

The Influence of Age on Clinical Biochemical Parameters in Pure-bred Arabian Mares

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ABSTRACT

Specific reference intervals are needed for each animal species for the appropriate interpretation of the results obtained from serum biochemical tests. The aim of this study was to investigate the blood composition of pure-bred Arabian mares to evaluate the need for defining reference values for different age groups. In all, 90 clinically healthy mares from five farms were used in the trial. For the determination of the effect of age, 90 mares were assigned to six groups. Groups A, B, C, D, E, and F comprised 15 foals aged ≤ 5 months (mean \pm SD: 2.45 ± 1.88), 15 foals aged 6 to 18 months (mean \pm SD: 9.33 ± 2.93), 15 mares aged 2 to 5 years (mean \pm SD: 3.91 ± 0.7), 15 mares aged 6 to 12 years (mean \pm SD: 8.66 ± 2.3), 15 mares aged 14 to 20 years (mean \pm SD: 17.81 ± 2.13), and 15 mares aged >20 years (mean \pm SD: 22.8 ± 1.93), respectively. Glucose, blood urea nitrogen (BUN), albumin, creatinine, total bilirubin, direct bilirubin, total protein, alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactate dehydrogenase (LDH), calcium, iron, magnesium, and phosphorus concentrations were measured in the blood serum samples. There were significant age-related alterations for most of the biochemical parameters, except for ALT, LDH activities, and glucose, albumin, magnesium, and iron levels. The results of the present study showed that direct bilirubin ($P < .01$), ALP, and phosphorus decreased significantly ($P < .001$), whereas BUN, calcium ($P < .01$), creatinine, total protein, and total bilirubin increased ($P < .001$) with age. In foals, ALP activity, direct bilirubin, and phosphorus levels were higher, whereas BUN, creatinine, total protein, total bilirubin, and calcium levels were lower as compared with older animals. Biochemical values determined in the present study serve as reference ranges for pure-bred Arabian mares and can be used for health control and diagnosis of diseases.

Keywords: Pure-bred Arabian mare; Age; Serum biochemistry; Reference value

INTRODUCTION

Hematological and biochemical parameters are used in horses as an aid in the clinical diagnosis of organic, infectious, and several parasitic diseases. They are also used in monitoring the recovery during treatment and in the assessment of metabolic conditions of a single animal or an entire herd.¹

Specific reference intervals are needed for each animal species for the appropriate interpretation of serum biochemical results. Sometimes, a distinct reference value is needed for an analyte from a specific age or breed of animal. Many values vary with the age of the animal, with major changes occurring before puberty.² Consequently, some analytes require different reference intervals for different age groups.² Some researchers^{3,4} demonstrated that parameters such as total serum protein, globulins, and γ -glutamyltransferase were influenced by the intake of the first colostrum, thereby increasing their concentrations in the serum of the calves.⁵ Furthermore, Steihardt and Thielscher^{6,7} reported that the total serum protein, albumin, and inorganic phosphorus concentrations were influenced not only by age but also by the nutrition of calves.

However, a limited number of observations have been reported on the effects of age on the biochemical values in horse breeds.^{1,8} To our knowledge, no study related to the effects of age on biochemical values in pure-bred Arabian mares has been performed.

Taking into consideration all the aforementioned information, the present study was performed to determine the effects of age on the reference values of some biochemical parameters (such as, glucose, blood urea nitrogen [BUN], albumin, creatinine, total bilirubin, direct bilirubin, total protein, alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactate dehydrogenase (LDH), calcium, iron, magnesium, and phosphorus) in pure-bred Arabian mares. We aimed to verify the hypothesis that age induces some biochemical alterations in pure-bred Arabian mares.

MATERIALS AND METHODS

In all, 90 clinically healthy, pure-bred Arabian mares from five farms located in the Sanliurfa region of Turkey were

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Table 1. The distribution of six different age groups of pure-bred Arabian mares for farms (groups A, B, C, D, E, and F) (n = 15)

Age Groups	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5
23 days–5-month-old foals (group A)	2	6	5	2	–
6–13-month-old foals (group B)	4	1	2	2	6
2–5-year-old mares (group C)	1	5	3	1	5
6–12-year-old mares (group D)	7	–	6	1	1
14–20-year-old mares (group E)	–	4	5	4	2
>20-year-old mares (group F)	3	4	–	3	5

used in the trial. To determine the effect of the age of the animal on the normal ranges of serum biochemical parameters, mares were allocated to six different age groups. The distribution of the pure-bred Arabian mares, assigned to the six different age groups, on the basis of the farms they were obtained from is shown in Table 1. The first group (group A) comprised 15 foals aged ≤ 5 months (mean \pm SD: 2.45 ± 1.88 months), the second (group B) 15 horses aged 6 to 18 months (mean \pm SD: 9.33 ± 2.93 months), the third (group C) 15 horses aged 2 to 5 years (mean \pm SD: 3.91 ± 0.7 years), the fourth (group D) 15 horses aged 6 to 12 years (mean \pm SD: 8.66 ± 2.3 years), the fifth (group E) 15 horses aged 14 to 20 years (mean \pm SD: 17.81 ± 2.13 years), and the sixth (group F) 15 horses above the age of 20 years (mean \pm SD: 22.8 ± 1.93 years). The farms selected were representative samples of the farms located in the Sanliurfa region, and were determined to apply an appropriate nutrition regimen and to have a good health status. All horses were healthy and showed no sign of abnormality during the study period. Before the start of the trial, the mares, which were reproductively active, were confirmed not to be pregnant by ultrasonography and were also ascertained not to be lactating (groups C, D, and E); the mares included in groups A and B were reproductively inactive. The mares in group F were those that were not used for breeding purposes. Among the foals ≤ 5 months of age, two were 23- and 27-days old, three were 2 months, three were 3 months, three were 4 months, and four were 5 months. In all, 90 blood samples were collected from the animals between April and May 2009, and these were handled with care to minimize stress-induced effects. To reduce circadian variations, all samples were collected between 8:00 AM and 12:00 AM, before the animals were fed. The animals were fed twice a day with hay and oats. They did not receive any mineral supplements in their diet. Drinking water was given ad libitum. None of the animals performed physical exercise before blood samples were collected. All samples were drawn from the jugular vein of each animal into vacuum glass tubes without anticoagulant. After clotting, the serum was separated by centrifugation at 3,000 rpm

for 15 minutes at 4°C and the aliquots were kept frozen at -20°C until the analysis.

Concentrations of serum glucose, BUN, albumin, creatinine, total bilirubin, direct bilirubin, total protein, ALP, AST, ALT, LDH, calcium, iron, magnesium, and phosphorus were measured by commercial kits (Biolabo SA, France) using a biochemical autoanalyser (AIRONE 200, Medisis Medical Systems Ltd., Italy), known to be appropriate for veterinary use.⁹⁻¹¹

All data were analyzed using the statistical program SPSS, version 11.5, for Windows (SPSS Inc., SPSS 11.5, Chicago, IL, USA). For the evaluation of the effect of age, the data were analyzed using the ANOVA procedure, and Turkey's multiple range test was used to determine the statistical significance of differences among the experimental groups.¹² A significance level of $P < 0.05$ was used. All values were presented.

RESULTS

Tables 2 and 3 present the mean values of some biochemical parameters and mineral levels in pure-bred Arabian mares according to age. Significant variations were observed in the values of BUN, direct bilirubin, calcium ($P < .01$), ALP, creatinine, total protein, total bilirubin, and phosphorus ($P < .001$) between different age groups. In foals, ALP activity, direct bilirubin, and phosphorus levels were higher, whereas BUN, creatinine, total protein, total bilirubin, and calcium levels were lower as compared with older animals.

Mean serum concentrations of glucose, albumin, iron, and magnesium, and mean serum activities of AST, ALT, and LDH did not differ significantly among the different age groups ($P > .05$).

DISCUSSION

Reference values for biochemical variables in the blood may vary per breed and are influenced by age and, to a certain extent, by rearing conditions.^{1,8}

Several studies¹⁵⁻¹⁷ have reported a decrease in serum albumin level with advancing age in sheep and calves,

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