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Serum Electrolytes Variation in Arabian Mares

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Abstract: The aim of this study was to determine the difference in biochemical serum constituents of Arabian mares in different ages. Calcium, Phosphorus, Sodium, Potassium, triglycerides and total proteins were determined. According to thier age. Mares were assigned to the flowing five groups, G1 were 2 years old (n=5), G2 were 4 to 5 years old (n=7), G3 were 6 to 11 years old (n=7), G4 were 13 to 17 years old (n=10) and G5 were older than 20 years (n=12). Mares were grouped on the basis of history records. There was no significant difference between all groups for Calcium, sodium, potassium and triglycerides serum levels ($P>0.05$). However fillies in G1 had a phosphorus serum level significantly higher than all other groups ($p<0.05$) and $p=0.008$ with aged mares, Magnesium serum level in the first group was significantly lower than ($p<0.05$) than mares of the second group. The mean levels of total protein in the older mares were significantly higher ($p<0.05$) than the mares aged between 4 and 5 years old. In this study differences in some biochemical serum constituents were recorded, in mares within different ages due to differences in requirements and reproductive status.

Key words: Age of Arabian Mares · Serum Macro-Minerals · Calcium · Reproduction

INTRODUCTION

Since 1877, Arabian horses were bred in Algeria in the national Haras of Chawchawa. Animals are used only for horse sports and reproduction. Fertility was always controlled by a qualified personnel or the veterinary, lately ultrasonography was introduced for a best control of reproduction. Regarding the origin of the breed studied, Arabian horses are considered hot-blooded characterized by their higher metabolic requirements [1].

Hormonal dysfunction, genetic disabilities and management factors, including the nutrition of brood mare were reported to be the major causes of infertility in mares [2]. Inadequate nutrition has been reported to impair reproduction in farm animals [3, 4]. Horse requirement for calcium phosphorus and magnesium, change in pregnancy due to increased needs of the developing fetus [5].

Studies revealed higher calcium levels in estrual mares compared with infertile mares [6]. Also the deficiency of various minerals was correlated with reproductive disorders and embryonic mortalities [2]. Magnesium deficiency delays the uterine involution and causes fetal loss and irregular estrus cycle in mares [7].

Based on available data in animal nutrition, it can be inferred that macro minerals metabolism and nutrition, with some exceptions, is similar among animal species and therefore observations on one species may be extrapolated to others [8]. Mares received high quality of protein ovulated earlier in the breeding season [9]. High protein quality stimulated FSH and LH production in the late transitional period [10].

The present study, aimed to correlate the age of mares to serum levels of some minerals, total proteins, calcium, inorganic phosphorus, magnesium, sodium, potassium and triglycerides.

MATERIALS AND METHODS

The present study was conducted on forty-four Arabian pure bred mares in Tiaret, Algeria from 2009 to 2010, aged between 2 and 25 years old. All animals belong to the national Haras of Chawchawa, history of the animals since birth were recorded. Animals were provided with barley, seasonal available fodder and water, was available *ad libitum*.

The mares were grouped according to their age. The category of each mare was determined according to its record history and assigned to five groups.

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G1 (n=5) comprised fillies within two years old.G2 (n=7) mares from 4 to 5 years old.G 3 (n=7) contained mares between 6 and 11 years old. G 4 (n= 10) included mares between 13 and 17 years old. G 5 (n= 12) comprised mares older than 20 years.

Fasting blood samples were collected directly in a clean sterile heparine test tubes kept in Ice and sent to MAACHI biochemical laboratory as soon as possible for analysis. Serum was immediately separated by centrifugation. Serum levels of sodium, magnesium, phosphorus, potassium, calcium, triglycerides and total protein were determined using a Roche® COBAS *Integra 400*. Sodium and potassium plasma levels were determined by plasmatic selective electrodes ISE ILYTE.

Data were statistically computed using STATISTICA 5.0 PL and tabulated as *means and standard deviation*

RESULTS AND DISCUSSION

The distribution of serum biochemical parameters concentration is listed in Table 1.

Calcium and inorganic phosphorus represent 70% of minerals in any living organism [11]; In horses, their homeostatic regulation is not yet clear [12].

In this study, all values were in the average reported. However there was no significant difference for Calcium serum levels (P>0.05) between all groups. The same results were previously reported [13]. While a significant difference between fertile and infertile animals was observed [6].

A mean value of calcium about 2.86 ±0.08 mmol/L in foals between one and six months of age was also observed. [14]. The concentration of Calcium and inorganic phosphorus, increase significantly in early lactation, the low maintenance of normocalcaemia with reduced bone synthesis in late pregnancy prove the role of estradiol in bone metabolism in mares during pregnancy and lactation [15].

In this study the fillies in G1 had a serum Phosphorus serum level values significantly higher than all other groups ($p<0.05$). The results showed that phosphorus decreased significantly, whereas calcium and total protein increased with age. In fillies phosphorus levels were higher, whereas total protein and calcium levels were lower as compared with older animals.

In foals phosphorus levels were higher, compared with older animals [16]. Also, it was reported a phosphorus serum values for foals aged between one and six months about 2.00±0.16 mmol/L and in mares between 0.36 and 1.42 mmol/L[14]. However all values found were in the average of values reported between 0.5 and 1.6 mmol/L[17]. The calcium to phosphorus ratio in this study was lower in G1 than the previously reported values

The serum levels of magnesium in this study were significantly lower ($p<0.05$) in fillies than in mares aged between 4 and 6 years, but no differences were recorded between other groups. However, all values were lower than those previously reported [14] for non pregnant mares 0.75 mmol/L, 0.83 mmol/L for early pregnancy and 0.82 mmol/L for late pregnancy. Low serum magnesium levels have been reported [18, 19] to cause either complete sterility or considerable fetal malformation with resorption and abortion.

Sodium presents the principal base of plasma and its function appears to be physiochemical in nature, where in it is responsible to maintain osmotic pressure and acid base balance. A decrease in serum sodium contents in physiological conditions like pregnancy or pathological conditions like pneumonia has been seen [20]. The serum sodium levels average of 132.76mmol/L was reported [21]. The values determined for most groups in this study are within the previously reported ranges, but there were no significant differences between mean values recorded in all groups.

After 12 hours of life, there is generally a decrease in serum concentrations of Sodium, plasma protein and possibly calcium and glucose concentrations are all higher in foals than in mature horses [22].

Table 1: Mean (± SD) serum levels of macrominerals, triglycerides and proteins in mares with different ages

ages (Years)	*n*	*Ca mmol/l*	*P mmol/l*	*Mg mmol/l*	*Na mmol/l*	*K mmol/l*	*Trigly. mmol/l*	*Proteins g/l*
2	5	2.91±0.03	1.43±0.26	0.57±0.07	135.62±1.75	4.39±0.64	0.72±0.27	66.40±3.44
4-5	7	2.96±0.60	0.97±0.14	0.67±0.07	134.60±4.61	3.86±0.63	0.99±0.45	64.67±4.93
6-11	7	2.75±0.23	0.97±0.16	0.66±0.10	136.31±2.89	3.65±0.98	0.83±0.25	69.86±5.08
13-17	10	3.10±0.61	0.96±0.17	0.61±0.07	134.28±4.46	3.71±0.60	0.76±0.29	65.86±3.34
≥ 20	15	3.15±0.60	0.87±0.18	0.63±0.08	133.99±3.48	3.71±0.07	0.88±0.51	70.40±5.78
Total	44							

In this study the mean levels of potassium for fillies group were higher than all others, whereas the values don't change significantly between adult mares groups. For serum potassium, similar values to those obtained in this study were given by some workers to be 3.5±0.5mmol/L [14].

Potassium deficiency is more likely to occur when horses are maintained on a high grain, low forage diet. For example, when horses were fed a diet consisting of 1/3 grass hay and 2/3 oats, a diet commonly fed to horses in training or racing, a net loss of potassium occurred [23].

In this study no significant differences were noted in the serum mean values of triglycerides, but the lowest value was observed in fillies group. However triglycerides serum average values for late prenatal mares was reported to be 0.86 ±0.40 mmol/L higher than in mares in late pregnancy 0.33±0.12 mmol/L and 0.35±0.13 mmol/L [27].

The mean value of plasma total protein in fillies group was significantly higher 66.40±3.44 g/l than in mares aged between 13 and 17 years 65.86±3.34 g/l and it was significantly lower in mares aged between 4 and 5 years 64.67±4.93 g/l than in mares older than 20 years 70.40±5.78 g/l, however serum values of total protein was not significantly different in mares aged between 6 and 11 years. A value of total protein about 62±3 g/l was observed in foals between one and six months of age [14]. Nevertheless, mean values were lower than values reported by Andrey *et al*. [28], 78.5±1.5 g/l and 78.7±1.4 g/l for non pregnant mares, 76.5±1.0 g/l and 76.6±1.0 g/l for early pregnant, 75.3±1.0 g/l and 79.4±1.0 g/l for mid pregnancy, 75.9±1.0 g/l and 78.8±1.0 g/l for late pregnant mares.

The lack of scientific studies referring to haematological parameters and total plasma protein concentration in horses, specifically in pregnant mares, makes it difficult for the clinical veterinarian to perform blood examinations, especially physiological changes that may occur during the different periods of pregnancy [29, 30].

Factors such as breed and physiological changes during the pregnancy influenced the serum results [30]. Nevertheless, factors such sex and age did not generate differences in the studied variables agreeing with workers reports [31].

CONCLUSION

It was concluded that because of specific requirement there was differences between serum profiles of mares with different ages, fillies within 2 years old had only requirement for growing therefore no deficiencies were observed, moreover many differences in serum constituents were observed in the different age groups, however mares in age of reproduction had requirement for fetus growing or milk yielding.

Mare is capable of considerable adjustment to variety of situations, but the extreme of excesses or deficiencies of biochemical constituents may lead to lower reproductive efficiency. It is preferable to experiment impact of deficiencies on reproduction in Arabian mares.

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