

## Serum chemistry values for Jindo dogs

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### 珍島犬의 血液化學值

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**초록 :** 임상적으로 건강한 진도개 179두의 血液化學值와 血清酵素值를 조사하였다. 179두에는 암수가 다 포함되어 있었고 연령은 3개월에서 10세까지 이었다. 血清酵素值는 연령에 따른 변화를 나타내지 않았으나 측정된 化學值의 대부분은 연령에 따라 변화하였다. 酵素值중에 gamma glutamyltransferase 활성도는 진도개에서는 처음으로 측정된 것이었는데 다른 품종의 개의 정상치 범위내에 들어 있었다. 한편 血清總蛋白質量과 알부민量만性に 따른 변화를 나타냈다.

**Key words :** blood, serum chemical values, Jindo dogs, age, sex

#### Introduction

The analysis of whole blood, plasma, or serum for various components has been conducted with increasing frequency for the diagnosis and treatment of diseases. In the reserarch laboratory, blood examination techniques are used to monitor the condition of animals or to indicate changes in various tissues resulting from an applied experimental procedure. The normal value of a blood constituent is used as a reference on which decisions of healthy or diseased states are made and as a determination of effect of a given treatment on an animal. Due to the variation of test results for animals determined to be normal and healthy, the normal test value is more correctly expressed as in normal minimal and maximal limits. The variations of normal level from animal to animal may be the result of age, sex, season and climate, altitude, or species, as well as the different levels of metabolic function and hormonal regulation of the individual.

In companion papers, the blood grouping<sup>1</sup> and hematologic values<sup>2</sup> of normal Jindo dogs were reported. In the present study, serum chemical analyses were performed on samples

from 179 normal Jindo dogs, and age- and sex-related differences in the values of the constituents were evaluated.

#### Materials and Methods

Jindo dogs used in the present study and sample collection from them were described in a companion paper.<sup>2</sup> The serum was separated from the clot stored at 4°C within ten hours and any sample with hemolysis was discarded. Serum chemical analyses were performed on samples from 179 dogs using Abbott VP(Abbott Laboratories, Illinois) or a spectrophotometer(Spectronic-20, Bausch Lomb). Total protein, albumin, blood urea nitrogen(BUN), calcium, and inorganic phosphate, and aspartate(AST) and alanine aminotransferase(ALT) were determined with Abbott VP using commercial kits(Abbott Laboratories, North Chicago, Illinois). Blood glucose was determined with spectrophotometer using a commercial kit(Asan Chemical Co, Hwa-sung, Kyungki). Total protein concentration was determined by the Biuret method.<sup>3</sup> Globulin concentration was calculated by subtracting albumin content from total protein.<sup>4</sup> Lactic dehydrogenase(LDH) was determined with Abbott VP, using a commercial kit(LDH,

MA701, Asan Chemical Co). Gamma glutamyltransferase (GGT) was assayed with spectrophotometer using Asan kit (Asan Chemical Co.).

Means and differences were tested by T-TEST or ONE-WAY programs in Statistical Packages for the Social Sciences.<sup>5</sup> As this report concerns only clinically normal dogs,<sup>2</sup> blood samples with a WBC count above 20,000 cells/ $\mu$ L were not included in statistical analyses.<sup>6</sup>

### Results

As no differences were found in the serum chemical values between the yellow- and white-colored Jindo dogs, analysis of blood chemistry determinations was made to show the influence of age on the results (Table 1). Differences according to age appeared specifically in the serum protein determinations between 6-month- to 1-year and 1- to 2-year age groups where there was an increase in total protein, albumin, and globulin. There was a significant decrease in inorganic phosphate and glucose levels between these 2 groups of dogs. Albumin/globulin ratio decreased with age. Blood urea nitrogen level and calcium/phosphate ratio increased until 12 months of age and thereafter remained unchanged. The effect of age on serum chemical values was inapparent in the AST, ALT, LDH and GGT determinations. In general, female dogs had higher total protein and albumin values than male dogs (Table 2).

**Table 2.** Influence of sex on the serum total protein and albumin values in Jindo dogs

	Male (n = 52)	Female (n = 127)	Significance level
Total protein (g/dL)	5.66 ± 1.24	6.18 ± 1.49	0.05
Albumin (g/dL)	2.87 ± 0.54	3.23 ± 0.75	0.01

### Discussion

As was in the hematologic values,<sup>2</sup> no differences were found in the blood chemical values of yellow- and white-colored Jindo dogs. The serum chemistry values in the present study are substantially comparable with those in standard reference sources<sup>7-9</sup> and in other studies concerning both other breeds of dogs<sup>10-14</sup> and Jindo dogs.<sup>15,16</sup>

Few reports indicate differences in blood chemical values between male and female dogs.<sup>17,18</sup> The differences were in the concentrations of a few blood chemical constituents, and although statistically significant they were small and had no practical application. In the present study, the female dogs had higher total protein and albumin values than their male counterparts, but the differences were small. In Jindo area the female dogs are kept as an important source of income and fed with better quality feeds than the male dogs.

It is well known that the canine blood chemistry values change with age. The serum total protein increased with

**Table 1.** Influence of age on the serum chemical values in Jindo dogs (mean ± S.D.)

	Age, months					Significance level
	3~6 (69~71) *	7~12 (32~34)	13~24 (40~43)	25~36 (15~16)	>37 (13~15)	
Total protein (g/dL)	5.4 ± 1.3	5.6 ± 1.2	7.0 ± 1.5	6.8 ± 1.1	6.5 ± 1.1	0.001
Albumin (g/dL)	2.9 ± 0.7	3.0 ± 0.6	3.5 ± 0.8	3.3 ± 0.6	3.0 ± 0.7	0.001
Globulin (g/dL)	2.4 ± 0.7	2.6 ± 0.7	3.5 ± 0.9	3.5 ± 0.7	3.5 ± 1.0	0.001
Albumin/globulin ratio	1.3 ± 0.3	1.2 ± 0.2	1.1 ± 0.2	1.0 ± 0.2	0.9 ± 0.3	0.001
Urea nitrogen (mg/dL)	9.7 ± 7.3	11.9 ± 6.0	13.3 ± 6.7	14.4 ± 7.7	12.9 ± 8.3	0.05
Calcium (mg/dL)	11.4 ± 2.4	10.5 ± 2.4	11.2 ± 2.6	10.9 ± 2.5	11.0 ± 3.3	NS
Phosphate (mg/dL)	8.4 ± 1.6	6.6 ± 2.1	5.1 ± 1.8	5.1 ± 1.6	5.1 ± 1.5	0.001
Calcium/Phosphate ratio	1.4 ± 0.4	1.7 ± 0.5	2.4 ± 0.7	2.3 ± 0.5	2.2 ± 0.3	0.001
Glucose (mg/dL)	82.6 ± 22.9	76.7 ± 19.8	70.9 ± 16.9	73.1 ± 20.6	61.7 ± 20.8	0.01
Aspartate aminotransferase (U/L)	18.2 ± 10.2	18.6 ± 9.1	23.9 ± 12.6	21.5 ± 11.9	23.3 ± 22.9	NS
Alanine aminotransferase (U/L)	21.2 ± 9.2	20.9 ± 11.6	18.6 ± 13.1	17.8 ± 11.9	19.8 ± 14.2	NS
Lactic dehydrogenase (IU/L)	135.3 ± 79.4	197.2 ± 66.1	110.8 ± 70.4	93.8 ± 76.4	94.0 ± 71.7	NS
Gamma glutamyltransfe- rase (mU/mL)	15.9 ± 9.2	12.3 ± 9.6	15.7 ± 11.1	18.9 ± 13.6	14.1 ± 10.2	NS

\* Number of animals in each group.

age.<sup>19-21</sup> McKelvie et al<sup>22</sup> reported that serum glucose and inorganic phosphate values were higher in the young dogs, while the serum total protein and globulin values increased with age. The results in the present study are in good agreement with these results. In particular the globulin content was higher in the adult dogs than in the young. In this connection it was pointed out that the globulin fraction of plasma or serum protein increases throughout life in response to periodic exposure to various antigenic substances.<sup>19</sup> Similar results were obtained in other species of animals.<sup>23</sup>

AST, ALT, LDH and GGT values of Jindo dogs in this study did not change with age. Reece<sup>24</sup> reported that serum activities of these enzymes in the physically exerted dogs were considerably greater than published normal values. There has been no report of GGT levels in Jindo dogs so far. This enzyme was determined as a valuable diagnostic test for hepatic disorders in cattle<sup>25,26</sup> and dogs.<sup>27</sup> The enzyme level in the present study is within the normal range in the dog.<sup>28</sup>

### Summary

Serum chemical values were determined in blood samples obtained from 179 normal, healthy Jindo dogs of both sexes that ranged in age from 3 months to 10 years. Female dogs had higher total protein and albumin values than their male counterparts. Age-related differences were detected for serum proteins, inorganic phosphate, glucose, and blood urea nitrogen levels. The GGT level was within the normal range in dogs.

### References

1. Han BK, Lee CG, Ikemoto S. Studies on the blood groups of Jindo dogs by dog erythrocyte antigen system. *Korean J Anim Sci* 1988; 30 : 643~651.
2. Lee CG, Lee CY, Kim CS, et al. Hematologic values of normal Jindo dogs. *Korean J Vet Res* 1989; 29 : 433~436.
3. Gornall AG, Bardawill CJ, David MM. Determination of serum proteins by means of the Biuret reaction. *J Biol Chem* 1949; 177 : 751~766.
4. Cheong CK. Studies on the hematology and blood chemistry of Korean cattle. II. Studies on the blood chemistry of Korean cattle. *Korean J Vet Res* 1965; 5 : 97~123.
5. Nie NH, Hull CH, Jenkins JG, et al. *Statistical packages for the social sciences*. 2nd ed. New York : McGraw-Hill, 1975; 249~274 and 398~430.
6. Bulgin MS, Munn SL, Gee W. Hematologic changes to 4 1/2 years of age in clinically normal Beagles. *J Am Vet*

- Med Assoc* 1970; 157 : 1064~1070.
7. Benjamin MM. *Outline of veterinary clinical pathology*. 3rd ed. Ames, Iowa : Iowa State University Press, 1978; 213~264.
8. Swenson MJ. Physiological properties and cellular and chemical constituents of blood. In : Swenson MJ, ed. *Duke's physiology of domestic animals*. 9th ed. Ithaca : Cornell University Press, 1977; 14~35.
9. Bentinck-Smith J, French TW. A roster of normal values for dogs and cats. In : Kirk RW, ed. *Current veterinary therapy. Small animal practice*. 10th ed. Philadelphia : WB Saunders Co, 1989; 1355~1345.
10. Michaelson SM, Scheer K, Gilt S. The blood of the normal Beagle. *J Am Vet Med Assoc* 1966; 148 : 532~534.
11. Porter JA, Canaday WR. Hematologic values in mongrel and Greyhound dogs being screened for research use. *J Am Vet Med Assoc* 1971; 159 : 1603~1606.
12. Weiner DJ, Bradley RE. The hemogram and certain serum protein fractions in normal Beagle dogs. *M/SAC* 1972; 67 : 393~398.
13. Jordan JE. Normal laboratory values in Beagle dogs of twelve to eighteen months of age. *Am J Vet Res* 1977; 38 : 509~513.
14. Lumsden JH, Mullen K, McSherry BJ. Canine hematology and biochemistry reference values. *Can J Comp Med* 1979; 43 : 125~131.
15. Rim BH, Park NY, Lee BW. Studies on hematologic values and blood chemistry values of normal Jindo dogs. II. Blood chemistry for Jindo dogs. *J Korean Vet Med Assoc* 1980; 16 : 143~149.
16. Park NY, Rim BH, Cho SM. Studies on hematologic values and blood chemistry values of normal Jindo dogs. III. Serum electrolyte values for adult Jindo dogs. *Korean J Vet Res* 1980; 20 : 175~178.
17. Stewart EV, Longwell BB. Normal clinical chemical values for certain constituents of blood of Beagle dogs 13±1 months old. *Am J Vet Res* 1969; 30 : 907~916.
18. Cramer MB, Turbyfill CL, Dowes WA. Serum chemistry values for the Beagle. *Am J Vet Res* 1969; 30 : 1183~1186.
19. Schalm OW. Clinical significance of plasma protein concentration. *J Am Vet Med Assoc* 1970; 157 : 1672~1675.
20. Ewing GO, Schalm OW, Smith RS. Hematologic values of normal Basenji dogs. *J Am Vet Med Assoc* 1972; 161 : 1661~1664.
21. Jain NC. *Schalm's veterinary hematology*. 4th ed. Philadelphia

- : Lea and Febiger, 1984;104~105.
22. McKelvie DH, Powers S, McKim F. Microanalytical procedures for blood chemistry long-term study on Beagles. *Am J Vet Res.* 1966;27 : 1405~1412.
  23. Kang BK, Lee CG, Park LS, et al. Studies on the blood chemistry of fattening pigs. *Rural Develop Rev* 1981;16 : 41~46.
  24. Reece WO. Serum activity for glutamic oxalacetic transaminase and lactic dehydrogenase, and hematologic values for treadmill-exercised Beagles. *Am J Vet Res* 1972; 33 : 357~359.
  25. Rico AG, Braun JP, Benard P, et al. Blood and tissue distribution of gamma glutamyl transferase in the cow. *J Dairy Sci* 1977; 60 : 1283~1287.
  26. Blackshaw C. Serum gamma glutamyltransferase in the diagnosis of liver disease in cattle. *N Z Vet J* 1978;26 : 25~26.
  27. Kraft W, Ghermai AK, Winzinger H, et al. Vergleich der serumaktivitäten von AST, ALT, GLDH, AP und GGT in der diagnostik von lebererkrankungen des hundes. *Berl Münch Tierärztl Wschr* 1983;96 : 421~431.
  28. Han HR, Lee CG, Lee CW. *Veterinary clinical pathology.* Seoul : Gijun Co, 1985;418.
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