EPIDEMIOLOGICAL AND HEMATOLOGICAL STUDIES OF ANAPLASMA SPP. IN SHEEP IN MIDDLE PARTS OF IRAQ.

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ABSTRACT

The present study was designed to identify *Anaplasma spp.* in sheep in middle of Iraq, since 632 local sheep breeds were randomly selected from (Baghdad, Babylon, Wasit, Najaf and Karbala) to examine. Results indicated that different *Anaplasma spp.* were identified: *Anaplasma marginale* 75 (11.86%) positive cases, *Anaplasma centrale* 45 (7.12%) positive cases and *Anaplasma ovis* 19 (3.01%) positive cases; as well as there were many cases of mixed infection distributed as *A. marginale* and *A. centrale* 15 (2.37%) cases, *A. marginale* and *A. ovis* 9 (1.42%), *A. centrale* and *A. ovis* 4 (0.63%) cases and there were 4 (0.63%) cases carried mixed infection with *A. marginale* , *A. centrale* and *A. ovis*. Results were also showed that infected animals show different clinical manifestation such as fever, change in pulse and respiratory rate, loss of appetite, emaciation, change in hematological parameters, further more anemia were of types macrocytic hypochromic which more predominant type followed by microcytic hypochromic and normocytic hypochromic respectively.

INTRODUCTION

Anaplasmosis is a disease caused by various species of Anaplasma poses important economic constraint to animals besides the costs of additional veterinary care, anaplasmosis causes abortion in animal/reduction in milk production and frequently lead to death (40).

Anaplasma spp. were obligated intracellular gram-negative bacteria and representative of the order Rickettsiaceae and anaplasmat families (10). Anaplasmosis of sheep and goat occurs in Africans, Mediterranean countries, Russia and United State (33).

Infection with pathogens were attributed to the genus *Anaplasma*, such as *Anaplasma centrale*, *Anaplasma marginale*, *Anaplasma platys*, *Anaplasma ovis* and *Anaplasma bovis*, and also the etiological factor of human and animals anaplasmosis, *Anaplasma phagocytophilum.* The disease was worldwide distributed and transmitted to animals by multiple ways, in depending on geographic location and management factors. The principal routs of infection were the presence of a carrier, which serve as

a reservoir, spread from host to host occurs chiefly by arthropods biological or mechanical vectors, multiple species of arthropods serve as vectors but ticks in the family Ixodidae and biting flies in the family Tabanidae were significant vectors (14). In general, affected animals show: transient fever at the peak of infection, weakness, lethargy and respiratory signs, especially post exercise, depression and loss of appetite and decreased milk yield as early symptoms of disease, mucous membrane of the sclera, vulva, and oral cavity became pale (anemic), then membranes

become yellow (jaundice) two or three days later, dead animals from anaplasmosis were generally highly anemic and jaundiced, thin watery blood splenomegaly, the liver may be mottled and yellow-orange in color, and the gall bladder was often enlarged and contains thick brown or green colored bile (35).

MATERIALS AND METHODS

The study include examination of 632 sheep (219 male and 413 female) from mixed breeds, ranges of age from less than 1 year to up to5 years, selected randomly from different areas of Baghdad, Babylon, Wasit Najaf and Karbala province/ Iraq, clinical signs and case history were collected for each animal in a special form prepared for this purpose; also physical examination of each animal (body temperature, pulse rate, respiratory rate) done. Blood samples were taken from jugular vein under a septic condition; each sample was collected into 2.5 ml anticoagulant tube (EDTA k3) for hematological analysis and blood smear staining by using Giemsa stain. A statistical program (SPSS 20.0) was used for statistical analysis. Means were subjected to the T - test and level of the significance at ($P < 0.05$) .

RESULTS AND DISCUSSION

Epidemiology

Results of examination of 632 local breed of sheep in middle parts of Iraq of different age and sex: in Baghdad 141 samples from all samples showed 38 (26.95%) were infected, Babylon; 138 samples, 31, (23.46%) samples infected, Wasit; 128 samples, 26, (20.31%) infected, Najaf; 117 samples, 21, (17.94%) infected and Karbala; 108 samples, 23, (21.29%) infected, the total number of infected cases were 139, (21.99%) (table 1).

Table (1) Percentage of infection with *Anaplasma spp.* according to governorates.

Age/ years	No. of samples	Infected	Percentage (%)
<1-3	155	26	16.77
3-5	251	47	18.72
>5	226	66	29.20
Total	632	139	21.99

The results showed insignificant differences between groups P>0.05 (X^2=2.5).

Percentage of infection according to age groups

The effect of age groups showed in table (4-3), the percentage of infection highest in sheep more than 5 years recorded 66, (29.20%), while 1 year to 3 years 26, (16.77%) positive cases, but at 3 years to 5 years 47, (18.72%) positive cases (table 2).

Table (2) Percentage of infection according to age groups.

Governorate	Number of samples	Infected	Percentage (%)
Baghdad	141	38	26.95
Babylon	138	31	23.46
Wasit	128	26	20.31
Najaf	117	21	17.94
Karbala	108	23	21.29
Total	632	139	21.99

The results showed significant differences between groups P<0.05 (X^2=8.22).

Diagnosis of Anaplasmosis

Physical examination

All sheep were examined clinically, the observed frequencies and percent of primary characteristic variable with comparison showed in table (3) animals that infected with *Anaplasma spp.* showed several clinical signs that were including fever 89 cases (64.02%) raged 40-41.2^{o}C, pale mucous membrane, loss of appetite, emaciation, constipation, dyspnea, decrease in milk yield, anemia and poor body conditions.

Table (3) Clinical signs of *Anaplasma spp.* infected sheep.

Signs	infected sheep		Non-infected sheep	
	No.	Average (mean ±SE)	No.	Average (mean ±SE)
Temperature (^{o}C)	139	40.2-41.2 (41.36 ±0.11)	80	38.5-40 (39.33 ±0.12)
Pulse rate (beat/minute)		82-98 (87.00 ±0.70)		70-90 (79.15 ±1.36)
Respiratory rate (rate/minute)		30-38 (34.00 ±0.60)		20-30 (24.85 ±0.72)

The vital clinical signs include increase pulse rate 82-98 beat/minute while normal average 70-90 beat/minute and increase in respiratory rate 30-38 rate/minute while the normal average 20-30 beat/minute table (4).

Table (4) Vital clinical signs of *Anaplasma spp*. infected sheep.

Signs	infected sheep		Non-infected sheep	
	No.	Average (mean ±SE)	No.	Average (mean ±SE)
Temperature (^{o}C)	139	40.2-41.2 (41.36 ±0.11)	80	38.5-40 (39.33 ±0.12)
Pulse rate (beat/minute)		82-98 (87.00 ±0.70)		70-90 (79.15 ±1.36)
Respiratory rate (rate/minute)		30-38 (34.00 ±0.60)		20-30 (24.85 ±0.72)

The systemic signs of clinically affected animals were observed in table (5) single infected animals with *A. marginale* the fever ranged from 40-40.8 (40.4 ±0.06) ^{o}C, respiratory rate 32-43 (36.95 ±0.74) rate/min, pulse rate from 76-94 (87.70 ±1.35) beat/min as well as pale mucous membrane, the results recorded high fever in animals infected with *A. centrale* at range from 39.1-40.3 (39.68 ±0.08) ^{o}C, respiratory rate 28-41(34.45 ±0.90) rate/min, pulse rate from 68-95 (79.55 ±1.77) beat/min and slightly pale mucous membrane, but *A. ovis* showed fever ranged from 39.1-40.1

(39.60 ±0.06) °C, respiratory rate 29-42 (35.85 ±0.84) rate/min, pulse rate from 70-91 (81.50 ±1.67) beat/min and slightly pale mucous membrane.

Sheep that carried mixed infection the results appeared as follow:

A. marginale and *A. centrale*: fever ranged 40.3-41.0 (40.68 ±0.05) °C, respiratory rate ranged 34.42 (37.65 ±0.56) rate/min, pulse rate ranged 77.93 (85.85 ±1.13) beat/min and the mucous membrane appeared pale; *A. marginale* and *A. ovis* fever ranged 40.2-40.9 (40.56 ±0.05) °C, respiratory rate 33-43 (37.65 ±0.71) Rate/min, pulse rate 74-92 (83.95 ±1.42) Beat/min and pale mucous membrane; *A. centrale* and *A. ovis* fever ranged 40.1-40.7 (40.40 ±0.04) °C, respiratory rate ranged 32-41 (36.95 ±0.65) rate/min, pulse rate ranged 69-92 (81.30 ±1.83) beat/min and the mucous membrane appeared slightly pale; *A. marginale*, *A. centrale* and *A. ovis* fever ranged 40.3-40.8 (40.56 ±0.04) °C, respiratory rate 34-43 (37.65 ±0.62) Rate/min, pulse rate 76-91 (83.70 ±1.12) Beat/min and pale mucous membrane.

Table (5) Range of vital clinical signs (temp, RR and PR) associated with *Anaplasma spp.* infection in sheep.

Type of infection	**No.**	**Species**	**Vital signs (range, mean and ±SE)**			
			Temperature °C	Respiratory rate Rate/min	Pulse rate Beat/min	Mucous membrane
Single	75	*A. marginale*	40-40.8 (40.4 ±0.06)	32-43 (36.95 ±0.74)	76-94 (87.70±1.35)	Pale
	45	*A. centrale*	39.1-40.3 (39.68 ±0.08)	28-41 (34.45 ±0.90)	68-95 (79.55±1.77)	Slightly pale
	19	*A. ovis*	39.1-40.1 (39.60 ±0.06)	29-42 (35.85 ±0.84)	70-91 (81.50 ±1.67)	Slightly pale
Mixed	15	*A. marginale* and *A. centrale*	40.3-41.0 (40.68 ±0.05)	34-42 (37.65 ±0.56)	77-93 (85.85 ±1.13)	Pale
	9	*A. marginale* and *A. ovis*	40.2- 40.9 (40.56 ±0.05)	33-43 (37.65 ±0.71)	74-92 (83.95±1.42)	Pale
	4	*A. centrale* and *A. ovis*	40.1- 40.7 (40.40 ±0.04)	32-41 (36.95 ±0.65)	69-92 (81.30 ±1.83)	Slightly pale
	4	*A. marginale, A. centrale* and *A. ovis*	40.3- 40.8 (40.56 ±0.04)	34-43 (37.90 ±0.62)	76-91 (83.70 ±1.12)	Pale

Hematological parameters of *Anaplasma* spp. infected sheep.

The results of hematology showed significant differences between infected and non-infected sheep (table 6) (mean ± SE) as follows:

Table (6) Hematological parameters of infected sheep with *Anaplasma spp.* compared with non-infected sheep.

State	Hematological parameters (Mean ±SE)					
	PCV %	Hb g/ dL	RBC 10^6/ml	MCV fl	MCH pg	MCHC g/dL
Infected	29.92 ± 0.43 B	7.96 ± 0.14 B	5.77 ± 0.11 B	52.45 ± 0.70 A	14.10 ± 0.35 A	26.85 ± 0.53 B
Non-infected	32.96 ± 0.71 A	11.27 ± 0.37 A	9.37 ± 0.27 A	35.28 ± 0.43 B	12.22 ± 0.30 B	34.08 ± 0.59 A

The different letters refers to significant differences at level P< 0.05

Also the results of hematological values showed significant differences between age groups as follows (table 7):

Table (7) Hematological parameters of infected animals according to age.

Age	Hematological parameters (Mean and ±SE)					
	PCV %	Hb g/ dL	RBC 10^6/ml	MCV Fl	MCH pg	MCHC g/dL
<1-3	32.96 ± 0.71 A	11.27 ± 0.37 A	9.37 ± 0.27 A	35.28 ± 0.43 C	12.22 ± 0.30 B	34.08 ± 0.59 A
3-5	31.78 ± 0.77 A	8.43 ± 0.22 A	5.96 ± 0.18 C	53.70 ± 1.10 A	14.34 ± 0.52 A	26.74 ± 0.85 B
>5	29.46 ± 0.84 B	7.52 ± 0.26 B	6.00 ± 0.21 B	49.58 ± 1.12 B	12.66 ± 0.43 B	25.67 ± 0.79 C

The different letters refers to significant differences at level P< 0.05

While the results also showed significant differences between *Anaplasma spp.* the results as follow (table 8):

Type of infection	Species	No.	Hematological parameters (Mean ±SE)					
			PCV %	Hb g/ dL	RBC 10^6/ml	MCV fl	MCH pg	MCHC g/dL
Single	*A. marginale*	75	30.64 ± 0.89 B	7.36 ±1.22 B	6.25 ± 0.84 C	49.25 ± 0.98 A	11.81 ± 0.35 B	24.18 ± 0.81 B
	A. centrale	45	31.94 ± 0.68 A	11.27 ±1.66 A	9.37 ± 1.21 A	34.42 ± 0.41 C	11.71 ± 0.30 A	35.38 ± 0.59 A
	A. ovis	19	33.18 ± 0.69 A	11.43 ±1.54 A	9.44 ±1.22 A	35.29 ±0.45 C	12.13 ±0.26 A	34.31 ± 0.54 A

Mixed	*A. marginale* and *A. centrale*	15	30.61 ±0.71 B	9.39 ±0.47 C	7.48 ±0.33 B	41.04 ±0.79 B	12.67 ±0.44	30.88 ± 0.68
	A. marginale and *A. ovis*	9	33.09 ±0.89 A	9.62 ±0.56 C	8.19 ±0.50 B	40.79 ±1.7 B	11.81 ±0.76	29.18 ±0.83
	A. centrale and *A. ovis*	4	33.08 ±0.68	10.96 ±0.27	9.00 ±0.05	36.67 ±0.35	12.38 ±1.02	33.13 ±0.74
	A. marginale, A. centrale and *A. ovis*	4	31.72 ±0.56	9.93 ±0.47	8.10 ±0.50	39.61 ±0.73	11.59 ±0.82	29.71 ±0.60

Table (8) Hematological parameters of *Anaplasma spp.* infected sheep according to species.

The different letters refers to significant differences at level P< 0.05

Anemia

Most cases of Anaplasmosis related with anemia in infected animals, the predominant type of anemia which were macrocytic hypochromic 115 cases, in second degree microcytic hypochromic 21 cases and the minimum type of anemia which were normocytic hypochromic 12 cases.

Most cases of single infection with *A. marginale* showed anemia of type macrocytic hypochromic 48 cases, while microcytic hypochromic and normocytic hypochromic which were 6 and 7 cases respectively.

Single infection with *A. centrale* showed anemia of type macrocytic hypochromic 34 cases, microcytic hypochromic 5 cases and normocytic hypochromic 3 cases.

Single infected sheep with *A. ovis* showed cases of anemia of type macrocytic hypochromic 19 cases, microcytic hypochromic 3 cases and normocytic hypochromic 0 cases.

There was several cases carried mixed infection with *Anaplasma spp.* the results appeared as follow:

A. marginale and *A. centrale* macrocytic hypochromic 7 cases, microcytic hypochromic and normocytic hypochromic 2 and 1 cases respectively; *A. marginale* and *A. ovis* macrocytic hypochromic 3 cases, microcytic hypochromic 3 cases and normocytic hypochromic 0 cases; *A. centrale* and *A. ovis* macrocytic hypochromic 1 cases, microcytic hypochromic 2 cases and normocytic hypochromic 1 cases; *A. marginale*, *A. centrale* and *A. ovis* macrocytic hypochromic 3 cases, microcytic hypochromic and normocytic hypochromic 0 cases (table 9).

Table (9) Morphological classification of anemia during infection with *Anaplasma* spp.

Type of infection	Species	No.	Types of anemia		
			Microcytic hypochromic	Macrocytic hypochromic	Normocytic hypochromic
Single	*A. marginale*	75	6	48	7
	A. centrale	45	5	34	3
	A. ovis	19	3	19	0
Mixed	*A. marginale* and *A. centrale*	15	2	7	1
	A. marginale and *A. ovis*	9	3	3	0
	A. centrale and *A. ovis*	4	2	1	1
	A. marginale, *A. centrale* and *A. ovis*	4	0	3	0

Discussion

Epidemiology

This study considered the first report about epidemiology of *Anaplasma spp.* infection in middle of Iraqi sheep, the disease was one of the most prevalent tick-borne diseases worldwide. It spread from temperate to tropical regions (15). It was important issue of intensive animal industry causes significant magnitude of economic losses. Apart from the costs of veterinary care, the disease substantially reduces productivity even in chronic infection (15). The differences in the infection rate with *Anaplasma* spp. From area to area may be affected by many factors like climatic condition, seasonal variation of tick vectors and of hematophagous flies, susceptibility of breeds, and distribution of vector, system of breeding, vaccination, and strategy of prophylactic and treatment methods (36).

The results revealed percentage of infection in Baghdad city (26.95%) was the higher in percent of infection than other cities this may be due to the animals undergo from stress such as environmental stresses, overcrowding, starvation, and other management problem, or may be due to mixed living of different animal species that were facilitate the transmission of ticks between animals which were lead to transmission of disease.

Percentage of infection according to age groups

The age group more than 5 years showed the highest percentage of infection may be due to the immune status of animals was depressed resulted from the progressive in age and infection with diseases that may predisposed to *Anaplasma spp.* infection and repeated pregnancy and mixing with other animals species that act vector to diseases, also infestation with blood suckling ticks that all lead to infection with *Anaplasma*

spp. this agreed with (23) and disagreed with (20). While the age group >1-3 years showed the lowest percentage of infection (16.77%) it may due to the residual effect of maternal antibodies that were received from his dam that were prevent it from infection with *Anaplasma spp.* this agreed with (6); also in this age group the animals do not sufficiently exposed to factors that may cause immune depression like repeated pregnancy and milk production also the immune system able to protect animal from infection and this agreed with (32).

Diagnosis of Anaplasmosis

Physical examination

Anaplasmosis was usually subclinical or in some cases mild condition; moderate to severe clinical disease must be occurred accompanied with fever and variable degree of anemia and icterus (39).

The absence of clinical signs doesn't mean absence of infection this may be due to the carrier state of the sheep, this explain the extremely high prevalence of ovine anaplasmosis (17, 3).

The severity of clinical signs may depend on the severity of the infection, infective dose and willingness of sheep to infection.

Dyspnea may be attributed to presence of anemia and related decrease in oxygen transport capacity of the blood and physiologic adjustment to increase the efficiency of the erythron and reduce the workload on the heart (11, 8, 44)**.** In acute cases, fever, dullness, depression, lack of appetite, decrease of milk production, stop rumination, constipation as well as paleness of mucous membranes and general weakness were mentioned by other investigators in different countries of the world (45). Whereas, emaciation, severe weakness, decreases milk production, pale mucous membranes and normal body temperature were prevalent signs for persistently infected cases or carriers (21; 44).

Paleness of mucus membranes occurred as a results of decrease in PCV, RBCs and Hb (37).

The elevation in body temperature may be associated with peak level of rickettsemia and anemia, where a transient febrile response occurs concurrently with increased pulse and respiratory rate (21), the febrile crisis may be a result of pyrogens releasing from destruction of white blood cells, these pyrogens effect on the hypothalamus, causing elevation of the body temperature, the elevation of body temperature causes increasing in respiratory rate, while the increasing in pulse rate resulting from anemia and dehydration, furthermore, the increased respiratory rate may be attributed to hypoxemia and subsequent tissue hypoxia , anemia is usually accompanied by increase cardiac output, pulse rate and respiratory rate (44). These

signs may also be affected by several factors including stress, environment, species, age, sex, pregnancy, lactation and trace mineral deficient diet (21, 44; 30).

Hematological parameters associated with Anaplasma spp. infection in sheep

Hematological analysis of sheep blood samples revealed significant decreasing in RBCs count, PCV values, and Hb concentrations as well as MCHC values between infected and non-infected sheep with *Anaplasma spp*. MCV and MCH were also significantly higher in infected group compared with non-infected group, these indices referred to development of macrocytic hypochromic anemia in infected animals due to regenerative response (27).

(43) investigated the hematological and clinical effects of experimental ovine Anaplasmosis infection, finding revealed marked normocytic normochromic anemia at the beginning of the experiment, then became macrocytic hypochromic with the development of disease with reticulocytosis and basophilic stippling in the animals of experiment.

There were negative relationship between parasitemias and RBCs, PCV, and Hb values.

In a research conducted by (1) he reported the hematological analysis of Anaplasmosis infected sheep and goats showed a significant decreases in RBCs count, PCV values and Hb concentration when compared with non-infected group; these results agreed with results of our study.

The reasons of decreasing in RBCs counting, PCV values and Hb concentration may attributed to erythrophagocytosis in lymph nodes, spleen and other organs of monocyte-macrophage system, also may be due to immune mediated hemolysis and oxidative damage to erythrocytes were also possible mechanism (25, 29).

In experimentally anaplasmosis infected sheep there were development of a febrile response and reduction in Hb concentration and RBCs count were observed (45).

PCV values was an accurate, practical evaluation of RBC status, it was provide a simple quick and accurate means of detecting blood parameters and anemia which considered the most important feature of tick-borne diseases (18).

(42) concluded the mean values of PCV, RBCs and Hb concentration were significantly decreased in Anaplasmosis infected animals compared with healthy animals and attributed the cause to immune-mediated destruction of non-parasitized erythrocytes besides parasitized erythrocytes.

Anemia

These results were similar to many researchers reported in Iraq and other countries, different types of anemia had been described as a result of anaplasmosis (41, 5, 13, 29, 9).

Anemia was usually classified according to size (MCV) and Hb concentration (MCHC) of the erythrocytes (16).

Anemia occurred as a result of phagocytosis of infected RBC to removal parasites during the period of rising parasitemias, hemoglobinuria was unusual signs of Anaplasmosis, because anemia resulted from extravascular opsonization and phagocytosis of parasitized erythrocytes by reticuloendothelial cells (4).

The severity of anemia may be as a result of immune-mediated destruction of non-parasitized RBCs in addition to parasitized RBCs (39).

Severity of anemia increased when the severity of parasitemia increased and effected by individual characteristics and defense system of animals (29).

Anaplasmosis was characterized by a progressive hemolytic anemia which considered one of the most important diseases of ruminant worldwide, leading to high economical losses in tropical and subtropical areas (22).

Hemolytic anemia associated with fever, weight loss, abortion, decrease milk yield and in some cases death of the infected animals (31, 2).

Extravascular hemolytic anemia is the key sign of *Anaplasma spp.* infection (24). Anemia results due to phagocytosis of parasitized erythrocytes in spleen and bone marrow (18). Usually intravascular and extravascular hemolysis takes place simultaneously, along with the destruction of parasitized erythrocytes the destruction of non-parasitized erythrocytes also takes place due to immune mediated autolysis, antibodies were produced against *Anaplasma spp.* antigen infected RBCs as well as against its non-infected red blood cells (34).

Increased MCV and decrease of MCHC is usually the indication of regenerative anemia, the MCV was found higher in infected as compared to healthy control sheep, the decrease of MCHC and increase of MCV was noticed as compared to healthy controls in both breeds; this classify the anemia as hypochromic and macrocytic, the increase in MCV was usually the indication of regenerative anemia; after rapid destruction of RBCs by phagocytosis the immature RBCs were released from bone marrow due to increase demand, the immature RBCs larger in size than mature red blood cells explain the reason for increased MCV (34).

دراسة وبائيه و دمويه للاصابه بالانابلازما في الاغنام في وسط العراق

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الخلاصة

أجريت هذه الدراسة لتحديد نسبة الاصابة بجرثومة الأنابلازما في الاغنام في وسط العراق حيث تم جمع 632 عينة دم من الاغنام المحلية عشوائياً من محافظات (بغداد، بابل، واسط، النجف الاشرف وكربلاء المقدسة) حيث اظهرت النتائج وجود عدة انواع من جرثومة الأنابلازما. حيث كانت نسبة الاصابة باستخدام المسحة الدموية: الأنابلازما الهامشية 75 (11.86%) حالة، الأنابلازما المركزية 45(7.12%) حالة والأنابلازما الغنمية 19(3.01%) حالة مصابة. وكذلك هناك عدة حالات من الاصابة المشتركةبنوعين او اكثر من جرثومة الأنابلازما موزعة كالأتي: الأنابلازما الهامشية والأنابلازما المركزية 15(2.37%) حالة، الأنابلازما الهامشية والأنابلازما الغنمية 9(1.42%) حالة، الأنابلازما المركزية والأنابلازما الغنمية 4(0.63%) حالة والأنابلازما الهامشية والأنابلازما المركزية و الأنابلازما الغنمية 4(0.63%) حالة. واظهرت النتائج علامات سريرية على الحيوانات المصابة كالأتي: ارتفاع درجة الحرارة، تغيرات في معدلات النبض والتنفس، فقدان الشهية، هزال، تغيرات في الصورة الدموية وبالأضافة الى حالات فقر الدم من نوع ناقص الانصباغ الكبير الكريات وهو النوع الاكثر حدوثاً يليها الصغير الكرية منقوص الصبغة وسوي الكريات منقوص الصبغة على التوالي.

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