

Evaluation of some Physiological, Hematological and Biochemical Indices in Non-Infested and Infested Dogs with Ticks

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Abstract

Due to rareness and an insufficiency of available information about physiological, hematological and biochemical indices of non-infested and infested dogs with ticks, the present study was carried out to explore these indices in local breed. In non-infested dogs, the results of physiological examination were revealed that their indices within the normal international values, while in relation to infested dogs; they were, significantly different. In association to hematology, which measured by using a laser-based analyzer system, the values of RBCs, Hb, PCV, MCV, WBCs, Lymphocytes and Neutrophils had been different, significantly, with the international reference, whereas, the values of infested dogs were different in Hb, PCV, MCV, MCHC, Lymphocytes and Neutrophils. At a level of ($P \leq 0.05$), the statistical difference was reported during measurement of biochemical indices in non-infested and infested dogs with ticks, when compared between them or with international values.

Keywords: Physiological, Hematological, Biochemical, Non-infested, Infested, Ticks

تقييم بعض المؤشرات الفسلجية والدموية والكيموحيوية في الكلاب غير المصابة والمصابة بالقراد

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فرع الفسلجة والأدوية / كلية الطب البيطري / جامعة واسط

الخلاصة

نتيجة لقلّة وعدم كفاية البيانات المتوفرة عن القيم الفسلجية والدموية والكيموحيوية للكلاب غير المصابة والكلاب المصابة بالقراد ، فقد اجريت الدراسة الحالية للتحري عن هذه القيم في السلالة المحلية . كشفت نتائج الفحص الفسيولوجي في الكلاب غير المصابة ، بان قيمها كانت ضمن القيم العالمية الطبيعية ، في حين انها كانت مختلفة في الكلاب المصابة . فيما يتعلق بالقيم الدموية التي تم قياسها باستعمال جهاز التحليل المعتمد على الليزر، فقد امتلكت قيم كريات الدم الحمر والهيموغلوبين وحجم الخلايا المرصوفة ومعدل حجم الكريات وكريات الدم البيض والخلايا اللمفية والعدلات اختلافا هاما مع القيم المسجلة عالميا ، في حين ان قيم الهيموغلوبين وحجم الخلايا المرصوفة ومعدل حجم الكريات ومعدل تركيز الهيموغلوبين في الكريات والخلايا اللمفية والعدلات للكلاب المصابة كانت مختلفة . عند مستوى ($P \leq 0.05$) ، فقد سجلت الاختلافات الاحصائية خلال قياس المعايير الكيموحيوية في الكلاب غير المصابة والكلاب المصابة بالقراد اذا ما قورنت فيما بينها او مع القيم العالمية .

Introduction

Tick is a blood sucking arthropod persists in most tropical and semi-tropical regions, and infecting most domestic and wild animals as well as humans resulting in serious external and internal host's ills (١). Although several types of ticks have been detected in dogs, the extents of which ticks parasitize dogs are unknown and the actual information that available locally or globally is low and stingy (٢). However, several studies demonstrated, experimentally and practically, that ticks can be result in large scale of diseases (viral, bacterial, rickettsial and protozoal) by biological or mechanical transmission causing a great public health problems (٣). In dogs, the tick-related pathogens are divers and can be associated with considerable abnormalities in physiology and hematology of an infested animal (٤). In addition, many factors such as nutrition, sex, breed, age and climate, were

known to be affected on the hematological and biochemical indices in dogs resulting in apparent variation in their values (5, 6). In Iraq, a very little information was concerned with the canine hematology and biochemistry in healthy and parasitized dogs. As well as, the hematological parameters were measured in these studies through depending on classical and manual methods (7). This study was designed to measurement of some physiological (temperature, pulse and respiratory rates), hematological (total erythrocyte count, Hb, PCV, MCV, MCH, MCHC, and total leukocyte count) and biochemical indices (total bilirubin, ALT, AST, ALP, and GGT); in healthy and infested dogs with ticks, and also to evaluate the effect of tick's infestation on theses studied indices.

Material and Methods

The present study was performed during the period of May to September / 2015 on 100 dogs, involved 50 dogs non-infested with ticks, and 50 dogs infested with ticks, from both sexes that had more than 1 year of an old age, in Baghdad province. In first, all dogs were subjected for clinical examination to measurement the physiological parameters (temperature, respiratory and pulse rates) for each one. Also, about 5 ml of blood samples were collected from cephalic or jugular veins of each dog by using a disposable syringe. Each blood sample was divided by using two types of tubes; 1 ml of blood was installed into an anticoagulant tube with EDTA for hematological parameters detection, while 4ml of blood sample was installed into a free anticoagulant tube for serum and biochemical testing (8, 9). The hematological parameters were performed involved total red blood cells count (TRBCs), hemoglobin (Hb), packed cell volume (PCV), mean corpuscles volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC), total white blood cells (TWBCs), lymphocytes, monocytes, neutrophils, eosinophils and basophils; which measured by using a computerized analysis system, Mythic 18 vet (Orphee SA, Switzerland) that based on an impedance technology (10). Whereas, the biochemical indices evaluated in this study, were included serum total bilirubin, serum alanine aminotransferase (ALT), asparate aminotransaminase (AST), alkaline phosphatase

(ALP), and gamma-glutamyl transferase (GGT) that measured by using specific standard diagnostic kits (11).

All studied physiological, hematological and biochemical indices of non-infested dogs were compared with the international values that detailed in (Table 1) (12, 13, 14).

Table (1): International references of some physiological, hematological and biochemical indices

Indices		Unit	International Values
Physiological Indices (12)	Temperature	°C/ minute	38-39.2
	Pulse Rate	beat/minute	70 - 120
	Respiratory Rate	breath/minute	18 - 34
Hematological Indices (13)	RBCs	$\times 10^6 / \mu\text{L}$	6.3 - 7.65
	Hb	g/dl	15.8 - 17.07
	PCV	%	43 - 52
	MCV	fL	66 - 69
	MCH	pg	23 - 24
	MCHC	g/dl	32.9 - 36.6
	WBCs	$\times 10^3 / \mu\text{L}$	10.55 - 11
	Monocytes	%	5.1 - 7
	Lymphocytes	%	26 - 30.8
	Neutrophils	%	62.2 - 66
	Eosinophils	%	3.5 - 9
	Basophils	%	0 - 1
Biochemical Indices (14)	ALT / SGPT	IU/L	10-94
	AST / SGOT	IU/L	10-62
	ALP	IU/L	0 - 90
	Total bilirubin	mg/dl	0.1-0.6

Statistically, all data were arranged, tabled and analysed by using the computerized the Microsoft Excel (2013) and IBM-SPSS v.22/2014, programs. The results of physiological, hematological and biochemical examinations for non-infested and infested dogs, were compared between them and with the, locally and internationally, authorized references and, then, subjected to descriptive statistics

(Chi-square). The results were considered to be a significant at the level of $P \leq 0.05$ value (15).

Results

∴ In (Figure 1), the study's results of physiological indices in non-infested dogs reported that the temperature, pulse rate and respiratory rate were had (38.2 ± 0.23) °C/minute, (87 ± 2.61) beats/minute and (25 ± 1.4) breaths/minute, respectively. These indices were without significant differences if compared with international reference

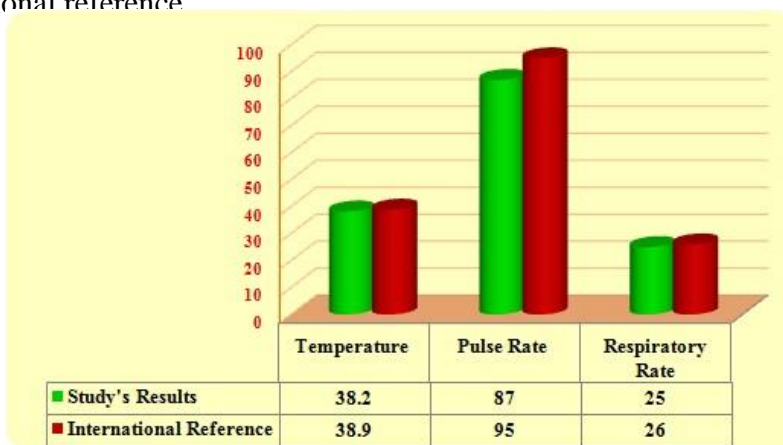


Figure (1): Physiological Indices of Non-Infested Dogs

∴ In infested dogs, the results of physiological indices revealed that the temperature had (39.7 ± 0.14) °C, pulse rate (104 ± 1.73) beats / minute and the respiratory rate (37 ± 0.45) breaths / minute. These results were with significant differences if compared with study's results of non-infested dogs (Table 2).

Table (2): Results of Physiological Indices in Infested and Non-Infested Dogs

Status of dogs	Temperature / °C	Pulse Rate / Min.	Respiratory Rate / Min.
Infested	$39.7^a \pm 0.14$	$104^a \pm 1.73$	$37^a \pm 0.45$
Non-Infested	$38.2^b \pm 0.23$	$87^b \pm 2.61$	$25^b \pm 1.4$

Difference in small letters, vertically, refer to significant differences at level of $P \leq 0.05$

∴ In (Figure 2), the study's results of hematology in non-infested dogs showed the following results, RBCs (5.9 ± 1.57) $\times 10^6/\mu\text{L}$, Hb (14.2 ± 0.22) g/dl, PCV (39.4 ± 1.28) %, MCV (66.8 ± 0.51) fL, MCH (24.1 ± 0.32) pg, MCHC (36 ± 0.46) g/dl, WBCs (11.8 ± 0.27) $\times 10^3/\mu\text{L}$, Monocytes (5.5 ± 0.31) %, Lymphocytes (27.2 ± 1.7) %, Neutrophils (62.7 ± 1) %, Eosinophils (3.9 ± 0.12) % and Basophils (0.7 ± 0.77) %. Statistically, these results of RBCs, Hb, PCV, MCV, WBCs, Lymphocytes and Neutrophils were with significant differences if compared with the international reference.

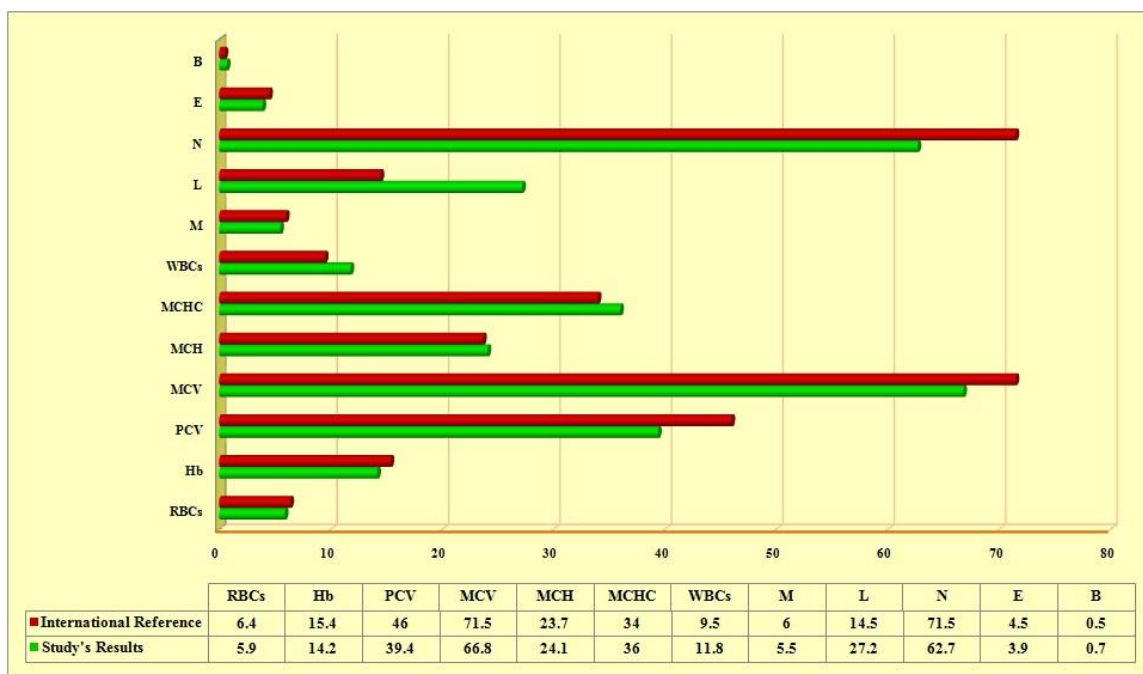


Figure (2): Hematology Indices of Non-Infested Dogs

∴ In infested dogs, the results of hematology were as follow, RBCs (5.2 ± 0.83) $\times 10^6/\mu\text{L}$, Hb (13.3 ± 0.19) g/dl, PCV (32.6 ± 0.97) %, MCV (62.7 ± 0.94) fL, MCH (25.6 ± 0.22) pg, MCHC (40.8 ± 0.13) g/dl, WBCs (12.5 ± 1.23) $\times 10^3/\mu\text{L}$,

Monocytes (6.2 ± 0.14) %, Lymphocytes (23.4 ± 0.82) %, Neutrophils (65.6 ± 0.81) %, Eosinophils (3.7 ± 0.09) % and Basophils (1.1 ± 0.45) %. Hb, PCV, MCV, MCHC, Lymphocytes and Neutrophils were different, significantly, if compared with the study's results of non-infested dogs (Table 3).

Table (3): Results of Hematological Indices in Infested and Non-Infested Dogs

No.	Indices (Unit)	Infested (M \pm SE)	Non-Infested (M \pm SE)
1	RBCs ($\times 10^6 / \mu\text{L}$)	$5.2^b \pm 0.83$	$5.9^b \pm 1.57$
2	Hb (g/dl)	$13.3^b \pm 0.19$	$14.2^a \pm 0.22$
3	PCV (%)	$32.6^b \pm 0.97$	$39.4^a \pm 1.28$
4	MCV (fL)	$62.7^b \pm 0.94$	$66.8^a \pm 0.51$
5	MCH (pg)	$25.6^b \pm 0.22$	$24.1^b \pm 0.32$
6	MCHC (g/dl)	$40.8^a \pm 0.13$	$36^b \pm 0.46$
7	WBCs ($\times 10^3 / \mu\text{L}$)	$12.5^b \pm 1.23$	$11.8^b \pm 0.27$
8	Monocytes (%)	$6.2^b \pm 0.14$	$5.5^b \pm 0.31$
9	Lymphocytes (%)	$23.4^b \pm 0.82$	$27.2^a \pm 1.7$
10	Neutrophils (%)	$65.6^a \pm 0.81$	$62.7^b \pm 1$
11	Eosinophils (%)	$3.7^b \pm 0.09$	$3.9^b \pm 0.12$
12	Basophils (%)	$1.1^b \pm 0.45$	$0.7^b \pm 0.77$

Difference in small letters, horizontally, refer to significant differences at level of $P \leq 0.05$

∴ In (Figure 3), the study's results of biochemical indices (ALT, AST, ALP and total bilirubin) in non-infested dogs were (25 ± 0.17) IU/L, (12.6 ± 0.41) IU/L,

42 ± 1.39 IU/L and (0.7 ± 0.22) mg/dl, respectively. ALT was with significant difference where compared with the international reference.

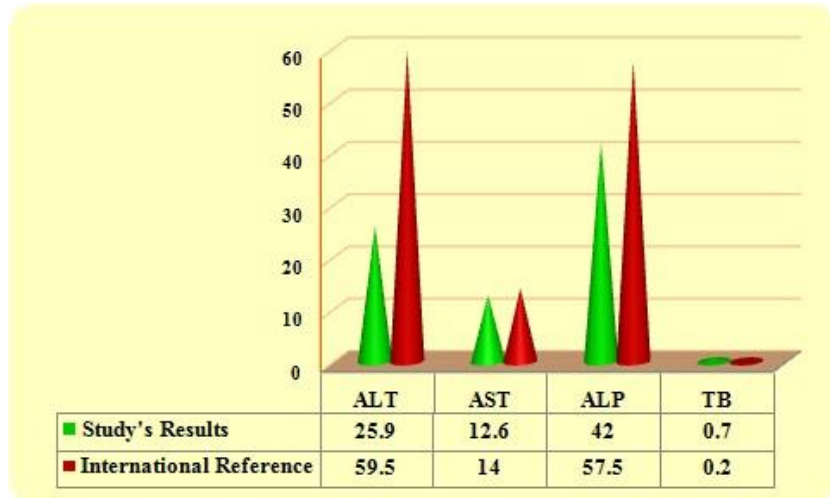


Figure (3): Biochemical Indices of Non-Infested Dogs

∴ In infested dogs, the biochemical testing revealed on the following results, ALT (34.1 ± 0.39) IU/L, AST (19.4 ± 0.75) IU/L, ALP (68.3 ± 0.8) IU/L and total bilirubin (3.1 ± 0.85) mg/dl (Table 4). Statistically, all these results were different, significantly, where compared with study's results of non-infested dogs.

Table (4): Results of Biochemical Indices in Infested and Non-Infested Dogs

No.	Indices	Infested (M ± SE)	Non-Infested (M ± SE)
1	ALT / SGPT (IU/L)	$34.1^a \pm 0.39$	$25.9^b \pm 0.17$
2	AST / SGOT (IU/L)	$19.4^a \pm 0.75$	$12.6^b \pm 0.41$
3	ALP (IU/L)	$68.3^a \pm 0.8$	$42^b \pm 1.39$
4	Total Bilirubin (mg/dl)	$3.1^a \pm 0.85$	$0.7^b \pm 0.22$

Difference in small letters, horizontally, refer to significant differences at level of $P \leq 0.05$

Discussion

In this study, the received results of non-infested dogs with ticks were, mostly, within normal or subnormal ranges if compared to the international values, whilst, they different, significantly, if compared to the results of infested dogs. Worldwide, many studies had been performed to find out the normal values of physiological, biochemical and hematological indices of dogs, but most of them were accomplished in American and European countries whereas breeds, climate and environment are different (11). Blood represented as one of most important fluids or matters that rely on it, firstly, in diagnosis of many diseases to access the health status of animals and to evaluation of their parameters (5). Also, the hematological tests were used to determine a disease state, mineral content, drug effectiveness, and the organ's functions in a variety of animals (16).

The global importance of ticks in dogs has been accepted due to its high morbidity and mortality, as well as, it act as a vectors for several parasitic, bacterial and viral agents, especially, in endemic areas (17). In tropical and sub-tropical areas, ticks are prevalent throughout the year, and they most active in temperate regions from the late spring to early autumn (18). It could be difficult to formulate a universal reference value in dogs, and these differences necessitate the need to establish appropriate physiological baseline values that could be help in practical evaluation of the management practice, nutrition and diagnosis of health condition (19). Although, the physiological indices may help in predict the type of disease or for confirmatory diagnosis, the interactions among these pathogenic agents affect, indisputably, on the host with changeful signs ranged from an incidental hematological changes to sever life-threatening illness depending on the synergistic effects between the etiological agents (20).

In infested dogs, the causes of increasing temperature are, usually, not obvious and may be related to existence of an acute infection, immune-mediated, tumors, metabolic disturbances, inflammatory conditions, toxins, or exercise that appears to be sufficient for rising the body temperature as a result of increasing muscles work (21, 22). The most common reasons of increasing respiratory and pulse rates might

be associated with excitement, pain, overheating, fever, low oxygen, heart failure and anemia (23). Also, the hematological examinations revealed a pronounced reduction in total Hb, PCV, MCV and MCHC. In almost, the low PCV resulting in low Hb, which could attributed to any causes of anemia including blood sucking parasites, heavy flea infestation, wounds, blood parasites, autoimmune problems or could be due to malnutrition and vitamins / mineral deficiencies such as B₁₂, iron and folate (7, 20). In respecting to WBCs indices, the results of infested dogs showed a slight an increase in total WBCs, monocytes, eosinophils and bsophils; and significant differences was reported in lymphocytes and neutrophils. In non-infested dogs, lymphocytes and neutrophils reported significant increasing and decreasing, respectively, if compared with international references, which could because of their complex origin and the intricate things they constantly do to keep dog healthy (24). In infested dogs, lymphocytes and neutrophils reported a reversing result that might because of autoimmune and allergic reactions, sudden stress, infections and tumors (25). As reported in several previous studies, the results of this study reported high levels of ALT, AST, ALP and total bilirubin in infested dogs with ticks, and this could be related to hepatic dysfunction, intravascular or extravascular hemolysis, chronic infections, liver necrosis or cholestasis that caused by an infections with blood parasites (20, 26, 27, 28). However, several factors such as age, sex, breed and some environmental circumstances could be affecting, directly or indirectly, on hematological and biochemical indices of clinically healthy dogs as well as diseased dogs resulting in an alteration and variation in their values (29).

For first time, a fully automated hematology bench-top analyzer mythic 18 was used for detection of complete blood count in dogs submitted for the present study, and the obtained results could be served as a reference because of rareness of studies and information related to local breed of dogs in Iraq.

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