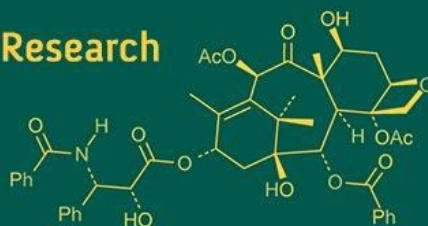


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Iron deficiency anemia in dogs: Therapeutic management

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Abstract

A total of 1951 dogs were screened, of which 117 were anemic, and 23 (19.66%) were diagnosed with IDA, resulting in an overall hospital prevalence of IDA as 1.18%. Clinical signs observed in IDA-affected dogs included lethargy, melena, weight loss, anorexia, and inappetence. Physical examination revealed pale mucous membranes, enlarged lymph nodes, and icteric mucous membranes. Haematological analysis confirmed microcytic hypochromic anemia, with significantly decreased haemoglobin (7.25 ± 0.24 g/dl), PCV ($21.87 \pm 0.73\%$), and TEC ($3.60 \pm 0.13 \times 10^6/\mu\text{l}$). Serum biochemical findings showed low iron levels (57.35 ± 3.78 $\mu\text{g/dl}$), increased TIBC (383.20 ± 9.25 $\mu\text{g/dl}$), and reduced%TSAT ($15.06 \pm 0.98\%$). Etiological factors included *Ancylostoma caninum*, gastritis, *Babesia gibsoni*, demodicosis, and haematuria. The 20 IDA-positive dogs were divided into two treatment groups: Group I received allopathic therapy (iron dextran, ferrous glycinate, copper glycinate, and cobalt glycinate), and Group II received homeopathic treatment (*Ferrum metallicum* 30C, *Cobaltum metallicum* 30C, and *Cuprum metallicum* 30C). Both allopathic and homeopathic treatments were effective in managing IDA in dogs, with allopathy providing marginally faster iron replenishment and homeopathy offering sustained benefits. The study highlights the potential of homeopathic remedies as a viable and cost-effective alternative to synthetic iron supplementation, particularly in non-emergency cases.

Keywords: Iron deficiency anemia (IDA), homeopathic treatment, microcytic hypochromic anemia, alternative therapy

Introduction

Dogs have been domesticated for millennia and currently serve various roles ranging from companionship to working and security duties (Wallace *et al.*, 2017) ^[1]. Among the numerous health challenges affecting canines, anemia is a commonly encountered condition, often secondary to inflammatory, neoplastic, parasitic, nutritional, or toxicological causes (Fry, 2010; Dhuria *et al.*, 2013) ^[2, 3].

Anemia is defined as a reduction in red blood cell count, hemoglobin concentration, or packed cell volume below the species-specific reference interval (Ettinger *et al.*, 2017) ^[4]. One notable subtype is iron deficiency anemia (IDA), typically characterized as a microcytic hypochromic anemia. It is often the result of chronic blood loss due to gastrointestinal bleeding, ectoparasite infestations, or dietary insufficiencies, especially in young or malnourished dogs (Schalm *et al.*, 1975; Naigamwalla *et al.*, 2012) ^[5, 6]. Iron is a vital micronutrient for metabolic processes, including oxygen transport and energy production. It exists primarily in hemoglobin but also participates in enzymatic reactions through cytochromes and myoglobin (Crichton, 2009) ^[7]. Iron homeostasis is tightly regulated to prevent deficiency or overload, with dietary iron being absorbed predominantly in the duodenum and exported into circulation via ferroportin. This process is hormonally controlled by hepcidin, which modulates iron efflux based on systemic iron levels (Crichton, 2009; Harvey, 2008; Knovich *et al.*, 2009) ^[7, 8, 9].

IDA manifests clinically with signs such as pallor, lethargy, reduced exercise tolerance, and in severe cases, pica—an unusual craving for non-nutritive substances (Harvey, 2008; Giger, 2005) ^[8, 10]. Diagnosis is confirmed by evaluating serum ferritin, total iron binding capacity (TIBC), transferrin saturation, and red blood cell morphology (Weiss, 2010) ^[11]. Standard treatment involves cessation of blood loss, correction of the underlying cause, and

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and iron supplementation. Parenteral iron preparations like iron dextran allow rapid replenishment of iron stores, especially when oral absorption is compromised (Giger, 2005; Plumb, 2008) [10, 12]. On the other hand, oral iron therapy must be tailored carefully to avoid gastrointestinal irritation and requires prolonged administration.

Recently, interest has grown in alternative treatments such as homeopathy. Remedies like *Ferrum metallicum* are proposed to enhance iron utilization and absorption, with anecdotal evidence suggesting benefits in IDA management (Boericke *et al.*, 2008; Dwivedi, 2019) [13, 14]. However, scientific validation through controlled studies is lacking. Considering these aspects, the present study was undertaken to evaluate the hospital prevalence of IDA in dogs, analyze associated clinico-haematological parameters, and compare the therapeutic efficacy of allopathic and homeopathic interventions.

Materials and Methods

Selection of cases

Between September 2024 and February 2025, client-owned dogs presented with clinical signs indicative of anemia such as pallor of conjunctival mucous membranes, lethargy, weakness, and anorexia were screened. Diagnostic procedures included peripheral blood smear examination, faecal examination, complete blood count and serum biochemical assessments. Dogs exhibiting mild (PCV 30-36%) to moderate (PCV 20-29%) anemia were enrolled, resulting in a total of 20 IDA-positive subjects.

Each of the 20 IDA-positive dogs underwent a thorough clinical evaluation. Parameters recorded included rectal temperature (°F), respiratory rate (breaths/min), heart rate (beats/min), mucous membrane color, and lymph node examination. Blood (4 mL) was collected aseptically from the cephalic or saphenous vein. Two milliliters were placed in EDTA vials for hematological analysis, and the remaining 2 mL was transferred to clot-activator vials for serum separation. Peripheral blood was obtained from the ear tip and smears were prepared, fixed in methanol, stained

with 1:20 diluted Giemsa stain for 20 minutes, and examined under oil immersion (100×) for haemoparasites. Faecal samples were emulsified, filtered, and centrifuged at 3000 rpm for 5 minutes. Sediments were examined microscopically to identify ova of gastrointestinal parasites contributing to anemia.

Haematological Parameters

Hematological indices including hemoglobin concentration, packed cell volume (PCV), total erythrocyte count (TEC), total leukocyte count (TLC), platelet count, and differential leukocyte count (DLC) were assessed using an automated blood analyzer (Abacus ABJ Vet-5, Junior Vet 5). Evaluations were performed on day 0 (pre-treatment), and repeated on day 14 and 21 (post-treatment).

Serum Biochemical Parameters

Serum samples were analyzed using standard assay kits with a semi-auto biochemistry analyzer (Alta ADX-CHEM-220). The parameters included serum iron, total iron-binding capacity (TIBC), unsaturated iron-binding capacity (UIBC), percentage transferrin saturation (%TSAT), total protein, and glucose. Measurements were performed at the same intervals as hematological assessments.

Serum Iron and TIBC Estimation

Iron profile study parameters, including serum iron, serum TIBC, and %TSAT, were estimated using the Coral Clinical System IRON + TIBC kit via spectrophotometry at 570 nm. Serum iron was determined by the Ferrozine method, serum TIBC was calculated using a biochemical method, and transferrin saturation was computed using the formula:

$$\% \text{ TSAT} = (\text{Serum iron} / \text{TIBC}) \times 100$$

Treatment Protocol

The dogs were divided into two experimental groups (n=10 each), along with a control group (n=10) of healthy animals. Treatment protocols were as follows:

Treatment Protocol

Group	Treatment	No. of Animals	Sample Collection Days
I	Allopathic: Iron dextran @ 10 mg/kg IM weekly for 2 weeks + oral ferrous glycinate, copper glycinate, and cobalt glycinate syrup @ 5 mL/20 kg BID for 21 days	10	0, 14, 21
II	Homeopathic: Ferrum metallicum, Cobaltum metallicum, and Cuprum metallicum (6-10 drops 30C BID) for 21 days	10	0, 14, 21
III	Healthy Control-No treatment	10	0

Supportive therapy included multiple electrolytes, dextrose injections, papaya extract, and liver protectants. Treatment for underlying etiologies was administered per standard veterinary protocols. Therapeutic response was evaluated through clinical observation and follow-up hematological and biochemical tests on days 14 and 21. All data were analyzed using SPSS (Statistical Package for the Social Sciences). Descriptive statistics and appropriate inferential tests were applied to assess treatment efficacy.

Results and Discussion

Of 1,951 dogs presented to the VCC, 117 were anemic and screened for IDA. Twenty of the 23 IDA-positive dogs were randomly assigned to two treatment groups: Group I

(allopathic) and Group II (homeopathic), and their responses were documented.

Prevalence

In this study, 23 of 117 anemic dogs (19.66%) were diagnosed with IDA, representing a hospital prevalence of 1.18% among 1,951 dogs. IDA was most common in dogs under 1 year old (40%), followed by those over 6 years (25%), aged 1-3 years (20%), and 3-6 years (15%). Male dogs had a higher prevalence (60%) compared to females (40%). Among breeds, Labradors had the highest prevalence (25%), followed by non-descript dogs (15%). German Shepherds, Golden Retrievers, Pomeranians, and Rottweilers each showed a prevalence of 10%, while

Pitbulls, Saint Bernards, Dachshunds, and Beagles each had a prevalence of 5%.

Clinical Signs

Among 20 IDA-positive dogs, the most common clinical signs were lethargy (90%), melena (60%), and weight loss (55%), followed by anorexia (45%), inappetence (40%), pica (35%), vomiting (40%), exercise intolerance (30%), epistaxis (20%), ascites (15%), and hematochezia (5%). Rectal temperature was recorded in all IDA-positive dogs, with 50% showing hyperthermia. Tachycardia was observed in 60% of dogs, and tachypnea in 55%. On physical examination, 60% of dogs had enlarged lymph nodes, and 90% showed pale mucous membranes, the most prominent finding.

Table 1: Different etiological findings associated with IDA-positive dogs

Etiology	Number	Percentage
<i>Ancylostoma caninum</i>	4	20
Gastritis	4	20
<i>Babesia gibsoni</i>	3	15
Demodicosis	2	10
Haematuria	2	10
<i>Dipylidium</i> spp.	1	5
<i>Toxocara</i> spp.	1	5
NSAID toxicity	1	5
Dietary	1	5
Abnormal mass	1	5
Total	20	100

The treatment of IDA in dogs was based on the underlying cause. Parasitic infections such as *Ancylostoma caninum* were managed with a single oral dose of Praziquantel (5 mg/kg BW), Pyrantel pamoate (14.4 mg/kg BW), and Fenbendazole (50 mg/kg), while *Toxocara* spp. was treated with Pyrantel pamoate (5 mg/kg) for three days, and *Dipylidium* spp. with Praziquantel (20 mg/kg) for two days. Protozoal infections like *Babesia gibsoni* were addressed using Clindamycin (25 mg/kg BW, BID), Doxycycline (10 mg/kg BW, OD), Metronidazole (15 mg/kg BW, BID), and Carica papaya extract (5 ml/dog) orally for 21 days. Dermatological conditions such as demodicosis were treated with a single oral dose of Fluralaner (10 mg/kg). Gastrointestinal issues, including gastritis, were managed with Sucralfate (500-1000 mg/dog) and Inj. Ondansetron (0.2 mg/kg) as needed, while NSAID toxicity was treated with Activated Charcoal (10 ml orally once), Liver tonic (5 ml orally twice for 10 days), Normal Saline, and Ranitidine

(2 mg/kg). Hematological disorders like haematuria required intravenous administration of Normal Saline and Haemocoagulase (0.5-1 ml/dog), and any abnormal mass was surgically removed. Dietary deficiencies were addressed by including egg yolk, chicken liver, and fish in the diet, providing a comprehensive approach to managing IDA by targeting both the primary causes and associated conditions.

Table 2: Effect of allopathic treatment on haematological values in IDA-positive dogs.

Parameter	Allopathic treatment (Mean $\pm$ SE)		
	Day 0	Day 14	Day 21
Haemoglobin (g/dl)	7.46 $\pm$ 0.29	9.41 $\pm$ 0.20**	10.99 $\pm$ 0.21**
PCV (%)	22.99 $\pm$ 0.79	28.23 $\pm$ 0.59**	33.17 $\pm$ 0.59**
TEC (10 ⁶ /μl)	3.74 $\pm$ 0.14	5.24 $\pm$ 0.14**	6.42 $\pm$ 0.25**
TLC (10 ³ /μl)	13.74 $\pm$ 2.85	12.93 $\pm$ 1.53	11.47 $\pm$ 0.26
Platelets (Lacs/μl)	3.32 $\pm$ 0.58	4.01 $\pm$ 0.41	4.44 $\pm$ 0.37
Neutrophils (%)	81.4 $\pm$ 2.00	73.8 $\pm$ 1.13**	68 $\pm$ 0.76**
Lymphocytes (%)	15.6 $\pm$ 1.34	23.5 $\pm$ 0.89**	29.8 $\pm$ 0.64**
Monocytes (%)	0.6 $\pm$ 0.15	0.5 $\pm$ 0.16	0.5 $\pm$ 0.21
Eosinophils (%)	2.3 $\pm$ 0.75	1.1 $\pm$ 0.39	0.6 $\pm$ 0.25

*Significant at 0.05 level; **significant at 0.01 level

Table 3: Effect of homeopathic treatment on haematological values in IDA-positive dogs.

Parameter	Homeopathic treatment (Mean $\pm$ SE)		
	Day 0	Day 14	Day 21
Haemoglobin (g/dl)	7.03 $\pm$ 0.36	9.03 $\pm$ 0.24**	10.11 $\pm$ 0.31**
PCV (%)	20.74 $\pm$ 1.13	27.09 $\pm$ 0.71**	30.32 $\pm$ 0.93**
TEC (10 ⁶ /μl)	3.46 $\pm$ 0.22	4.99 $\pm$ 0.21**	6.18 $\pm$ 0.34**
TLC (10 ³ /μl)	14.57 $\pm$ 2.16	12.51 $\pm$ 0.97	10.74 $\pm$ 0.31
Platelets (Lacs/μl)	2.03 $\pm$ 0.44	3.18 $\pm$ 0.45	3.77 $\pm$ 0.42**
Neutrophils (%)	76.80 $\pm$ 3.60	70.50 $\pm$ 2.06	66.40 $\pm$ 0.50**
Lymphocytes (%)	22.10 $\pm$ 3.64	26.30 $\pm$ 2.07	31.90 $\pm$ 0.66*
Monocytes (%)	0.30 $\pm$ 0.21	0.80 $\pm$ 0.25	0.80 $\pm$ 0.25
Eosinophils (%)	0.80 $\pm$ 0.29	0.80 $\pm$ 0.29	0.80 $\pm$ 0.25

*Significant at 0.05 level; **significant at 0.01 level

Table 4: Effect of allopathic treatment on serum biochemical values in IDA-positive dogs.

Parameters	Allopathic treatment (Mean $\pm$ SE)		
	Day 0	Day 14	Day 21
Iron (μg/dl)	55.47 $\pm$ 4.78	89.10 $\pm$ 4.71**	114.49 $\pm$ 6.18**
TIBC (μg/dl)	374.50 $\pm$ 13.41	353.90 $\pm$ 13.26	341.50 $\pm$ 12.95
UIBC (μg/dl)	319.03 $\pm$ 13.99	264.80 $\pm$ 14.72*	227.01 $\pm$ 12.45**
%TSAT	14.95 $\pm$ 1.35	25.52 $\pm$ 1.66**	33.73 $\pm$ 1.75**
TP (g/dl)	5.48 $\pm$ 0.37	5.85 $\pm$ 0.37	6.01 $\pm$ 0.37
Glucose (mg/dl)	80.90 $\pm$ 0.79	84.74 $\pm$ 1.34*	92.90 $\pm$ 1.51**

*Significant at 0.05 level; ** significant at 0.01 level

Table 5: Effect of homeopathic treatment on serum biochemical values in IDA-positive dogs.

Parameters	Homeopathic treatment (Mean $\pm$ SE)		
	Day 0	Day 14	Day 21
Iron (μg/dl)	59.22 $\pm$ 6.05	94.04 $\pm$ 6.36**	113.44 $\pm$ 7.07**
TIBC (μg/dl)	391.90 $\pm$ 12.83	369.30 $\pm$ 11.87	356.80 $\pm$ 12.23
UIBC (μg/dl)	332.68 $\pm$ 13.34	275.26 $\pm$ 11.97**	243.36 $\pm$ 12.66**
%TSAT	15.18 $\pm$ 1.49	25.56 $\pm$ 1.67**	31.98 $\pm$ 1.96**
TP (g/dl)	5.32 $\pm$ 0.40	5.69 $\pm$ 0.40	5.85 $\pm$ 0.40
Glucose (mg/dl)	81.59 $\pm$ 0.80	87.68 $\pm$ 0.95	94.77 $\pm$ 0.66**

*Significant at 0.05 level; **significant at 0.01 level

The comparative analysis of the two treatment groups (allopathic and homeopathic) for IDA in dogs revealed significant improvements in both clinical and

haematobiochemical parameters. In Group I, which received allopathic treatment which included injection iron dextran @ 10 mg/kg B.wt IM OD every week for 2 weeks, syrup

ferrous glycinate + copper glycinate + cobalt glycinate @ 5 ml/20Kg B.wt PO BID for 21 days, there was a highly significant increase in Hb levels from 7.46 ± 0.29 g/dl on day 0 to 10.99 ± 0.21 g/dl on day 21 ($p < 0.01$). Similarly, PCV rose from $22.99 \pm 0.79\%$ to $33.17 \pm 0.59\%$ ($p < 0.01$), and TEC increased from $3.74 \pm 0.14 \times 10^6/\mu\text{l}$ to $6.42 \pm 0.25 \times 10^6/\mu\text{l}$ ($p < 0.01$). Similarly, Group II, which received homeopathic treatment which included *Ferrum metallicum* 6-10 drops 30C PO BID for 21 days, *Cobaltum metallicum* 6-10 drops 30C PO BID for 21 days, and *Cuprum metallicum* 6-10 drops 30C PO BID for 21 days, also showed significant improvements in haematological parameters, though with slightly different trends. Haemoglobin levels rose from 7.03 ± 0.36 g/dl at baseline to 10.11 ± 0.31 g/dl by day 21 ($p < 0.01$), and PCV increased from $20.74 \pm 1.13\%$ to $30.32 \pm 0.93\%$ ($p < 0.01$). The TEC levels followed a similar pattern, rising from $3.46 \pm 0.22 \times 10^6/\mu\text{l}$ to $6.18 \pm 0.34 \times 10^6/\mu\text{l}$ ($p < 0.01$). While the pattern of improvement was comparable between both groups, the overall rise in Hb, PCV, and TEC was significantly higher in the allopathic group, suggesting

improved iron utilization. Neutrophil and lymphocyte percentage variations in both groups indicated an improved immune response. Neutrophils significantly decreased in Group I (from $81.4 \pm 2.00\%$ to $68 \pm 0.76\%$, $p < 0.01$) and Group II (from $76.80 \pm 3.60\%$ to $66.40 \pm 0.50\%$, $p < 0.01$), while lymphocytes increased in both groups, indicating recovery. Although the changes in TLC and monocyte levels were not significant, eosinophils decreased in both groups.

Serum biochemical analysis further reinforced the efficacy of both treatments. In Group I, iron levels increased significantly from 55.47 ± 4.78 $\mu\text{g/dl}$ to 114.49 ± 6.18 $\mu\text{g/dl}$ ($p < 0.01$), while in Group II, iron levels improved from 52.21 ± 4.31 $\mu\text{g/dl}$ to 98.72 ± 5.89 $\mu\text{g/dl}$ ($p < 0.01$). The %TSAT also showed a highly significant increase in both groups, with Group I reaching $33.73 \pm 1.75\%$ and Group II reaching $30.11 \pm 1.92\%$ by day 21 ($p < 0.01$). Additionally, UIBC decreased significantly in both groups, confirming better iron absorption.

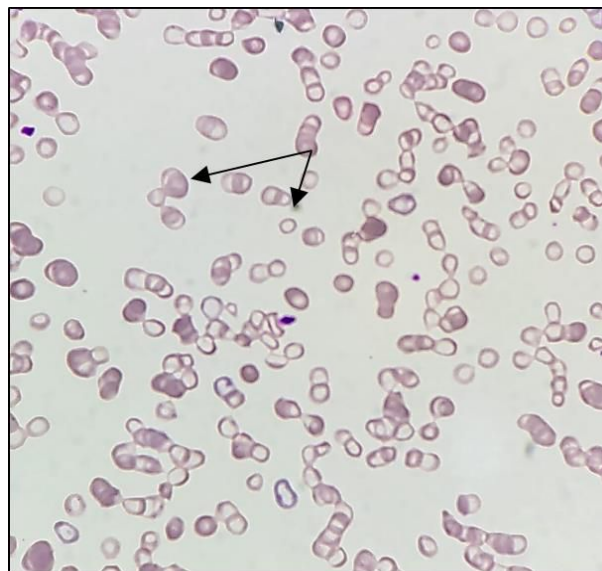


Plate 1: Microcytic hypochromic morphology in IDA- affected dog

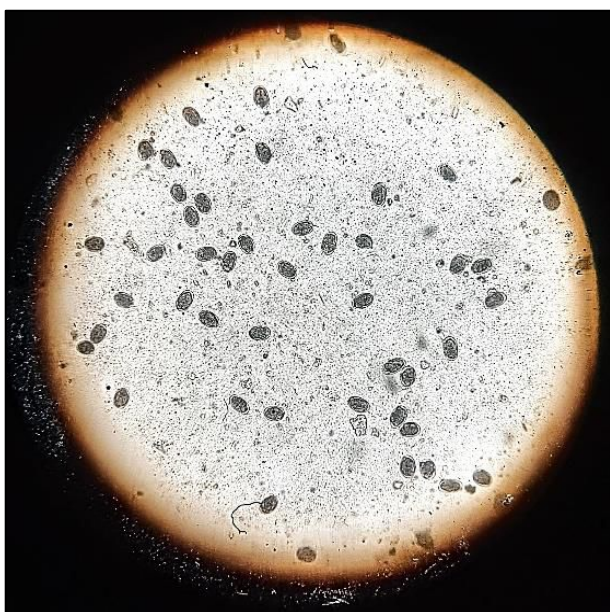


Plate 2: Severe *Ancylostoma caninum* infection in IDA- affected dog



Plate 3: Egg pockets of *Dipylidium* spp. infection in IDA- affected dog



Plate 4: *Toxocara* spp. infection in IDA- affected dog

Conclusion

Overall, both treatment approaches were effective in managing IDA, with significant improvements in haematological and biochemical parameters. The allopathic treatment demonstrated a slightly faster restoration in haemoglobin, PCV, and iron levels, suggesting rapid iron replenishment. On the other hand, the homeopathic regimen also produced substantial improvements, indicating enhanced iron utilization and erythropoiesis. The results suggest that while allopathy offers a more immediate correction, homeopathy can serve as a viable alternative with sustained benefits, potentially reducing dependency on synthetic iron supplementation.

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