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Short Communication

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Effect of Age, Gender, and Season on Hematological Parameters in Quarter Horses

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Abstract

Objective: To determine the effect of age, sex and season on some selected hematological parameters of quarter horses (QH) from the North East of Mexico.

Materials and Methods: Blood samples of 205 healthy QH were collected from January 2007 to January 2009 from the North East of Mexico and hematological parameters were determined. The values obtained were subjected to a one-way ANOVA ($p<0.05$) to determine the significant differences in the hematological parameters compared to variables as age, sex, and seasons of the year.

Results: Statistically significant differences (mean values ± SD) were detected in different hematological parameters such as regards age, sex and season.

Conclusion: The hematological parameters varied among breeds and are influenced by age, physical activity and environment, it is necessary to consider those parameters in future studies to obtain clinical diagnosis when working with this type of race. Similarly, it suggested a high number of studies on blood evaluation of QH for your specific application in health and development in these organisms.

Keywords

Hematological parameters; Mexico; Quarter horse

Introduction

The Quarter Horse (QH) is considered as a race-breed, which also is used for cutting, jumping, reining, roping cattle and other ranch activities. In addition, the QH also is used in the competition called "charreada", the Mexican equivalent of the American rodeo. Due to the several uses of the QH, which imply different intensities of exercise, it is essential to have effective health-programs. The first step of such programs consists of the identification of baseline values in clinically healthy horses, including hematological reference values (Table 1) [1,2]. Measurement of the most important haematological values of animals provides useful data to evaluate health condition of animals, to confirm clinical diagnoses, as well as to evaluate treatments and outcomes in both, a single animal or herds [3,4].

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The hematological values of horses, and many other animals, depend on several factors, including age, breed, environmental conditions, geographic location, sex, management, medical procedures, physical condition, rearing, reproductive status, etc. [3,5,6]. Several studies have determined the hematological values of some breeds such as hot-blooded and warm-blooded [3-5,7-11]. In addition, the influence of age and management conditions on hematological parameters has been evaluated in different studies [12].

In spite of the information in the abovementioned studies, data on hematological parameters in QH with different characteristics and under different environmental conditions is scarce. Therefore, the objective of this study was to determine the effect of age (colt, filly, gelding, male and female yearling, mare, and stallion), sex and season of the year (spring, summer, autumn and winter) on some selected hematological parameters in a population of clinically healthy QH, under similar environmental conditions, from the North East of Mexico.

Materials and Method

Study area and horses

The study was carried out from January 2007 to January 2009, in 15 different municipalities of the State of Tamaulipas in Northeast of Mexico (22° 12' 31" to 27° 40' 42" N; 97° 08' 38" to 100° 08' 52" W), which borders the Lower Rio Grande Valley of Southeast Texas, in the United States of America. The average environmental conditions in the study area are characterized by a semi-humid weather with an annual rainfall of this region is 891 mm and the average relative humidity is 67.5%.

Two-hundred and five clinically healthy QH (59 females, 71 males and 75 geldings) of ages ranging from one to 15 years old (4.23 ± 1.95) were involved in the study. These horses were fed with forage and commercially-formulated concentrates, and fresh water ad libitum. All horses were dewormed and vaccinated, following an appropriate schedule for each of them.

Sample collection and laboratory analysis

Blood samples were collected in vacuum tubes with EDTA 10% by jugular puncture. Then, the blood samples were stored at 4°C for up to three hours, until analysis under laboratory conditions.

Once in laboratory, the erythrocytic parameters such as Red blood cell count (RBC), Packed cell volume (PCV), Haemoglobin concentration (Hgb), Volumetric indexes (mean cell volume [MCV] and mean cell haemoglobin concentration [MCHC]); Leukogram; i.e., total white cell count (WBC), differential white cell count (monocytes, [MONO], Lymphocytes [LYMPH], Segmented neutrophils [Segs], Band neutrophils [Bands], Eosinophils [EOS] and Basophils [BASO]); also total plasma proteins (TPP) were evaluated.

In order to reduce differences and errors derived for using several kinds of automated analyzers and their quality controls, the above mentioned hematological values were determined using manual techniques, as previously described Jain in 1993, in spite these are considered laborious and time-consuming methods. All haematological parameters were evaluated following standard procedures.

Statistical analysis

The haematological values had a normal distribution, which was assessed with the Kolmogorov-Smirnoff non-parametric test. Consequently, the differences of horses' values grouped by sex (female, male and gelding) age/sex (yearling [either female or male, from one to two years old], filly [female, from two to four years old], colt [male, from two to four years old], mare [adult female, five years old and over], stallion [adult male used for breeding, five years old and over] and gelding [castrated adult male, five years old and over] and season of year (Spring, Summer, Autumn and Winter) were statistically analyzed by means of a one-way ANOVA ($P<0.05$) and summarized by mean ± standard deviation; these analyses were performed using the software Statistica (version 7.0).

Results

The variations of hematological values of the analyzed QH, grouped by sex, age/sex and season of year are shown in Tables 1, 2 and 3, respectively. Statistically significant differences were found in MCV, LYMPH and Segs between females, males and geldings (Table 1). The differences in the age/gender grouped variables were for RBC, MCV, MCHC, MONO, LYMPH and Segs (Table 2). Also there were statistically significant differences in PCV, Hgb, MONO, Segs and TPP for season of year in which the horses were evaluated (Table 3).

Discussion

The hematological values may vary between horse breeds, and might be influenced by age, physical activity and environment [5,10], and can lead to a misdiagnosis of some health conditions [1,12,13].

Hematological parameters and TPP of the evaluated QH, either sex and/or age, fell within the normal ranges when compared with reference values reported for all breeds [6]; erythrogram values were similar to the reference values reported for QH, but not the WBC that were considerably higher in this study [3]. Furthermore, the haematological values of the analyzed QH were similar to the reported for Criollo horses from Brazil [11], for Dutch Warmblood, Hanoverian and Holsteiner jumping horses [10], Lipizzan [3] and, for Brasileiro de Hipismo [1]. However, the erythrogram and leukogram of the analyzed QH stallions were considerably lower than Pantaneiro stallions, despite these values were similar between QH mares and pregnant Pantaneiro mares [13].

However, there were differences with other similar studies in warm-blooded breeds. The erythrogram values of Standardbred mares were higher than QH mares analyzed in this study, with exception of MCV, which were similar in both breeds. In the leukogram, WBC, LYMPH and Bands were higher in Standardbred mares than QH mares, but lower for MONO, Segs, EOS, BASO and TPP [6]. Also, the values of MCV and WCB were similar between Standardbred males and QH males, but higher for MONO, Segs, EOS and TPP, and lower for RCB, PCV, Hgb, MCHC, LYMPH, Bands and BASO [6]. Furthermore, in Standardbred, Gordon et al. [8] reported variations in PCV according age and gender; however, in the analyzed QH there were no statistically differences in the age/gender group for this parameter, similarly to the reported by Lacerda et al. [1] for racing Thoroughbred, Brasileiro de Hipismo and Criollo from Brazil. In Chilean purebred horses at resting, Tadich et al. [14] determined values of PCV, Hgb and TPP that were higher for the same parameters of the evaluated QH.

Concerning the horses' age, Rebeiro et al. [13] reported an increment of RBC until the age of 24 months for Pantaneiro horses, after which these values declined; similar response was found in the QH studied. Despite the obtained values of LYMPH were statistically significant different when analyzed for the age/gender group, there were not an increment relating the animals' age, as has been previously reported for WBC and LYMPH of QH foals [9]. In Dutch warm-blood foals, Kahn et al. [5] did not find differences related with age for Bands, EOS, BASO and MONO; however, in this study there were statistically significant differences for MONO. Also, the results of this study were considerably higher for the erythrogram, WBC, MONO and LYMPH values, in comparison with horses from Pakistan, but lower for EOS and TPP; only the BASO were similar in both studies [2]. The differences between MONO, LYMPH and Segs in the age/gender analysis reported in this study, could be explained due to

Table 1: Gender variations of hematological values (Mean ± SD) in the quarter horse from Mexico grouped by gender.

Parameter	Female	Male	Gelding
Erythrogram			
RBC (10^{12} g/L)	8.1 ± 1.5	8.1 ± 1.5	7.6 ± 1.6
PCV (10^{2} L/L)	35.6 ± 5.8	35.5 ± 5.4	35.5 ± 5.9
Hgb (g/L)	119 ± 19	119 ± 18	118 ± 20
MCV (fL)	44.2 ± 5.8^{a}	44.4 ± 6.2^{b}	47.6 ± 6.2^{c}
MCHC (g/L)	332 ± 2	332 ± 3	332 ± 1
Leukogram			
WBC (10^{9}/L)	10.8 ± 9.9	9.0 ± 2.2	8.9 ± 3.2
MONO (%)	4.9 ± 6.0	3.9 ± 2.9	3.2 ± 2.0
LYMPH (%)	39.0 ± 13.1^{b}	37.4 ± 11.9^{c}	31.6 ± 9.7^{a}
Segs (%)	53.0 ± 10.9^{c}	57.0 ± 11.3^{a}	59.6 ± 11.6^{b}
Bands (%)	0.3 ± 0.7	0.2 ± 0.4	1.0 ± 0.6
EOS (%)	4.0 ± 4.4	2.7 ± 1.8	4.1 ± 3.8
BASO (%)	0.5 ± 0.8	0.3 ± 0.6	0.48 ± 0.8
Other parameters			
TPP (g/L)	78 ± 09	78 ± 11	81 ± 12

Values with different letter in the same row are significantly different at $p<0.05$

RBC: Red Blood Cell Count; PCV: Packed Cell Volume; Hgb: Hemoglobin Concentration; MCV: Volumetric Indexes; MCHC: Mean Cell Haemoglobin Concentration; WBC: Total White Cell Count; MONO: Monocytes; LYMPH: Lymphocytes; Segs: Segmented Neutrophils; Bands: Band Neutrophils; EOS: Eosinophils; BASO: Basophils; TPP: Total Plasma Proteins

Table 2: Haematological values (Mean ± SD) of the quarter horse from Mexico grouped by age/gender group.

Parameter	Yearling	Filly	Colt	Mare	Stallion	Gelding	All groups
Erythrogram							
RBC (10^{12} g/L)	8.7 ± 1.6[a]	8.4 ± 1.4[b]	8.2 ± 1.3[c]	7.9 ± 1.79[d]	6.9 ± 1.7[e]	7.6 ± 1.6[f]	7.9 ± 1.6[g]
PCV (10^2 L/L)	35.4 ± 5.9	35.3 ± 4.7	35.7 ± 5.4	35.3 ± 6.9	33.6 ± 5.02	35.5 ± 5.9	35.4 ± 5.7
Hgb (g/L)	118 ± 20	117 ± 16	120 ± 18	116 ± 23	112 ± 17	118 ± 20	118 ± 19
MCV (fL)	40.9 ± 4.7[b]	42.6 ± 5.1[c]	44.4 ± 6.6[d]	45.1 ± 6.5[e]	46.4 ± 6.2[f]	47.6 ± 6.2[g]	45.5 ± 6.4[a]
MCHC (g/L)	332 ± 1[c]	332 ± 2[d]	332 ± 1[e]	332 ± 1[f]	330 ± 7[g]	332 ± 1[a]	332 ± 2[b]
Leukogram							
WBC (10^9/L)	9.3 ± 2.6	10.9 ± 6.6	9.5 ± 2.2	11.3 ± 13.2	7.5 ± 1.8	8.9 ± 3.2	9.6 ± 5.9
MONO (%)	3.8 ± 2.4[d]	6.5 ± 9[e]	4.3 ± 2.9[f]	3.8 ± 2.7[g]	3.6 ± 3.8[a]	3.2 ± 2.0[b]	4.0 ± 4.0[c]
LYMPH (%)	42.0 ± 10.0[e]	43.5 ± 10.5[f]	38.9 ± 11.7[g]	34.8 ± 14.6[a]	29.6 ± 11.2[b]	31.6 ± 9.7[c]	35.6 ± 11.9[d]
Segs (%)	52.7 ± 9.2[f]	48.8 ± 8.3[g]	55.4 ± 11.4[a]	56.2 ± 12.[b]	63.1 ± 10.8[c]	59.6 ± 11.6[d]	56.7 ± 11.6[e]
Bands (%)	0.3 ± 0.5	0.3 ± 0.8	0.1 ± 0.3	0.2 ± 0.5	0.4 ± 0.7	1.0 ± 0.8	0.5 ± 0.8
Leukogram							
EOS (%)	2.6 ± 1.1	4.2 ± 5.6	2.6 ± 1.7	4.1 ± 3.8	3.6 ± 2.4	4.1 ± 3.8	3.7 ± 3.6
BASO (%)	0.3 ± 0.7	0.7 ± 0.9	0.2 ± 0.5	0.5 ± 0.7	0.4 ± 0.7	0.5 ± 0.8	0.4 ± 0.8
Other parameters							
TPP (g/L)	79 ± 13	78 ± 09	80 ± 09	77 ± 11	71 ± 08	81 ± 12	79 ± 11

Values with different letter in the same row are significantly different at $p<0.05$

RBC: Red blood cell count; PCV: Packed cell volume; Hgb: Hemoglobin concentration; MCV: Volumetric indexes; MCHC: Mean cell haemoglobin concentration; WBC: Total white cell count; MONO: Monocytes; LYMPH: lymphocytes; Segs: Segmented neutrophils; Bands: Band neutrophils; EOS: Eosinophils; BASO: Basophils; TPP: Total plasma proteins

Table 3: Seasonal variation of haematological values (Mean ± SD) of the quarter horse from Mexico.

Parameter	Spring	Summer	Autumn	Winter
Erythrogram				
RBC (10^{12} g/L)	7.7 ± 1.7	7.8 ± 1.5	8.0 ± 1.6	8.1 ± 1.4
PCV (10^2 L/L)	34.8 ± 5.8[a]	34.2 ± 5.4[b]	36.3 ± 6.1[c]	37.2 ± 5.3[d]
Hgb (g/L)	117 ± 46.5[b]	110 ± 44.2[c]	121 ± 45.1[d]	124 ± 46.3[a]
MCV (fL)	46.5 ± 6.3	44.2 ± 5.8	45.1 ± 5.8	46.3 ± 7.0
MCHC (g/L)	332 ± 1	333 ± 3	332 ± 3	332 ± 2
Leukogram				
WBC (10^9/L)	9.6 ± 3.0	10.1 ± 9.6	8.9 ± 2.5	9.1 ± 5.3
MONO (%)	3.3 ± 2.6[c]	3.5 ± 3.1[d]	3.6 ± 2.4[a]	5.5 ± 6.2[b]
LYMPH (%)	32.1 ± 11.0	35.9 ± 11.3	36.4 ± 12.0	38.4 ± 13.3
Segs (%)	60.2 ± 9.9[d]	56.3 ± 9.7[a]	54.4 ± 14.0[b]	54.9 ± 13.1[c]
Bands (%)	0.3 ± 0.7	0.2 ± 0.4	1.7 ± 7.7	0.4 ± 0.6
EOS (%)	4.7 ± 3.6	3.3 ± 2.4	2.9 ± 2.8	3.6 ± 5.2
BASO (%)	0.3 ± 0.7	0.4 ± 0.6	0.4 ± 0.8	0.6 ± 0.8
Other parameters				
TPP (g/L)	78 ± 13[a]	74 ± 09[b]	83 ± 06[c]	81 ± 10[d]

Values with different letter in the same row are significantly different at $p<0.05$

RBC: Red Blood Cell Count; PCV: Packed Cell Volume; Hgb: Hemoglobin Concentration; MCV: Volumetric Indexes; MCHC: Mean Cell Haemoglobin Concentration; WBC: Total White Cell Count; MONO: Monocytes; LYMPH: Lymphocytes; Segs: Segmented Neutrophils; Bands: Band Neutrophils; EOS: Eosinophils; BASO: Basophils; TPP: Total Plasma Proteins.

the diverse physical activities in these groups, because the physical activity have influence on the leukogram values [11].

Despite on laboratory findings three colts presented *Babesia equi*, only one of them had slightly lower erythrogram values (5.36×10^{12} g/L and 31×10^2 L/L, for RCB and PCV, respectively); this condition also has been described in Thoroughbred horses with babesiosis and normal haematological values [7].

The differences obtained among QH of different age and gender, and between QH and other breeds could be explained by differences in environment, food and metabolism and, rearing and management conditions [5]. In addition, age and gender, as well as breed, must be taken in mind for both appropriate diagnosis and research studies.

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