high ferritin cannot exclude deficiency during inflammation; liver injury can also raise it. Hepcidin, an iron-regulating hormone, reduces iron release from stores and absorption from the gut. Transferrin may also fall, so mixed deficiency can lose the expected high TIBC and low ferritin.

High ferritin alone does not establish overload. Persistent high TSAT strengthens that possibility; some overload disorders have normal TSAT. Further evaluation establishes the cause and tissue iron burden.

When results do not agree

Compare with hemoglobin, red cell indices, C-reactive protein or another inflammation marker, and collection and iron-treatment history.

Soluble transferrin receptor may help when inflammation obscures ferritin, but increased red cell production also raises it and cutoffs vary by method. Reticulocyte hemoglobin shows the iron available to recently produced red cells. It can be low in either deficiency or inflammation. Diagnostic thresholds depend on the population and guideline.