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Studies on Hematologic Values and Serum Chemistry of Jindo, Poongsan and Mixed Dogs

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진도개, 풍산개 및 잡종견의 혈액학치 및 혈액화학치에 관한 연구

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요 약 : 본 연구는 진도개, 풍산개 및 잡종견의 혈액학 및 혈액화학치의 차이를 비교하고자 본 실험을 수행하였다. 총 80두가 본 조사에 이용되었으며 경기도지방, 제주도, 서울 및 전남지방을 대상으로 실시하였다. 각각 진도개 30두, 풍산개 20두 및 잡종견 30두로 구성되었으며 성비는 각 군간에 차이가 없었다(진도개: 수캐=16, 암캐=14, 풍산개: 수캐=9, 암캐=11, 잡종견: 수캐=15, 암캐=15). 연령은 진도개, 풍산개 및 잡종견 각각 1.3±0.9(년), 1.3±1.0(년), 1.3±1.6(년)이었다. 체중분포는 진도개, 풍산개 및 잡종견은 각각 9.0±4.5 kg, 9.8±4.0 kg, 8.4±4.7 kg이었다. 잡종견의 백혈구와 호중구수가 다른 두품종에 비해 유의성있게 높았다($p<0.05$). 풍산개의 림프구와 호산구수는 진도개와 잡종견의 수보다 높았다($p<0.05$). 하지만 풍산개의 단핵구 수는 진도개와 잡종견보다 유의성있게 낮았다($p<0.05$). 진도개의 콜레스테롤과 무기인 수준은 풍산개와 잡종개의 수준보다 낮았다. 잡종견의 중성지방(triglyceride)의 수준은 진도개와 풍산개의 수준보다 낮았다. 잡종견의 나트륨 농도는 진도개와 풍산개의 수준보다 낮았으며 진도견의 칼륨농도는 풍산개와 잡종견의 농도와 비교하여 높았다. 바베시아 검사에서 모든 품종에서 음성이었으며 심장사상충 검사결과 양성율은 잡종견, 진도견과 풍산견 각각 20%, 10%, 10%이었다.

Key words : Jindo dog, Poongsan dog, mixed dog, hematological values, serum chemistry

Introduction

About the origin of Korean dogs, Ha et al.[19] reported that Korean dogs were originated from the native breeds in the northern part of Korean peninsula, such as Eskimo dog and North Sahalin native dogs, on the basis of low frequency of tongue spots and principal component analysis using allele frequency of microsatellite DNA.

In Korea, several native dogs, such as Jindo dog, Poongsan dog, Sapsaree have been recognized traditionally[18]. Of these dogs, Jindo dogs are well known to public and a representative dog in Korea. Thus goverment designated this dog as special natural monuments. However, unfortunately, much effort was not made to hematological value, serum chemistry profile, examination of canine babesiosis and heartworm infection of the Korean domestic dogs.

Several studies on the hematological value, serum chemistry of Jindo dogs[24-26] have been performed. But a variety of survey among Korean domestic dogs including Poongsan dog, Sapsaree and other dogs have

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not been made.

Of those studies, most survey have been undergone to investigate the hematological values and serum chemical values of Jindo and/or Sapsaree dog [1-5].

However, no comparision has been made to detect any hematological differnece between populations of three dog breeds (Jindo dogs, Poongsan dogs and Mixed dogs).

Therefore, this study was performed to compare the difference of hematological, serum chemical values and infection rate of canine babesiosis and heartworm among three breeds.

Materials and Methods

Experimental Animals

Total 80 dogs (Jindo dogs = 30, Poongsan dogs = 20, Mixed dogs = 30) were used in this study. The ratio of gender was not significantly different from groups (Jindo dogs: male = 16, female = 14, Poongsan dogs: male = 9, female = 11, Mixed dogs: male = 15, female = 15).

Blood Samples

Ten milliliters of blood were collected from jugular vein or cephalic vein. The collected blood was centrifuged. And then sera were collected and stored at -4 °C until assayed.

Clinical Examination

During the 1-month period, 80 dogs were evaluated (Jindo dogs = 30, Poongsan dogs = 20, Mixed dogs= 30). General condition of the dog were recorded. Data included breeds, weight, age, sex, environment housed and diet. Ages of Jindo dogs, Poongsan dogs and mixed dogs were 1.3±0.9 (years), 1.3±1.0 (years) and 1.3±1.6 (years), respectively. Weight distribution of Jindo dogs, Poongsan dogs and mixed dogs were 9.0 ±4.5 (kg), 9.8±4.0 (kg) and 8.4±4.7 (kg), respectively.

Hematology and Serum Chemistry

Blood samples of each dog were collected in EDTA Na-CBC bottles or heparinized tubes. The complete blood counts were analyzed (automatic Hemavet). Total protein, albumin, aspartate transaminase, alanine transaminase, alkaline phosphatase, cholesterol, calcium, inorganic phosphorus, glucose, blood urea nitrogen, creatinine and triglyceride were analyzed by Serum Analyzer (IDDEX). Sodium, chloride and potassium were determined by electrolyte analyzer (Sicho).

Babesia and Heartworm Examination

After blood film was made, canine babesiosis and heartworm infection were examined by the mehtod of Wright and Giemsa Stain[17,18]. Briefly, after whole blood smear was made, blood film was air-dried. The subsequent steps of staining was performed by the standard method of laboratory. Especially, for the test of heartworm, buffy coat was examined carefully.

Statistical Analysis

GLM test was used to compare the difference of hematological value and serum chemistry among the groups.

Results

Hematology

White blood cells, segmented neutrophil and band neutrophil of mixed dogs were significantly higher than those of Jindo dogs and Poongsan dogs ($p<0.05$). Lymphocyte and eosinophil of Poongsan dogs were significantly higher than those of Jindo dogs and mixed dogs ($p<0.05$). But monocyte of Poongsan dogs was significantly lower than Jindo dogs and mixed dogs ($p<0.05$). Other hematological values showed no difference from Jindo dogs, Poongsan dogs and mixed dogs.

Serum Chemistry

The levels of cholesterol and inorganic phosphorus of Jindo dogs were significantly lower than those of Poongsan dogs and mixed dogs. Concentration of triglyceride of mixed dogs was significantly lower than those of Jindo dogs and Poongsan dogs.

Electrolytes

Sodium concentraion of mixed dogs was lower than that of Jindo dogs and Poongsan dogs. Potassium concentration of Jindo dogs was the highest compared to

Table 1. Comparison of complete blood count value of Jindo, Poongsan and mixed dogs

Parameters	Jindo Dogs (n=30)	Poongsan Dogs (n=20)	Mixed Dogs (n=30)
	Mean±SD	Mean±SD	Mean±SD
RBC($10^6/\mu l$)	7.0±1.62	7.4±1.21	66.5±1.09
Hb(mg/dl)	13.7±2.7	14.5±2.3	13.4±2.2
PCV(%)	42.8±7.3	45.1±6.5	40.9±6.4
MCH(pg)	18.8±1.7	19.4±0.7	20.8±1.3
MCHC(g/dl)	31.8±1.9	32.0±1.5	32.8±1.5
MCV(fL)	59.1±4.9	60.8±3.4	63.7±4.9
WBC($10^3/\mu l$)	12.6±3.42	13.7±3.35	16.1±5.84
Seg. Neut. ($10^3/\mu l$)	7.7±3.21	7.8±2.31	11.3±5.15
Lymphocyte($10^3/\mu l$)	2.3±0.78	2.8±1.03	2.2±0.66
Monocyte($10^3/\mu l$)	0.97±0.53	0.67±0.28	1.07±0.43
Eosinophil($10^3/\mu l$)	0.92±1.08	1.86±1.14	0.88±1.20
Band Neut.($10^3/\mu l$)	0.60±0.33	0.53±0.21	0.67±0.34
Basophil($10^3/\mu l$)	0.03±0.02	0.03±0.02	0.03±0.02
Platelet($10^5/\mu l$)	2.0±1.25	3.9±8.30	2.4±8.20

RBC: red blood cells, Hb: hemoglobin, PCV: packed cell volume, MCH: mean corpuscular hemoglobin, MCV: mean corpuscular volume, MCHC: mean corpuscular hemoglobin concentration, WBC: white blood cells, Seg. Neut.: Segmented neutrophil, Band Neut.: band neutrophil.

Table 2. Comparison of serum chemistry value of Jindo, Poongsan and mixed dogs

Parameters	Jindo Dogs (n=30)	Poongsan Dogs (n=20)	Mixed Dogs (n=30)
	Mean±SD	Mean±SD	Mean±SD
TPROT	7.6±0.7	6.7±1.4	6.6±0.8
ALBUMIN	2.6±0.1	2.7±6.3	2.9±0.2
AST	52.9±17.8	58.6±52.7	73.1±130.5
ALT	47.9±19.7	48.7±54.6	85.9±137.4
ALP	21.9±7.0	74.4±78.1	42.0±24.2
CHOL	140.6±33.2	179.8±54.2	170.3±34.3
PHOS	1.8±1.3	4.8±2.7	4.0±1.5
CALCIUM	11.2±3.1	11.2±2.2	10.1±1.2
GLU	71.6±11.1	93.2±15.7	85.2±26.5
BUN	16.5±5.1	15.4±5.3	11.6±5.6
CRET	0.8±0.3	0.9±0.3	0.7±0.2
TRIG	92.1±29.2	95.7±21.2	71.0±23.0

TPROT: total protein, AST: aspartate transaminase, ALT: alanine transaminase, ALP : alkaline phosphatase, CHOL: cholesterol, PHOS: phosphorus, GLU: glucose, BUN: blood urea nitrogen, CRET: creatinine, TRIG: triglyceride.

Table 3. Comparison of electrolytes value of Jindo, Poongsan and mixed dogs

Parameters	Jindo Dogs (n=30)	Poongsan Dogs (n=20)	Mixed Dogs (n=30)
	Mean±SD	Mean±SD	Mean±SD
Na (mEq/L)	150.3±3.3	152.3±4.5	147.9±2.4
K (mEq/L)	6.4±4.0	5.8±2.3	4.9±0.7
Cl (mEq/L)	115.6±2.6	119.2±3.7	115.1±3.1

Na : sodium, K : potassium, Cl : chloride

Table 4. Comparison of canine heartworm infection rate among three breeds (Jindo dogs, Poongsan dogs and Mixed dogs)

Breeds	Positive Number	Percentage
Jindo Dogs	3/30	10
Poongsan Dogs	2/20	10
Mixed Dogs	6/30	20

that of Poongsan dogs and mixed dogs.

Canine Babesiosis Examination

Examination of canine babesiosis was performed on all three breeds including Jindo dogs, Poongsan dogs and Mixed dogs. All breeds were negative to canine babesiosis.

Canine Heartworm Examination

Rates of canine heartworm infection among three breeds were shown in Table 4. Rate of heartworm infection of mixed dogs (20%) was significantly higher than those of Jindo dogs (10%) and Poongsan dogs (10%).

Discussion

In hematological analysis, white blood cells of mixed dogs were higher than those of Jindo dogs and Poongsan dogs. Because Jindo dogs and Poongsan dogs are well controlled by the owner, it is maybe that exposure of Jindo dogs and Poongsan dogs to infectious agents was low compared with mixed dogs.

In Poongsan dogs, the number of lymphocyte and eosinophil was higher than those of Jindo dogs and mixed dogs. Whereas, the number of monocytes was lower than those of Jindo dogs and mixed dogs. It is

thought that inbreeding is more common than other two breeds. When Poongsan dogs were imported from North Korea, small number of Poongsan dogs were imported. Thus, inbreeding may be commonly occurred.

In addition, Poongsan dogs may be more infected with endoparasites. Thus, there is possibility that general immune function may be immune suppressived compared with other two breeds.

In electrolyte analysis, the level of sodium was lowest compared with other two breeds. However, the level of potassium was highest in Jindo dogs. Park et al.[26] reported that sodium, potassium and chloride concentration of serum in Jindo dogs were 143±1.5 mEq/liter, 4.6±0.3 mEq/liter, 103±3.0 mEq/liter, respectively. In this study, results of sodium, potassium and chloride concentration were higher than Park et al[24-26].

Rates of canine heartworm infection among three breeds were shown in Table 4. Rate of heartworm infection of mixed dogs was significantly higher than those of Jindo dogs (10%) and Poongsan dogs (10%). Because attention was not paid to heartworm infection of mixed dogs, it is thought that infection rate of heartworm in mixed dogs was higher than those of other two breeds. In addition, because large breed dogs were housed outdoors compard with small breed dogs, exposure to canine heartworm in small breed dogs was higher than that of large breed dogs.

Results of heartworm infection in this study were similar compare with the results of Kim et al.[20].

In a survey of canine heartworm infection among German shepherds in 5 military bases, Lee et al.[15] reported that the infection rate was 10.2% by the modified Knott's tes and 28.3% by the antigen test. The infection rate among German shepherds was the highest in Hoengsung, Kwangwon Province (84.4%), while those of Yechon and Chungwon were 20.0% and 14.3%, respectively. None of dogs in the Kimhae and Kwangju areas were heartworm positive. The infection rates of dogs at the age of 1~3, 4~6, and 7~11 years were 6.3%, 21.4%, and 56.4%, respectively.

In a therapeutic trial of heartworm infection[6-13,21], clinical signs were anorexia, vomiting, diarrhea, nausea and arrythmia. After diagnosis was made with heartworm test kit, pretreatment was initiated with aspirin, then melarsomine dihydrochloride was injected intramuscularily. After treatment, each patient was evaluated for improvement of clinical signs. Clinical signs of two patients were markedly improved but one was not improved. The others were completely cured in clinical signs.

Jindo dogs, Poongsan dogs and mixed dogs were all negative to canine babesiosis. In my experience, infection rate of canine babesiosis in Pitbull terrier was higher than those of other breeds which live in indoors. It is maybe that pet dogs of indoors is relatively low to exposure of tick. Especially, Jindo dogs and Poongsan dogs were maintained on the well-controlled house against tick.

In our country, examination of canine babesiosis was performed by Seo and Shin[14]. They used the method of indirect Fluorescent Antibody (IFA) and Enzyme-Linked Immunosorbent Assay (ELISA). Antibody level of mixed dogs, Pitbull terrier and German shepherd for *Babesia gibsoni* in southern Gyungnam was examined. In IFA, positive rates were mixed dogs (7.8%), Pitbull terrier (81.3%) and German shepherd (15.6%). In ELISA, positive rates were mixed dogs (24.0%), Pitbull terrier (83.3%) and German shepherd (38.5%), respectively. However, in this study, there was no positive case to canine babesiosis. In addition, it is thought that because Pitbull terrier were excised in the moutain or the fields, Pitbull terrier have higher exposure possibility to tick compared with other two breeds.

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