

Serum Protein Values of Racehorse in Korea

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Introduction

Serum protein fractions have been measured as they indicate a condition that alters the tissues responsible for the balance between protein synthesis and catabolism or mechanical loss.

The concentrations of serum protein fractions of horse have been reported by many authors but their results differ widely from those of each other. The concentrations of serum protein fractions have been measured exclusively by electrophoresis in most clinical laboratories. But it is notorious that the results of serum protein fractions measured by electrophoresis differ widely according to many laboratory conditions such as supporting medium, the ingredient, pH and ionic strength of buffer, quantity of sample applied, method of sample application, voltage and time, electrophoresis chamber, staining solution, staining time, clearing agent, densitometer, etc.

Furthermore, the concentrations of serum protein fractions are changed not only pathologically but also physiologically. Most of the racehorses in this country have been imported from foreign countries where the feeds and environment are

much different from those in this country. In addition, the racehorses in this country are burden with more exercises than the horses in other countries. As the racehorses in this country must participate in average 1.1 races per month and daily training from 2 weeks before expected race, they have nearly no rest day.

In such circumstances it was required to investigate the values of serum protein fractions for the reference values.

Materials and Methods

Animals: Thoroughbred racehorses which had been healthy for at least 2 months, ranging from 3 years to 10 years of age, were used (Table 1).

The animals to be used were prohibited from racing for 2 weeks before blood collection. They were fasted overnight and the blood sample was collected in the morning (10:00-11:00).

Daily Feeds: The composition of daily feeds were as Table 2.

Methods: The concentration of total serum protein was measured using refractometer (American Optical). The concentrations of serum protein

Table 1. Experimental Animals

Season	Day of Blood Collection	Number of Animals
Spring	April 15	52 (M 27, F 25)
Summer	July 15	48 (M 22, F 26)
Autumn	October 15	48 (M 25, F 23)
Winter	December 15	50 (M 28, F 22)
	(Sum)	198 (M 102, F 96)

M: male. F: female.

Table 2. Composition of Daily Feeds

(kg)

Season	Barley	Wheat Bran	Hay	NaCl	Bone Meal	Supplement*
Spring	1.6	5.0	3.5	0.05	0.02	0.02
Summer	1.4	4.8	**	0.06	0.02	0.02
Autumn	1.6	5.0	3.5	0.05	0.02	0.02
Winter	1.4	4.8	3.5	0.04	0.02	0.02

*: Consists of calcium, phosphorus and vitamin complex.

**: Replaced by 18 kg of green grass.

fractions were measured by cellulose acetate memberane electrophoresis as follows.

Supporting medium: Cellulose acetate memberane
(Titan III, Helena)

Buffer: Tris-barbital-sodium barbital buffer,
pH 8.8, ionic strength 0.075

Power supply: Deluxe Regulated Power Supply
(Gelman)

Electrophoresis chamber: Deluxe chamber
(Gelman)

Staining solution: Ponceau-S

Clearing agent: Clear Aid(Helena)

Voltage/Time: 180V / 20 min.

Densitometer: DCD-16(Gelman)

Statistical Analysis: The differences between sexes were compared using t-test and the differences among seasons and among age groups were compared at 0.05 level using LSD multiple range test.

Results and Discussion

The concentration of total serum protein, the absolute and relative values of protein fractions, and the A/G ratio in each sex are summarized in Table 3.

Comparison of the results in this study with those in reports by Japanese workers^{1,2)} indicates relatively good agreement. In this study the

Table 3. Serum Protein Values in Clinically Normal Thoroughbred Racenhorse as Influenced by Sex

(Mean±SD)

Sex	n	Total Protein	Albumin	α -Globulin	β -Globulin	γ -Globulin	A/G Ratio
Male	102 (g/100ml)	6.5±0.3	3.4±0.2	0.8±0.1	1.2±0.2	1.1±0.3	1.13±0.19
Female	96 (g/100ml)	6.5±0.4	3.4±0.3	0.8±0.2	1.2±0.2	1.0±0.2*	1.16±0.16
Total	198 (g/100ml)	6.5±0.3	3.4±0.2	0.8±0.1	1.2±0.2	1.1±0.3	1.15±0.21
Male	102 (%)		52.3±6.1	11.9±1.9	18.1±2.2	17.2±3.5	
Female	96 (%)		53.4±4.0	12.2±2.0	18.2±2.3	16.2±2.9*	
Total	198 (%)		53.0±3.9	12.0±1.9	18.2±2.3	16.7±3.3	

*: Significant at 0.05 level.

Table 4. Absolute Serum Protein Values in Clinically Normal Thoroughbred Racehorse as Influenced by Age
(Mean±SD, g/100ml)

Age (year)	n	Protein	Albumin	α -Globulin	β -Globulin	γ -Globulin	A/G Ratio
3	21	6.4±0.4	3.4±0.3	0.8±0.2	1.2±0.2	1.1±0.3	1.15±0.18
4	37	6.5±0.3	3.4±0.2	0.8±0.2	1.2±0.2	1.0±0.2	1.19±0.25
5	51	6.5±0.3	3.5±0.2	0.8±0.1	1.2±0.2	1.1±0.2	1.15±0.18
6	33	6.4±0.4	3.5±0.3	0.8±0.1	1.2±0.2	1.0±0.2	1.19±0.18
7	33	6.6±0.3	3.5±0.3	0.8±0.1	1.2±0.1	1.1±0.3	1.14±0.24
8-10	23	6.6±0.4	3.4±0.3	0.8±0.2	1.2±0.2	1.2±0.3*	1.09±0.18
(Sum)	198						

*: Significant compared with 3-, 4-, 5-, and 6-year age groups.

Table 5. Relative Serum Protein Values in Clinically Normal Thoroughbred Racehorse as Influenced by Age
(Mean±SD, %)

Age (year)	n	Albumin	α -Globulin	β -Globulin	γ -Globulin
3	21	53.1±4.2	11.9±2.5	18.2±2.5	16.8±3.6
4	37	52.9±4.1	12.7±2.5	18.4±2.6	16.2±2.8
5	51	53.1±3.8	11.9±1.7	18.3±2.5	16.7±2.4
6	33	54.1±3.5	12.2±1.5	18.2±1.9	15.5±3.2
7	33	52.8±4.1	11.7±1.9	18.0±1.8	17.3±3.5 ^a
8-10	23	51.9±4.0	11.8±1.9	17.6±2.2	18.7±4.1 ^b
(Sum)	198				

a: Significant compared with 6-year age group.

b: Significant compared with 3-, 4-, 5-, and 6-year age groups.

Table 6. Serum Protein Values in Clinically Normal Thoroughbred Racehorse as Influenced by Season
(Mean±SD)

Season	n	Total Protein	Albumin	α -Globulin	β -Globulin	γ -Globulin	A/G Ratio
Spring	52 (g/100ml)	6.6±0.4 ^a	3.4±0.2	0.9±0.2 ^c	1.2±0.2	1.1±0.2	1.11±0.12
Summer	48 (g/100ml)	6.7±0.3 ^b	3.5±0.2	0.8±0.1 ^d	1.2±0.2	1.2±0.3 ^b	1.08±0.17
Autumn	48 (g/100ml)	6.3±0.3	3.4±0.3	0.7±0.1	1.1±0.2	1.0±0.2	1.23±0.26 ^e
Winter	50 (g/100ml)	6.4±0.3	3.4±0.2	0.8±0.1	1.2±0.1	1.0±0.2	1.17±0.20 ^f
(Sum)	198						

Spring	52 (%)		52.4±2.9	13.1±2.0 ^c	17.9±2.3	16.6±2.8	
Summer	48 (%)		50.8±7.8	11.8±1.9	18.2±2.0	18.2±3.9 ^b	
Autumn	48 (%)		54.7±4.6 ^f	11.4±1.7	18.0±2.8	15.8±3.2	
Winter	50 (%)		53.3±3.8 ^f	11.8±1.6	18.6±1.8	16.2±2.6	
(Sum)	198						

a: Significant compared with autumn and winter.

b: Significant compared with spring, autumn, and winter.

c: Significant compared with summer, autumn, and winter.

d: Significant compared with autumn.

e: Significant compared with spring, and summer.

f: Significant compared with summer.

differences between sexes were not demonstrated except for the γ -globulin fraction which showed higher values in the male. ($p < 0.05$)

The differences by age are summarized in Table 4 and 5. The only significant difference by age was in γ -globulin fraction which figured higher values in the 8-10-year age group than the younger age groups.

The differences by season are summarized in table 6. Seasonal variations in this study are slightly different from the results of other group of workers.²⁾

The values of serum protein can be influenced by the variations in the electrophoretic techniques, processing conditions used by different workers, and also by environment of the horses.

Summary

Resting serum protein values of clinically normal

racehorse in Korea were investigated. Total protein concentration was $6.5 \pm 0.3g / 100ml$ (mean \pm SD) and the concentration of albumin was 3.4 ± 0.2 , α -globulin 0.8 ± 0.1 , β -globulin 1.2 ± 0.2 , γ -globulin $1.1 \pm 0.3g / 100ml$ respectively and the A / G ratio was 1.15 ± 0.21 .

The differences of serum protein values as influenced by sex, age, and season were analyzed statistically.

References

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韓國競走馬의 血清蛋白質値

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抄 錄

임상적으로 건강하고 휴식상태에 있는 韓國 競走馬의 血清蛋白質値를 조사하였다. 總蛋白質濃도는 $6.5 \pm 0.3g / 100ml$ (평균 \pm 표준편차) 이었다. 알부민 농도는 3.4 ± 0.2 , α -글로부린 농도는 0.8 ± 0.1 , β -글로부린 농도는 1.2 ± 0.2 , γ -글로부린 농도는 $1.1 \pm 0.3g / 100ml$ 이었으며, A / G 비는 1.15 ± 0.21 이었다. 性, 연령, 계절에 따르는 血清蛋白質値의 차이를 통계적으로 분석하여 보고하였다.