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Study of serum concentrations of ferous, phsphourus and cobalt in cows with theilleriosis

Bakhshi, D.[1], Ali Hassanpour[2*] and Rahmani Kahnamoie, J.[2]

[1]*Student of veterinary medicine, Faculty of Veterinary Medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran*
[2]*Department of Clinical Sciences, Faculty of Veterinary Medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran*

ABSTRACT

Theileriosis is a common protozoan disease in cattle that affects a large population of cattle in the region annually. The present study was conducted in order to investigate of serum iron, phosphorous, cobalt levels of infected cows. 41 infected cows were identified based on laboratory and clinical signs at the large livestock clinic of a Tabriz Islamic Azad university, veterinary college. The blood sample was obtained from any cow's jugular vein followed by serum isolation. Simultaneously, 30 cattle of identical situation about age, feeding and management (with those 40 cattle) were sampled. Serum cobalt levels were measured using the atomic absorption method and the levels of phosphorous and iron were measured by means of Pars Azmoon biochemical kits. The mean level of iron in affected cattle was lower meaningfully compared with healthy cattle (p= 0.000). The mean rate of serum cobalt in affected cattle was meaningfully higher compared with healthy cattle (p= 0.001), but the increase of serum phosphorus was not significant in affected cattle (p = 0.632). There was not any relationship between age and iron, phosphorous, cobalt levels of affected cattle. Based on the percentage of affected animals' blood hematocrit, serum level of phosphorus and cobalt didn't change significantly but the serum iron decreased with the decrease of hematocrit percentage and the mean difference of serum iron in affected cattle was significant based on the percentage of hematocrit (p=0.030). We concluded that in Theileriosic cattle the serum levels of iron, phosphorous, cobalt were high. Regarding to the occurrence of anaemia in affected cattle and the role of iron in hematogenesis and the immune system as well as the main role of the phosphorous and cobalt, the use of complements containing the three elements orally or as an injection form of affected cattle is recommended.

Keywords: cow, Theileriosis, iron, phosphorous, cobalt

INTRODUCTION

Theilleriosis is a protozoan disease that is common in ruminants which imposes much economic losses in the farm animals. Cattle are one of the susceptible hosts to the disease and the occurrence of the disease in cattle in our area is abundant. The disease create many changes biochemically and hematologically. The role of selenium and vitamin E has been proposed as antioxidants since long time and the use of supplements containing selenium can serve a protective role in animal. On the other hand, zinc is one of the trace elements for animal which must be provided for them in their diet. The role of the element in the structure of various enzymes like lipase, super oxide dismutase, alkaline phosphatase, and etc is very important[1,2]. The role of zinc in protecting the insulin molecule, keratogenesis, protecting from stress complications, preventing the effect of testis degenerans, strengthening the immune system, and Enhance fertility of animals has been identified. The role of copper is proposed in the activity of super oxide dismutase and cytochrome oxidase enzymes, as well as in myelin synthesis and keratinisation [3,4,5,6]. Theilleriosis imposes many biochemical changes which have been discussed more or less at previous

studies. Also, it seems that the affected animals have low elemental serum levels because of anorexia [7,8]. The present study has been conducted in order to examine the serum levels of zinc, copper, and selenium of affected cattle and its comparison with healthy animals.

MATERIALS AND METHODS

The present study was conducted on 41 affected cattle by theilleriosis at the large animal clinic of Islamic Azad University's veterinary board. The affected cattle were identified based on laboratory and clinical symptoms (blood sample from ear vein and lymph node puncture). After obtaining a history of the cattle blood samples were taken from the jugular vein, and serum was isolated. Simultaneously, 30 cows at the same conditions of age, feeding and management were sampled as controls.

Infected cattle were divided into 6 age-groups; 1 year old (n = 4), 2 years old (n = 6), 3 years old (n = 9), 4 years old (n = 9), 5 years (n = 7) and over 5 years old (n=6). Infected cattle were divided into three groups based on parasitemia; +1 (n = 11), +2 (20), and +3 (n = 10) groups. Infected cattle were divided into 5 groups based on PCV percent; under 15% (n = 3), 15-20% (n = 10), 20-25% (n = 10), 25-30% (n = 11) and over 30% (N = 7).

Analysis method

SPSS software was used for data analysis, T-test was used for comparison between infected and healthy groups, ANOVA was used to compare the means in infected group and among different groups according to age, parasitemia and percent of PCV, and Correlation was used to determine the relationship between parameters.

RESULTS

The mean serum iron in cows with Theilleriosis (n=41) and in the control group (n=30) was 108.06 ± 1.82 µg / dl and 124.87 ± 2.47 µg / dl, that the mean difference between the two groups was significant (P =0. 000) (Table 1 and diagram 1).

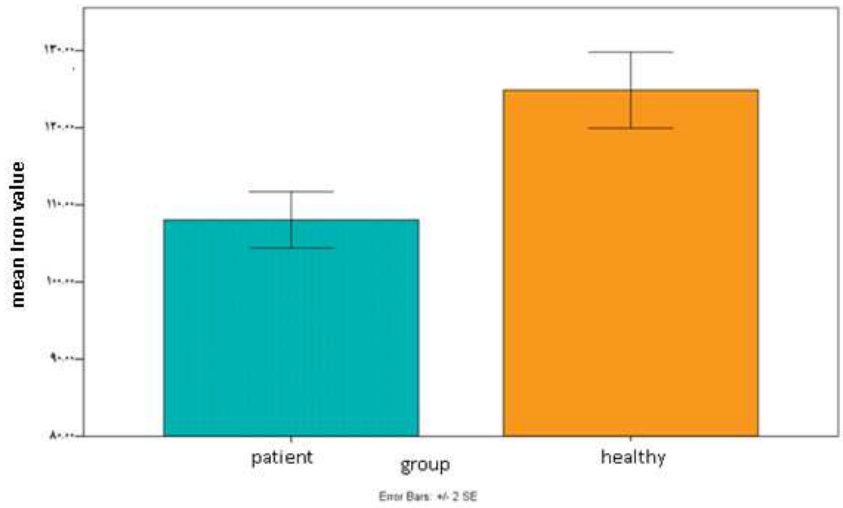

Diagram 1 - Mean serum iron levels in two groups of infected and healthy cattle

Mean serum phosphorus levels in infected cattle were non-significantly greater than control group (p=0. 632), so that these values were 5.51 ± 0.14 mg / dl and 5.37 ± 0.24 mg / dl, respectively. (Table 1 and Diagram 2).

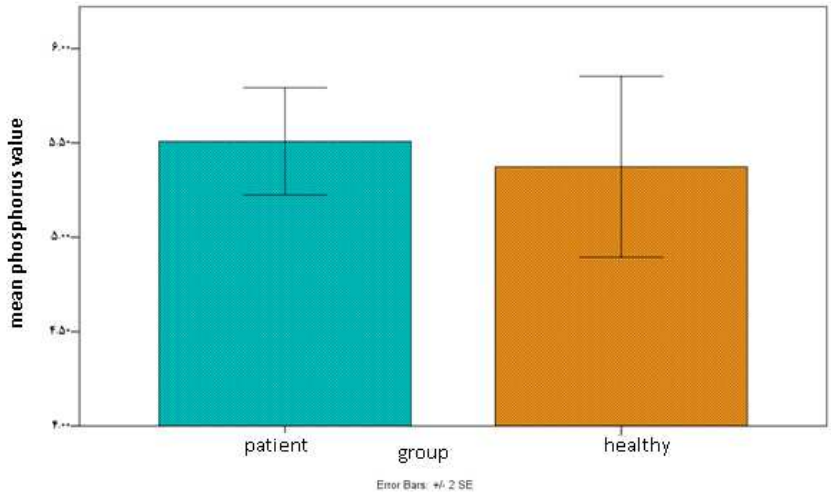

Diagram 2 - Mean serum phosphorus levels in the infected and healthy groups

The mean serum cobalt levels in infected and control groups were 1.43 ± 0.07 µg/dI and 0.94 ± 0.08, respectively. The mean difference of serum cobalt showed no significant difference between the two groups (p =0. 001) (Table 1 and Diagram 3).

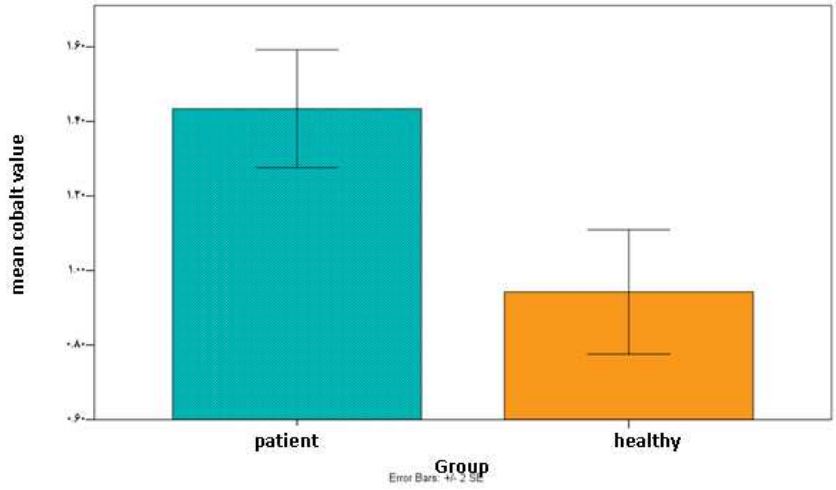

Diagram 3 - Mean cobalt levels in the infected and healthy groups

Table 1 – the comparison of the mean value of serum iron, phosphorus, and cobalt in cattle with Theilleriosis and control group.

Serum parameter	Group	Number	Mean	S.D	P value
Iron (µg/dl)	Patient healthy	41 30	108.06 124.87	1.82 2.47	0.000
Phosphorus (mg/dl)	Patient healthy	41 30	5.51 5.37	0.14 0.24	0.632
Cobalt(µg/dl)	Patient healthy	41 30	1.43 0.94	0.07 0.08	0.001

Infected cattle were divided into 6 age-groups; 1 year old (n = 4), 2 years old (n = 6), 3 years old (n = 9), 4 years old (n = 9), 5 years (n = 7) and over 5 years old (n=6) in which the mean serum Iron was 116.17±7.91, 95.50±3.08, 104.93±3.117, 103.09±2.89, 105.77±4.73, and 108.01±4.49, respectively. The difference among six age-groups was not significant (p=0. 126) (Diagram 4 and Table 2).

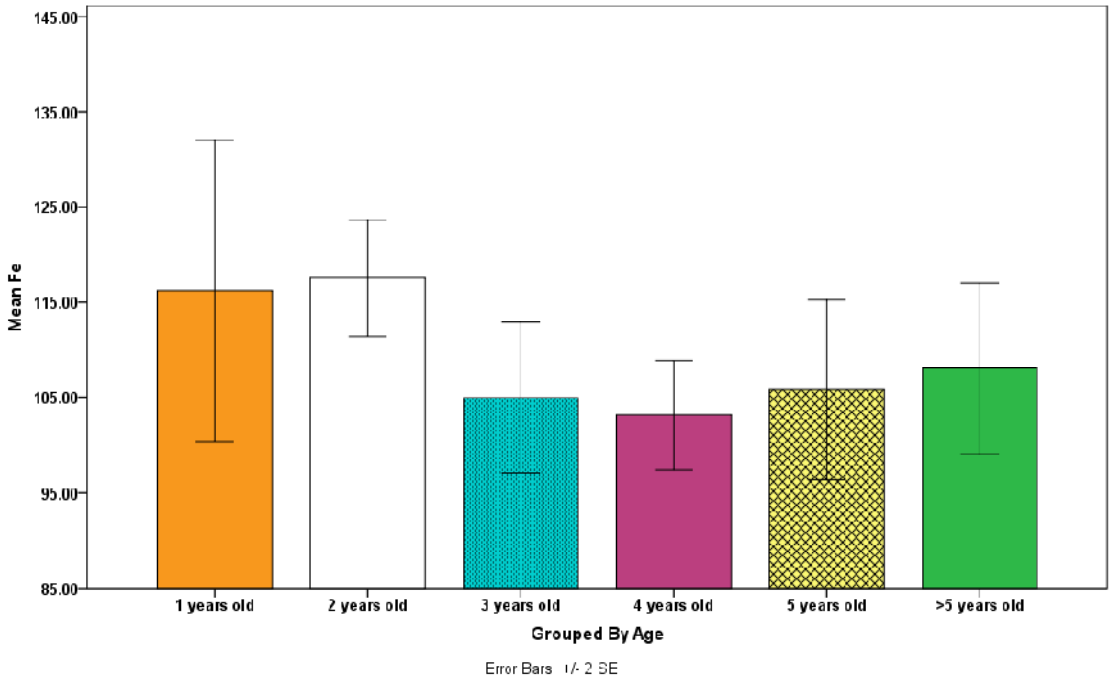

Diagram 4 - Mean levels of iron of infected cattle in different age groups

Mean serum phosphorus levels among different age-groups of infected cattle had not a significant change (p =0.531), so that the mean in 1 year old , 2, 3, 4, 5 years old and over 5 years old was 5.19±0.45, 5.38±0.14, 5.73±0.26, 5.92±0.35, 5.27±0.47, and5.16±0.33, respectively (Diagram 5 and Table 2).

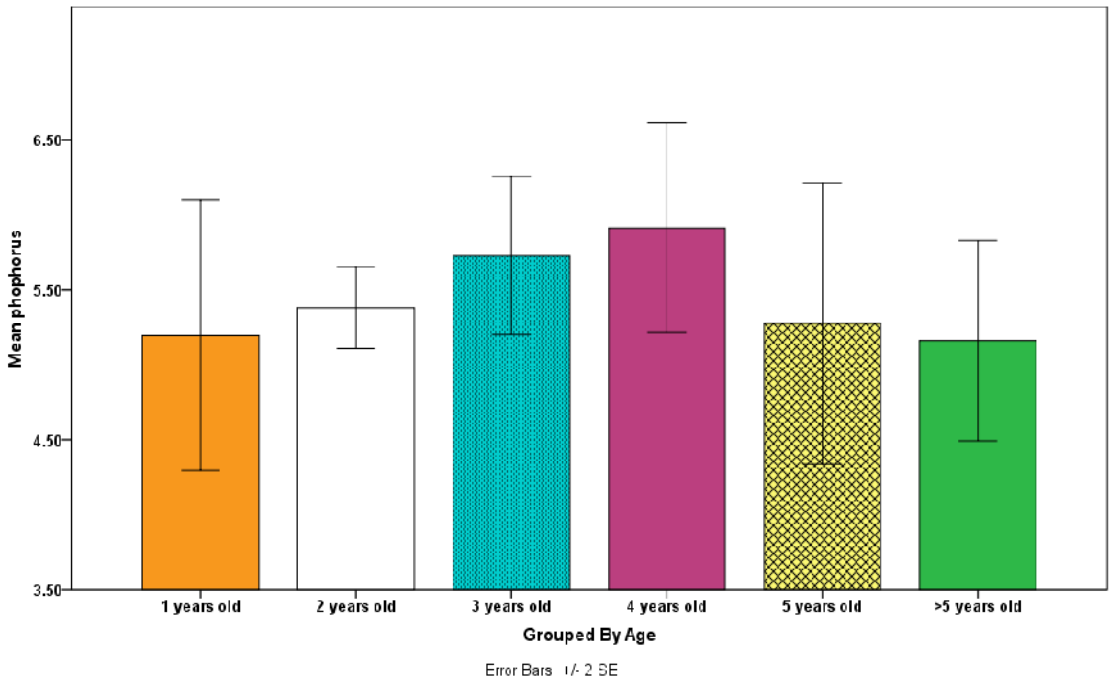

Diagram 5 - Mean levels of phosphorus of infected cattle in different age groups

In infected group, the mean serum cobalt in different age groups was 1.25± 0.24, 1.47±0.19, 1.37±0.18, 1.48±0.18, and 1.43±0.08 µg/dl that the mean difference between age groups was not significant (p= 0.948) (Diagram 6 and Table 2).

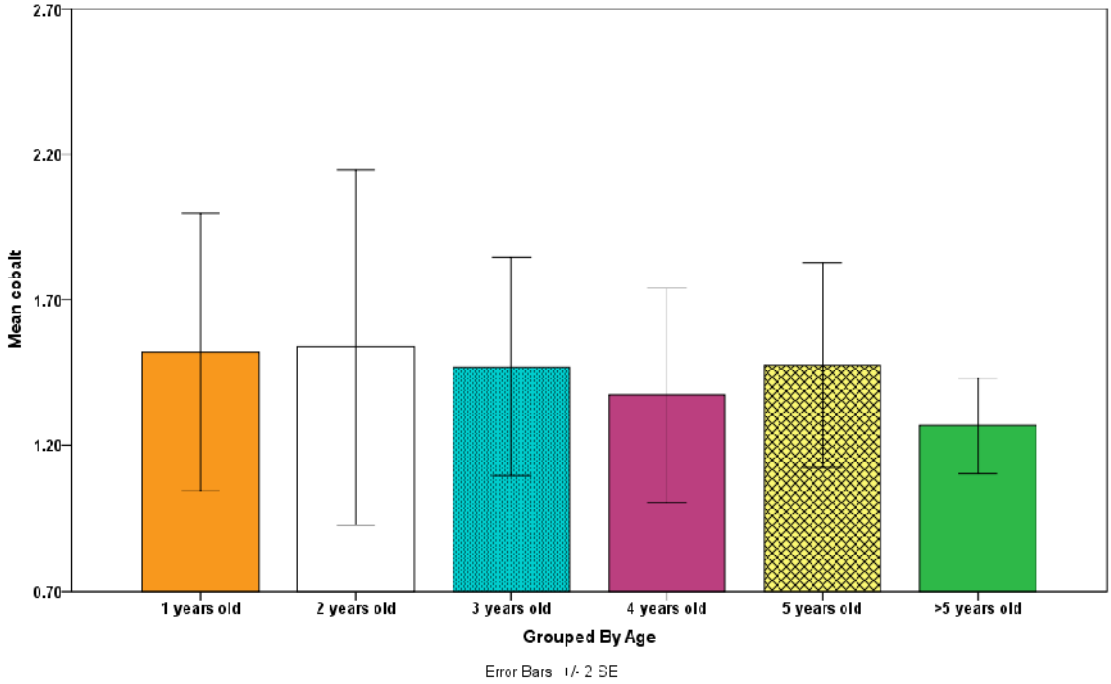

Diagram 6 - Mean levels of cobalt of infected cattle in different age groups

Table 2 - Comparison of mean serum iron, phosphorus, and cobalt in infected cattle with the separation of different age groups

Serum parameter	Group	Number	Mean	S.D	P value
Iron (µg/dl)	1	4	116.17	7.91	0.126
	2	6	117.50	3.08	
	3	9	104.93	3.95	
	4	9	103.09	2.89	
	5	7	105.77	4.73	
	Over5years old	6	108.01	4.49	
Phosphorus (mg/dl)	1	4	5.19	0.45	0.531
	2	6	5.38	0.14	
	3	9	5.73	0.26	
	4	9	5.92	0.35	
	5	7	5.27	0.47	
	Over5years old	6	5.16	0.33	
Cobalt(µg/dl)	1	4	1.52	0.24	0.948
	2	6	1.54	0.31	
	3	9	1.47	0.18	
	4	9	1.37	0.18	
	5	7	1.26	0.18	
	Over5years old	6	1.43	0.08	

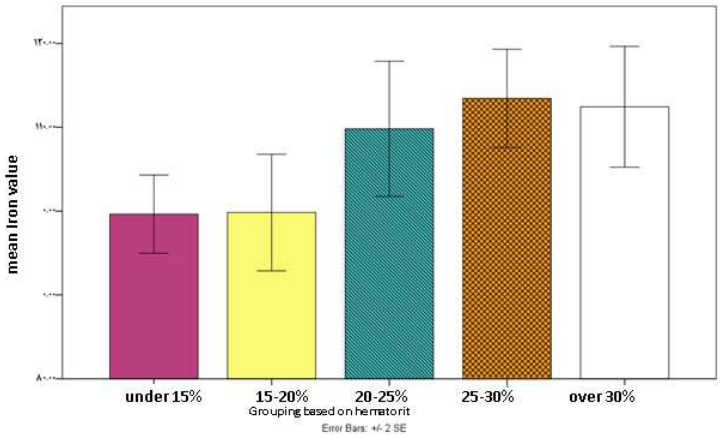

Diagram 7 - The mean serum levels of iron in infected cattle based on hematocrit percent

Infected cattle were divided into 5 groups based on PCV percent; under 15% (n = 3), 15-20% (n = 10), 20-25% (n = 10), 25-30% (n = 11) and over 30% (N = 7). The mean serum iron levels in the five groups was 99.64±2.33,

99.83±3.48, 9.82±4.03, 113.44±2.93, and 112.44±3.60 µg/dl, respectively, which was a significant mean difference among the five groups (p=0. 030) (Diagram 7 and Table 3).

Mean serum phosphorus levels among different groups of infected cattle based on hematocrit, did not change significantly (p=0. 404), so that the mean was 6.10±0.52, 5.52±0.31, 5.07±0.26, 5.60±0.23, and 5.72±0.42 mg/dl respectively in 1st, 2nd, 3rd, 4th, and 5th groups (Diagram 8 and Table 3).

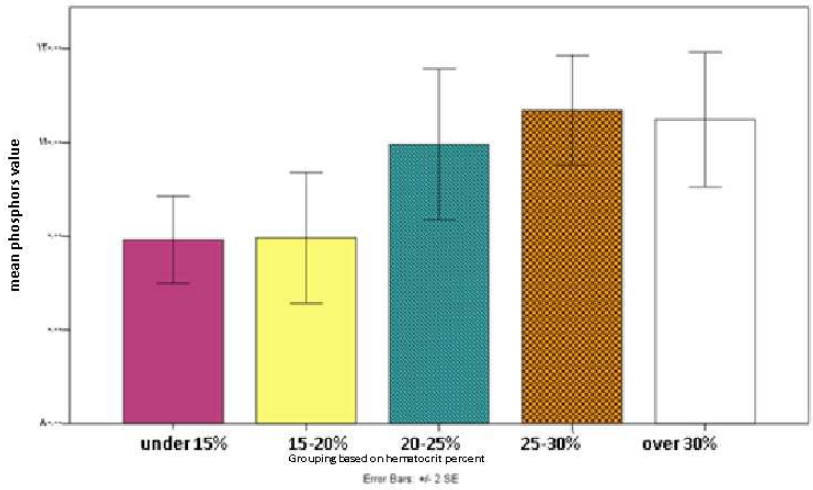

Diagram 8 - Mean serum phosphorus levels in infected cattle based on hematocrit

The mean serum cobalt in different infected groups based on the percent of hematocrit was 1.98±0.24, 1.59±0.24, 1.26±0.08, 1.45±0.12, and 1.20±0.14 µg/deal that the mean difference among groups was not significant (p=0. 131) (Diagram 9 and Table 3).

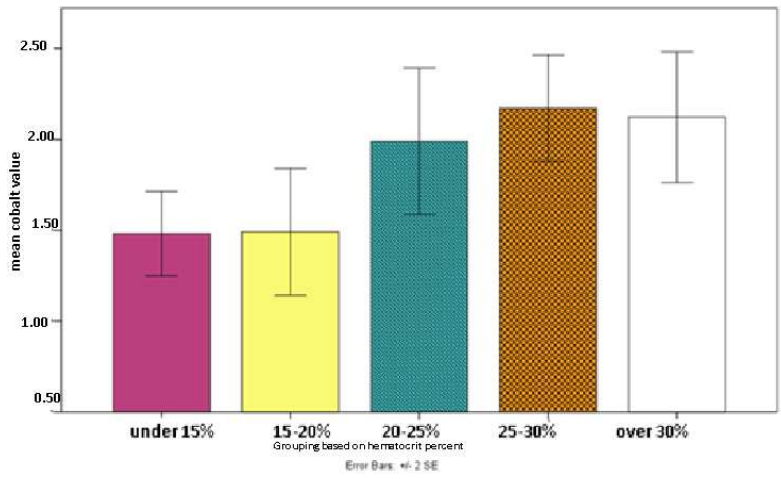

Diagram 9 - Mean serum levels of cobalt in infected cattle based on hematocrit percent

Table 3 - Comparison of mean serum iron, cobalt, phosphorus in infected cattle based on hematocrit percent

Serum parameter	Group	Number	Mean	S.D	P value
Iron (µg/dl)	Under 15%	3	99.64	2.33	0.030
	20%-15+	10	99.83	3.48	
	25%-20+	10	109.82	4.03	
	30%-25	11	113.44	2.93	
	Above 30%	7	112.44	3.60	
Phosphorus (mg/dl)	Under 15%	3	6.10	0.52	0.404
	20%-15+	10	5.52	0.31	
	25%-20+	10	5.07	0.26	
	30%-25	11	0.60	0.23	
	Above 30%	7	5.72	0.42	
Cobalt(µg/dl)	Under 15%	3	1.98	0.24	0.131
	20%-15+	10	1.59	0.24	
	25%-20+	10	1.26	0.08	
	30%-25	11	1.45	0.12	
	Above 30%	7	1.20	0.14	

DISCUSSION AND CONCLUSION

Based on the results of the experiments it was shown that serum iron values are reduced but serum phosphorus and cobalt are increased in theilleriosis. It was found that the mean serum iron was significantly lower in cows with theilleriosis compared with healthy cows (p=0.000). Also, the mean serum levels of infected cows were significantly higher compared with healthy one (p=0.001) but the increase of serum phosphorus was not significant in patient animals.

The deficiencies of trace elements in infectious or parasitic diseases often represent some complex interactions [8]. Especially copper, zinc, and iron participating in important structural biochemical functions are components of enzyme catalysts [9]. It has been shown that these intracellular factors are involved in the activation of immune cells and their deficiency increases the risk of contagion and mortality risks as a result of viral, bacterial and parasitic infections [4]. Micronutrient decrease may be due to increased metabolism or intake, decreased food intake due to anorexia or fatigue, stress or hypothermia. Moreover, the body quickly losses significant amounts of zinc and iron during the acute phase of an infectious disease [8]. In Theileria Annulata infection the body loses essential trace elements indirectly, which can be due to their excretion, or increased metabolism [9]. It has been shown that during illness the blood flow deviates from heat rejection of tissues (e.g. Skin) to heat producing tissues (such as muscle) that results in increased cardiac output. This phenomenon is as a part of the nonspecific defense mechanism of the organism against infection. So, the reduction of trace elements during the disease can be due to the re-release of these metals in the reticuloendothelial system [10]. Also, several studies have shown that iron and zinc levels were reduced in anemia [11,12]. Chhabra and Arora (1993) stated that Hypochromic macrocytic anemia was seen in goats' zinc deficiency [13].

Yadav and Sharma (1986), Sandhu et al (1998) and Col and Uslu (2007) were observed the reduction of serum calcium in cows with Theilleriosis [14, 15, 5]. Hussein et al (1997), Kumar et al (1999), Omer et al (2003) and Col and Uslu (2007) found a significant iron decrease and Watanabe et al (1998) recorded a mild increase in infected cows [16, 10, 3, 5, 17]. The significant serum iron reduction can be due to anemia that leads to excess use of iron in order to hematopoietic process [16].

Serum copper levels in patients with liver fibrosis imposed by hepatitis B virus have been reported more than healthy subjects [18, 19]. In pneumonia calves low serum zinc and copper levels has been expressed [20]. The results of our study are somewhat consistent with those studies. In a study the feeding of pregnant mares using supplements containing copper, zinc, iron, manganese, cobalt, iodine and selenium increased blood levels of these elements followed by an increase in their milk concentration. The study also found that foals born by these mares had high serum levels of iron, zinc, copper and cobalt [21]. In a study in Brazil conducted on Brazilian water buffalo with infectious diseases the serum copper, phosphorus, cobalt and zinc were measured and a significant increase in serum copper and zinc was reported, but cobalt and phosphorus levels did not change significantly [22]. In horses with Piroplasmosis the resulting change in serum protein, calcium and phosphorus were not significant [23]. In infected foals with rhodococcus the role of iron was investigated and it has been shown that they had iron deficiency and iron use in these foals was significant [24]. Serum iron levels in apparently healthy horses are reported 166 µg/dl. Gender and age, in that study, had not a role in serum iron changes [25].

In this study it was shown that in infected cattle group there was no significant increase or decrease in parameters with cattle age variable as well as there wasn't any relationship between the patient's age and animal serum iron, phosphorus and cobalt. Furthermore, there was no significant change in serum levels of phosphorus and cobalt based

on the infected animals' hematocrit percent but with decreasing hematocrit percent, the serum iron decreased as well; so serum iron mean difference was significant in infected animals based on a hematocrit percent (p=0.030) and there was a direct correlation between changes in hematocrit and serum iron levels. Decreased serum Iron is caused by decreased hematocrit values and it seems that low iron plays a role in anemia and oxidative stress occurrence.

In conclusion, in cattle with theilleriosis, serum iron and cobalt increased and increased serum phosphorus levels were not significant. With regard to the occurrence of anemia in cattle with theilleriosis and the role of iron in the hematopoietic process and immune system as well as the fundamental role of two other elements, the use of supplements containing iron, phosphorus and cobalt in oral or injectable forms for infected cattle is recommended.

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