Al-Qadisiyah Journal of Veterinary Medicine Sciences, Vol. 22, No.1 Supplement I, 2023 Proceedings of the 7th (National) 2nd (International) Scientific Conference of the College of Veterinary Medicine, University of Al-Qadisiyah

Al-Qadisiyah Journal of Veterinary Medicine Sciences
(P-ISSN 1818-5746/ E-ISSN 2313-4429)
https://qjvms.qu.edu.iq/

The correlation between the iron profile and some hematological values in dogs, Baghdad, Iraq

Noor Abd Al-Kareem Qasim[1] Naseir Mohammed Badawi[1]

[1]Department of Internal and Preventive Veterinary Medicine, College of Veterinary Medicine, University of Baghdad, Baghdad, Iraq.

Abstract

Iron is the important element when deficient is associated with decrease blood values and animal which located under risk of many diseases. Complete Blood Counts (CBCs) was done by (VET haematology system). While the iron profile included serum iron, total iron binding capacity (TIBC) was measured by the colorimetric method. So, the canine ferritin was determined by the canine-FE ELISA kit. The unbound iron binding capacity (UIBC) and transferrin saturation (TS%) were calculated by equations. Pearson's correlation coefficient was used to measure the relationship between these test values. The correlation analysis of iron profile and haematological values was conducted on 175 dogs. The results showed that serum iron concentrations were positively and significantly correlated with TIBC, TS%, RBC, HGB, HCT, and platelet counts, whereas ferritin concentrations were negatively correlated only with MCV. Also, the results showed a negative correlation between ferritin and lymphocyte counts. The study concluded that serum iron levels are highly correlated with erythrogram values. Ferritin is limited in the diagnosis of iron deficiency anaemia because it acts as a biomarker and is not correlated with most erythrogram values. The negative correlation between ferritin and MCV reflected that MCV can be used in the estimation of iron deficiency

.

Introduction

Iron is required for a variety of biological processes, the most significant of which is the generation of red blood cells (RBCs). Hemoglobin (Hb), myoglobin, the storage form of iron as hemosiderin or ferritin, the ferric form attached to the transferrin in plasma, and iron also play a role in generating enzymes (1). Because there are no adequate iron excretion mechanisms, iron balance is maintained through intestinal absorption, erythropoiesis, recycling of senescent lysed RBCs, and storage .(2)

In veterinary medicine, serum iron content is assessed to assess compartments related to iron in blood. Iron is a natural mineral that is required for oxygen transport to tissues as well as a coenzyme for various enzymes involved in energy and DNA synthesis (3). Iron (Fe) is an essential component of biological activities such as cellular metabolic pathways in the liver and oxidative reactions, as well as relative or absolute Fe overloads or deficiencies that lead to disease .(4)

There are numerous aspects of the relationship between the iron profile and haematological values that merit investigation, such as the efficacy of iron tests on blood changes, which can be used as clinical markers in the diagnosis and prognosis of diseases or disorders, as well as in treatment intervention. The purpose of the study was to determine the relationship between iron, TIBC, ferritin concentration, and their effects on haematological parameters. Also, the correlation between values of iron profiles included serum iron, TIBC, TS%, UIBC, and ferritin.

Materials and methods

One hundred and seventy-five dogs were randomly selected from the veterinarian clinic and the Baghdad veterinary hospital. Blood was collected from the cephalic vein with an EDTA tube for complete blood counts (CBCs), while serum was separated in plain tubes for iron profile measurements. The purpose of the study was to identify CBCs using a veterinary haematology autoanalyzer. Total iron binding capacity (TIBC) and serum iron were determined using commercial kits using colorimetric methods. To measure serum ferritin, an ELISA kit for canine ferritin was utilised (Sunlong Biotech Co., Ltd., China). Unbound iron binding capacity (UIBC) and transferrin saturation TS% were calculated using Equations (5). Statistical analysis was conducted by SPSS software (version 20, USA) for detecting Pearson's correlation coefficient to measure the relationship between iron profile and hematological values.

Results

The relationships between serum iron and ferritin with other iron values were presented in Table 1 and shown in figures of scatters (Figure 1 and Figure 2). The serum iron concentrations were positively significantly correlated with TIBC and TS%, whereas ferritin concentrations were unrelated to other iron values.

Table 1: Pearson Correlation of serum iron and ferritin concentrations with other iron parameters in dogs.

	TIBC	UIBC	TS%	Ferritin
S. iron	0.251**	-.106	0.694**	-0.081
	0.001	0.163	0.0001	0.289
Ferritin	-0.071	-0.043	-0.059	
	0.351	0.568	0.442	
**. Correlation is significant at the 0.05 level (2-tailed).				

Al-Qadisiyah Journal of Veterinary Medicine Sciences
(P-ISSN 1818-5746/ E-ISSN 2313-4429)
https://qjvms.qu.edu.iq/

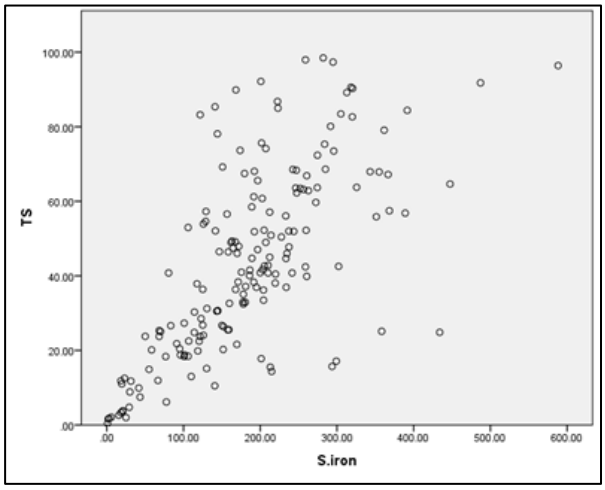

Figure 1: Scatter showing a positive correlation between S. iron in dogs and TS. There was a significant positive correlation at the 0.05 level (2-tailed).

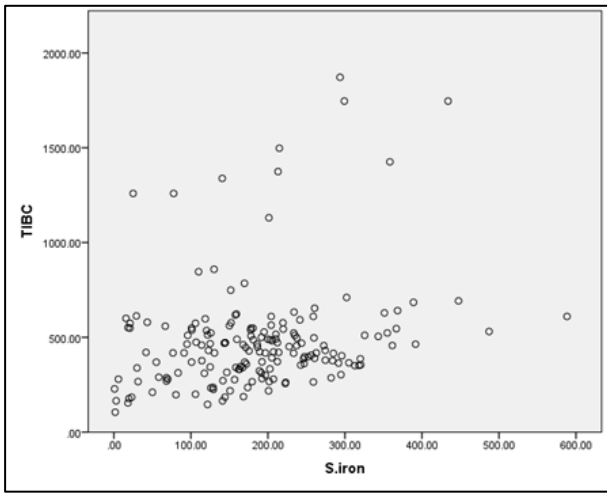

Figure 2: Scatter showing a positive correlation between S. iron in dogs and TIBC. There was a significant positive correlation at the 0.05 level (2-tailed).

The RBC, HGB, HCT, and platelet counts were strongly positively correlated with serum iron. The red blood cell indices were not correlated with serum iron, but ferritin concentration was negatively correlated only with MCV (Table 2), (Figures 3, 4, 5 and 6).

Table 2: Pearson correlation of serum iron and ferritin concentrations with hematological values in dogs.

	RBC	HGB	HCT	MCV	MCH	MCHC	PLT
S. iron	0.26**	0.28**	0.26**	0.02	0.058	-0.03	0.145**
	0.001	0.001	0.001	0.76	0.446	0.65	0.05
Ferritin	-0.02	-0.08	-0.07	-0.14	0.030	0.006	-0.01
	0.784	0.291	0.317	0.05	0.692	0.933	0.83

**. Correlation is significant at the 0.05 level (2-tailed).

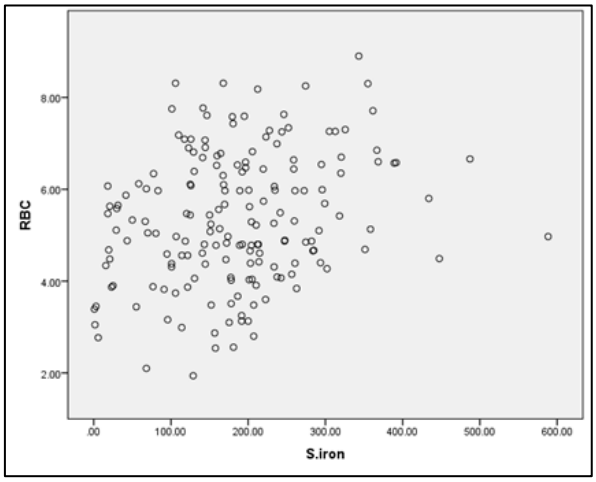

Figure 3: Scatter showing a positive correlation between S. iron in dogs and RBC. There was a significant positive correlation at the 0.05 level (2-tailed).

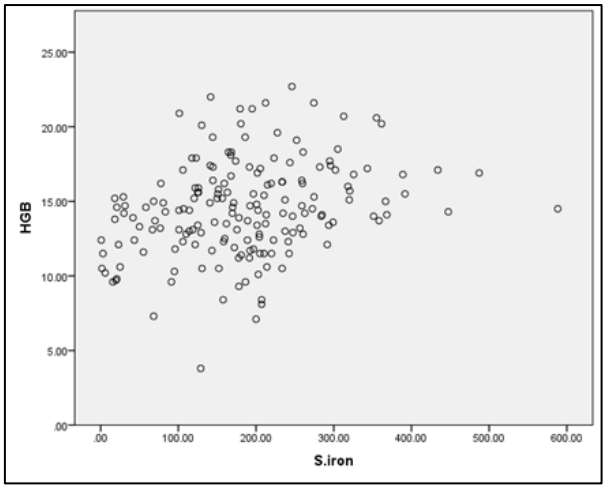

Figure 4: Scatter showing a positive correlation between S. iron in dogs and HGB. There was a significant positive correlation at the 0.05 level (2-tailed).

Al-Qadisiyah Journal of Veterinary Medicine Sciences
(P-ISSN 1818-5746/ E-ISSN 2313-4429)
https://qjvms.qu.edu.iq/

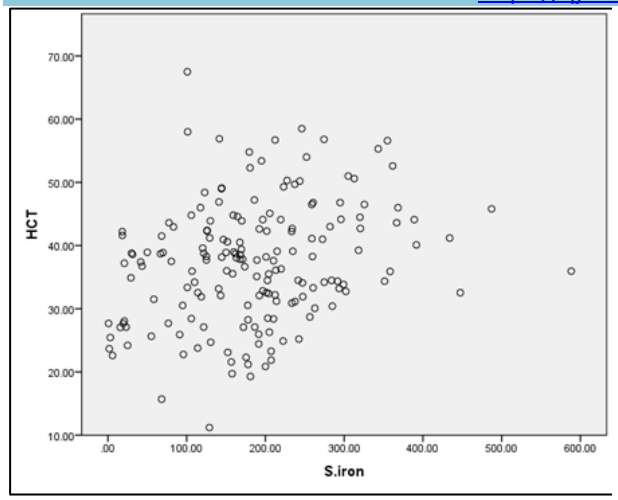

Figure 5: Scatter showing a positive correlation between S. iron in dogs and HCT. There was a significant positive correlation at the 0.05 level (2-tailed).

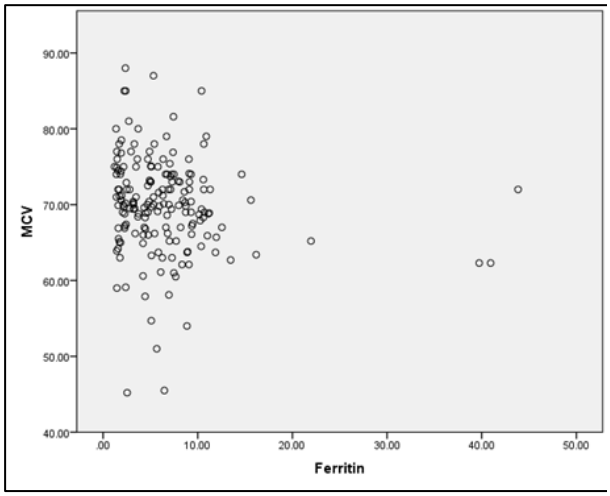

Figure 6: Scatter showing a negative correlation between ferritin in dogs and MCV. There was a significant negative correlation at the 0.05 level (2-tailed).

The correlation between serum iron and ferritin with leukogram values (Table 3). The results showed a negative correlation between ferritin and lymphocyte .counts (Figure 7)

Table 3: Pearson correlation of serum iron and ferritin concentrations with leukogram values in dogs.

	WBC	Lymph	Neutro	Mono	Eosino
S. iron	0.032	0.031	0.006	0.013	0.147
	0.675	0.687	0.935	0.866	0.051
Ferritin	-0.098	-0.163**	-0.032	-0.025	0.053
	0.199	0.031	0.678	0.745	0.484
**. Correlation is significant at the 0.05 level (2-tailed).					

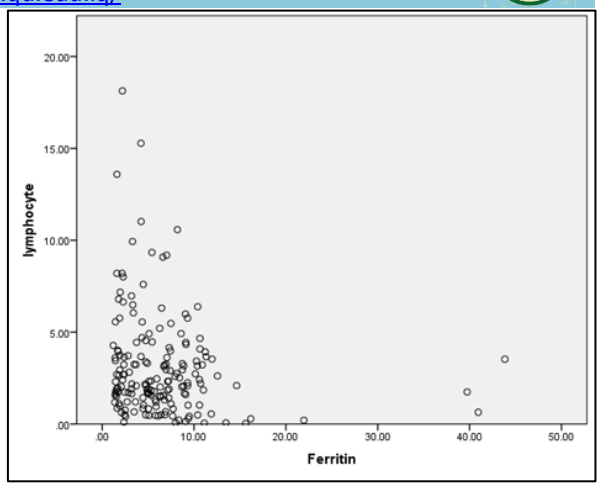

Figure 7: Scatter showing a negative correlation between ferritin and lymphocyte in dogs. There was a significant negative correlation at the 0.05 level (2-tailed).

Discussion

Based on the results, the correlation analysis showed that serum iron correlated with TS% and TIBC and strongly correlated with RBC, HGB, HCT, and platelet counts. The iron-deficient dogs were classified as anaemic when RBC, HCT, and HGB were below normal range (6). The relationship between iron and the number of platelets was presented because of the correlation between thrombopoietin and iron state. Thrombopoietin is important in regulating thrombocyte production (7). Erythropoiesis and iron metabolism are closely connected. The majority of the iron removed from circulation each day is needed to synthesise haemoglobin. Hepcidin, which is regulated by erythropoiesis, is a critical regulator of iron intake and recycling (8). Erythropoietin (EPO) is effective for erythropoiesis, and iron is necessary for haemoglobin production during erythropoiesis. EPO promotes the cell proliferation and survival of erythroid progenitor cells by producing intracellular signals that prevent apoptosis. There is new information about the interaction of hepcidin and erythropoiesis. Hepcidin is a protein that regulates the entry of iron into the circulation. The recently found iron regulatory protein and erythroid erythroferrone have roles in erythropoiesis regulation (9). For these reasons, serum iron is strong positive correlated with the erythrogram values.

The few studies assessed the correlation between hematologocal values and iron profiles in dogs (10) and cats (11). Paltrinieri et. al. (10) found a positive correlation between serum iron and MCV in dogs. Betting et. al. (11) reported a weak correlation between MCV and TS%, while HCT and HGB were not correlated with TS.%

On the other hand, in the results, ferritin was negatively correlated with MCV, while there was a strong negative correlation between ferritin and lymphocytes.

Al-Qadisiyah Journal of Veterinary Medicine Sciences
(P-ISSN 1818-5746/ E-ISSN 2313-4429)
https://qjvms.qu.edu.iq/

Lymphocytes bind to ferritin directly by an unknown mechanism (12). This binding can affect lymphocyte proliferation and immunoglobulin production or maturation (13). Ferritin was a marker of inflammation through its roles in innate immunity and effects on lymphocyte function. Ferritin has a role in inflammation and infection by inhibiting bacterial development, increasing the host's defensive mechanism, reducing free radical generation, and modulating inflammation. Furthermore, hyperferritinemia is a biomarker of inflammation (14). Ferritin needs more research into its role in blood disorders, inflammatory disorders, and as a biomarker in some diseases. For these reasons, ferritin is limited in the diagnosis of iron deficiency anaemia and is not correlated with most erythrogram values.

Microcytosis is characterised by a low MCV. Iron deficiency is indicated by low ferritin levels because of its considered storage form, its low level in serum, and its direct effect when iron deficient. Because iron deficiency is the most common cause of microcytosis, ferritin assay is indicated as the first test method for microcytosis evaluation. Other causes of microcytosis include chronic illness, anaemia, lead poisoning, and sideroblastic anaemia (15). According to previous information, the negative correlation between ferritin and MCV reflected that MCV can be used in the estimation of iron deficiency.

Conclusion

Serum iron levels are highly correlated with erythrogram values. Ferritin is limited in the diagnosis of iron deficiency anaemia because it acts as a biomarker and is not correlated with most erythrogram values. The negative correlation between ferritin and MCV reflected that MCV can be used in the estimation of iron deficiency.

Acknowledgements

The authors would like to acknowledge the staff of the Baghdad veterinary hospital and the veterinary college at Baghdad University for their efforts in conducting this study.

References

1 .Coleman M. Iron metabolism. Hematol Clin Princ Appl. 2007;116-23.
2 .McCown JL, Specht AJ. Iron homeostasis and disorders in dogs and cats: a review. J Am Anim Hosp Assoc. 2011;47(3):151-60. https://doi.org/10.5326/JAAHA-MS-5553
3 .Harvey JW. Iron metabolism and its disorders. Clin Biochem Domest Anim. 2008;6:259-85. https://doi.org/10.1016/B978-0-12-370491-7.00009-X
4 .Soubasis N, Rallis TS, Vlemmas J, Adamama-Moraitou KK, Roubies N, Prassinos NN, et al. Serum and liver iron concentration in dogs with experimentally induced hepatopathy. J Gastroenterol Hepatol. 2006;21(3):599-604. https://doi.org/10.1111/j.1440-1746.2005.04066.x
5 .Weiss DJ. Iron and copper deficiencies and disorders of iron metabolism. Schalm's Vet Hematol. 2010;6:167-71.
6 .Matur E, Ekiz EE, Erek M, Ergen E, Küçük SH, Erhan S, et al. Relationship between anemia, iron deficiency, and platelet production in dogs. 2019;75(6):351-4. https://doi.org/10.21521/mw.6233
7 .Mitchell O, Feldman DM, Diakow M, Sigal SH. The pathophysiology of thrombocytopenia in chronic liver disease. Hepatic Med Evid Res. 2016;15(8):39-51. https://doi.org/10.2147/HMER.S74612
8 .Li H, Ginzburg YZ. Crosstalk between iron metabolism and erythropoiesis. Adv Hematol. 2010;605435. https://doi.org/10.1155/2010/605435
9 .Singh AK. Erythropoiesis: The Roles of Erythropoietin and Iron. In: Textbook of Nephro-Endocrinology. Elsevier; 2018. p. 207-15. https://doi.org/10.1016/B978-0-12-803247-3.00012-X
10 .Paltrinieri S, Preatoni M, Rossi S. Microcytosis does not predict serum iron concentrations in anaemic dogs. Vet J. 2010;185(3):341-3. https://doi.org/10.1016/j.tvjl.2009.06.015
11 .Betting A, Schweighauser A, Francey T. Diagnostic value of reticulocyte indices for the assessment of the iron status of cats with chronic kidney disease. J Vet Intern Med. 2022;36(2):619-28. https://doi.org/10.1111/jvim.16367
12 .Recalcati S, Invernizzi P, Arosio P, Cairo G. New functions for an iron storage protein: the role of ferritin in immunity and autoimmunity. J Autoimmun. 2008;30(1-2):84-9. https://doi.org/10.1016/j.jaut.2007.11.003
13 .Yamashita M, Harada G, Matsumoto S, Aiba Y, Ichikawa A, Fujiki T, et al. Suppression of immunoglobulin production in human peripheral blood mononuclear cells by monocytes via secretion of heavy-chain ferritin. Immunobiology. 2014;219(2):149-57. https://doi.org/10.1016/j.imbio.2013.08.011
14 .Kernan KF, Carcillo JA. Hyperferritinemia and inflammation. Int Immunol. 2017;29(9):401-9. https://doi.org/10.1093/intimm/dxx031
15. Van Vranken M. Evaluation of microcytosis. Am Fam Physician. 2010;82(9):1117-22.