

Canine Iron Parameters

CLINICAL PATHOLOGY SERVICE

Iron-restricted erythropoiesis is a general term for conditions in which there is insufficient iron available for production of red blood cells, predisposing to anemia. **Absolute iron deficiency** is one type of iron-restricted erythropoiesis and is characterized by abnormally low iron stores in the body, which in dogs is most commonly due to chronic external blood loss rather than a nutritional deficiency. Another common type of iron-restricted erythropoiesis is iron sequestration anemia, also known as **anemia of inflammation**, in which inflammatory cytokines promote sequestration of iron into storage sites.

Tests used to identify dogs with iron-restricted erythropoiesis include reticulocyte indices and plasma biomarkers of iron. Reticulocyte indices, which can be measured using the hematology analyzer in the UTCVM Clinical Pathology Laboratory, provide information on reticulocyte size and hemoglobin concentration. These indices detect iron-restricted erythropoiesis earlier than the traditional red cell indices, MCV and MCHC. The reticulocyte index that is used most widely for this purpose is CHr, which is now included in all canine CBC reports from UTCVM for which reticulocyte counts are ordered. Additionally, UTCVM now offers a plasma iron panel which includes iron, TIBC, and %Saturation.

Specimen Requirement and Reporting

Iron Parameter	Specimen Requirement	Included in the following test panels
CHr	Whole blood in EDTA	Canine CBC with reticulocytes
Plasma Iron	Heparinized plasma	1) Small and large animal general biochemistry profiles 2) Profiles with electrolytes 3) Iron panel
TIBC	Heparinized plasma	Iron panel
%Saturation	Heparinized plasma	Iron panel

Expected Results in Absolute Iron Deficiency

Decreased iron stores due to absolute iron deficiency are expected to cause decreases in CHr, plasma iron, and %Saturation. Results for TIBC are often within the reference interval. If CHr, plasma iron, and %Saturation are normal in an anemic dog, then it is very unlikely that the anemia is due to absolute iron deficiency. In those cases, other causes of anemia should be considered.

Expected Results with Inflammation

Dogs with iron sequestration due to anemia of inflammation may also have decreased CHr, plasma iron, and %Saturation, although the changes are commonly less severe than with absolute iron deficiency. Inflammation promotes a decrease in the plasma concentration of transferrin, therefore TIBC (an indirect measure of transferrin concentration) may also be decreased in dogs with inflammation.

While one or more of these iron-related values are often decreased in dogs with systemic inflammation, inflammation should not be ruled out on the basis of normal iron parameters. Additional biomarkers of inflammation, such as acute phase proteins (e.g., C-Reactive Protein in dogs) may be more sensitive for detection of inflammation. See the UTCVM fact sheet on C-Reactive Protein for more information on this test.

Results in Other Conditions

One or more of these four iron parameters can be decreased, usually mildly, in some dogs with conditions other than absolute iron deficiency or anemia of inflammation, including dogs with portosystemic shunting or immune-mediated hemolytic anemia.

ABBREVIATIONS

CBC	<i>Complete Blood Count</i>
CHr	<i>Content of Hemoglobin of reticulocytes</i>
MCHC	<i>Mean Cell Hemoglobin Concentration of red blood cells</i>
MCV	<i>Mean Cell Volume of red blood cells</i>
TIBC	<i>Total Iron Binding Capacity; an indirect measurement of the plasma concentration of transferrin, the main plasma iron transport protein</i>
%Saturation	<i>Percent Saturation of transferrin; the percentage of total iron-binding sites on transferrin proteins currently occupied by iron</i>

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Additionally, healthy dogs with breed-associated microcytosis, such as Shiba Inu and Akita dogs, may have mildly decreased CHR.

In contrast, there are some conditions that can cause increased plasma iron and/or %Saturation, such as hepatocellular injury or hemolysis, due to release of intracellular iron. Additionally, increased glucocorticoids are associated with hyperferremia in some dogs, through an unknown mechanism.

To date, UTCVM can only provide reference intervals for CHR in dogs. Validation of reference intervals for other iron parameters and other species are ongoing in our laboratory. In the meantime, reference intervals provided by other laboratories using similar methodologies can be used with caution, such as those from the Animal Health Diagnostic Center at Cornell University.

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