

# An exploration of markers of iron deficiency in dogs

In association with 

**UCD researchers are examining the biomarkers of iron status of dogs with confirmed and suspected iron deficiency with a view to improving diagnoses and care of impacted animals**

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The diagnosis of iron deficiency in dogs can be challenging and often relies on a consistent clinical history and the identification of a microcytic hypochromic anaemia on routine haematology. Although measurement of total iron concentration, total iron binding capacity (TIBC), transferrin concentration or percentage transferrin saturation may support a diagnosis, these variables are affected by numerous other factors in dogs, and as a result, iron deficiency can be difficult to confirm or exclude definitively. As a result, a diagnosis of iron deficiency is easily missed. The resultant failure to provide replacement therapy can contribute to morbidity in affected animals.

## INDICES

In recent years, additional biomarkers of iron deficiency have become more widely used in human medicine. For example, reticulocyte indices (haemoglobin content [CHR] and mean cell volume [rMCV]) are routinely calculated by modern haematology analysers and can provide an early indication of developing iron deficiency by displaying hypochromasia or microcytosis within these immature cells before changes to the entire red cell population become apparent. These indices are infrequently reported

or used in a clinical setting, despite their potential value to provide a rapid, non-invasive and cost-effective method to screen for iron deficiency in routine haematology samples. Initial studies in dogs showed that values are also decreased in association with iron deficiency in this species.<sup>1</sup>

Serum ferritin concentration has also been shown to be a useful indicator of iron status in humans, especially in a clinical setting.<sup>2</sup> Specifically, in an anaemic patient, decreased serum ferritin concentration has a higher positive predictive value for the diagnosis of iron deficiency compared to other biomarkers. Ferritin has not been extensively evaluated in dogs to date.

## PROBLEMS

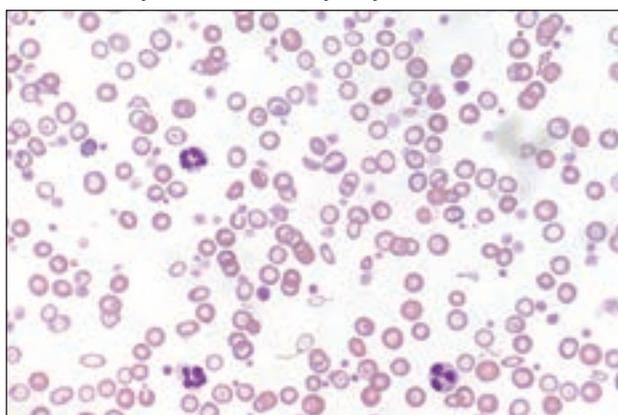
There are problems with the use of these biomarkers in a clinical setting. For example, many of the biomarkers are affected by the presence of inflammatory disease, and they may

lack either sensitivity or specificity, especially when used as a single diagnostic test.<sup>2,3</sup> As a result, additional studies are necessary to determine their clinical value in practice.

## UCD FOCUS

Monica Augusto and Olympia Ioannidi will be evaluating these and other biomarkers of iron status in dogs with confirmed and suspected iron deficiency presenting to the UCD Veterinary Hospital. These markers will be analysed in conjunction with clinical and clinicopathological information (including traditional tests of iron deficiency and biomarkers of inflammation) to determine their value as a clinical diagnostic test.

If successful, the use of these biomarkers will facilitate the diagnosis of iron deficiency in dogs, which in turn will improve management of the disorder as well as the standard of care and welfare of affected animals.



**A blood smear displaying the typical features of iron deficiency in dogs, including hypochromic and microcytic red blood cells. These features are only present in advanced/severe cases. Photo courtesy of Maureen McCullough.**

## REFERENCES

1. Steinberg JD and Oliver CS (2005) Hematologic and biochemical abnormalities indicating iron deficiency are associated with decreased reticulocyte haemoglobin content (CHR) and reticulocyte volume (rMCV) in dogs. *Veterinary Clinical Pathology* 34, 23-27.
2. Knovich MA, Storey JA, Coffman LG and Torti SV (2009) Ferritin for the Clinician. *Blood Reviews* 23, 95-104.
3. Radakovich LB, Santangelo KS, Olver CS (2015) Reticulocyte haemoglobin content does not differentiate true from functional iron deficiency in dogs. *Vet Clinical Pathology* 44, 511-8.

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