Open Veterinary Journal, (2018), Vol. 8(3): 330-334
ISSN: 2226-4485 (Print)
ISSN: 2218-6050 (Online)
Original Article
DOI: http://dx.doi.org/10.4314/ovj.v8i3.13

Submitted: 28/02/2018 Accepted: 30/08/2018 Published: 12/09/2018

Blood hematological values of Barb horses in Algeria

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Abstract
The Barb horse this famous Maghreb horse, symbol of the pride of the Berber peoples It is particularly significant in the Algerian history, tradition and culture. This study consists in establishing the hematologic values specific to the Barb horse in the national stud farm "Chaou-Chaoua" in Tiaret. Algeria. Age of the study animals varied between 1 and 23 years. The effects of age and sex were analyzed by dividing animals into four groups, A (1 - 2 years, n=5), B (3-5 years, n=5), C (5-10 years, n=5) and D (11-23 years, n=5); for females and E (2 - 3 years, n=5), F (5-7, n=5), G (10, n=5) and H (11-25, n=5) for males. Animals studied were clinically healthy. A blood sampling was carried out from all study animals, the following hematologic variables have been determined: erytrocytes (RBC), hematocrit (Ht), hemoglobin (Hb), mean cell volume (MCV), mean corpuscular hemoglobin concentration (MCHC), mean hemoglobin content (MHC), white blood cells (WBC), neutrophils, eosinophils, basophils, lymphocytes, monocytes, platelets, total number of platelets (PLT) and mean platelet volume (MPV). The obtained results showed that the hematologic values are within established standards for the other breeds of hot-blooded horses; these values approached the lower limits of the standards for the RBCs, HCT, Hb, WBCs and the lymphocytes. Statically significant ($P<0.05$) differences were observed between females in different age groups for the MCV, MCHC, Platelets and the MPV. Groups of males showed significant differences for lymphocytes and platelets and between males and females, significant differences related to the MCV, Neutrophils, Basophils Monocytes, Platelet and the MPV. This research showed that these hematologic parameters are weak, they approach the lower limits of the standards and that neither the age, nor the sex seem to have an influence on the hematologic values of the Barb horse.
Keywords: Age, Barb horse, Hematological parameters, Hematology, Sex.

Introduction

The Barb is one of the oldest equine breeds in the world; it would have settled during prehistory in North Africa thus, this breed is indigenous of the Maghreb region (Algeria, Libya, Morocco, Mauritania and Tunisia) (Bataille, 2008).

The Barb breed is a race susceptible to multiple variations due to its aptitude for adaptation to various environmental conditions, as well as the vast expanse of its cradle (North Africa) thus it is not uncommon to find multiple types of Barb. These variations are marked even at the individual level or more precisely at the blood level because of the various physiological factors (age, sex, food, gestation, stress, season…) being able to influence one or more blood parameters (Grutz, 2007).

It is often said that the various types of Barb come from their adaptation to the different regions of the Maghreb (according to their country of origin: Algeria, Morocco, Tunisia, Libya or Mali). The size and morphology of the Barb are different according to whether it develops from generations in areas of plains, mountains or in the northern boundary of the desert (Kadri, 2009).

It is a particularly rustic horse, of great sobriety, in particular under hot climates because of its resistance to dryness and climatic variations. He needs in particular a less food intake compared to horses of blood type Thoroughbred or the Selle Français. A famous saying on

him says that "he can hunger, he can thirst, he can cold, he can heat, never he is tired". The Barb acclimatizes itself perfectly to the life in the desert. Its highly reliable temperament makes an ideal horse for education. Calm, easy, balanced and brave, he is energetic and appreciates work. It is of an undeniable softness and an easy dressage (Bataille, 2008). The aim of the present study was to determine the reference hematologic values of the Barb, because the current standard values for blood testing are mainly compiled from data coming from horses of other breeds, and those cannot always be applied to many horses (Tyler *et al*., 1987; Radostits *et al*., 2000). Thus, if a veterinarian does not have laboratory reference values for the horse he examines, errors of diagnosis can occur. Consequently, blood samples were taken from 40 Barb horses of 1 to 23 years old in the national stud farm "Chaou-Chaoua" in Tiaret (35° 22′ 0″ N, 1° 19′ 0″ E), and mean with standard deviation of 15 parameters were determined in order to establish hematologic reference values. Now, the stud farm of Tiaret constitutes the leading provider

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of horses for races, while maintaining the "model" and the original type through a genetic capital of great value.

Materials and Methods

The present study was carried out on 40 horses (20 mares and 20 stallions) of Barb race aged from 1 to 23 years old. Effect of age was studied on four groups of mares: A, (1 - 2 years, n = 5); B (3-5 years, n = 5); C (5-10 years, n = 5) ; D (11-23 years, n = 5) and four groups of horses: E (2 - 3 years, n = 5);F (5-7 years n = 5) ;G (10 years, n = 5) and H (11-25 years, n = 5). The food ration consisted of barley and hay, the water was served ad-libitum. The animals were clinically healthy. The horses were selected on the basis of standard clinical examination and no clinical symptoms of any disease were noted. A blood sample was taken on all subjects between 9:00 am and 10:00 am before the distribution of their ration. The blood samples were taken during the October and November. Venous blood from the jugular vein is removed using a 18 gauge needle mounted on a 10 CC sterile syringe (KD-JECT® III, KDM®, Germany); then stored in test tube with K3EDTA x4ml (FL medical-ITALY) for hematological tests. In whole blood, the following are collected: red blood cell (RBC), hematocrit (Ht), hemoglobin (Hb), mean corpuscular volume (MCV), mean hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH), white blood cells (WBC), platelets (PLT) and mean platelet volume (MPV) were determined using a hematology automaton, calibrated for the equine species (Orphee Mythic 18 Hematology Analyzer®). Differential blood count (neutrophils (NEU), eosinophils (EOS), basophils (BAS), monocytes (MON), lymphocytes (LYM) was determined on a blood smear using a light microscope at x 400 magnification. The blood smears were ethanol-fixed and stained according to the May-Grünwald-Giemsa technique

Obtained results were analyzed with one way ANOVA using STATISTICA 9.1 (StatSoft Inc., Tusla.). The results considered statitistically significant for P values lower than 0.05.

Results

The mean value and the standard deviation for blood erythrocyte parameters, total and differential leukocyte count as well as the platelet formula are presented in Table 1 for all groups of females and males.

The mean value of the number of red blood cells (RBC), the hematocrit (Ht) and hemoglobin (Hb) were close to the lower limit according to (Jain, 1986) for all groups, no difference was observed for these parameters.

Mean blood cell volume (MCV) and mean corpuscular concentration Hb (MCHC) were high for all groups, with a significant difference in females and in males and females ($p<0.05$). Mean corpuscular Hb (MCHC) was slightly higher in group A, with a significant difference in groups of females.

The number of leucocytes was normal for the female groups, however the groups of males F, G and H had values below standards, no significant difference was found between the different groups. The average number of neutrophilic granulocytes in horses of the group G was below standard with a significant difference between groups of males. The mean value of eosinophils, basophils and lymphocytes was normal for all groups.

The number of monocytes was within standards regardless of the age group except for group C where the value was high; a significant difference was observed between groups of males. The average platelet count and mean platelet volume (MPV) were within standards (Jain, 1986) for all animals, but a significant difference was found in females, in males and between males and females.

Discussion

Hematological tests in horses helps in the clinical diagnosis of systemic, infectious diseases and some parasitic diseases. It can also provide important information on the treatment response and metabolic status of horses (Ricketts, 1987; Lassen and Swardson, 1995; Messer, 1995). Despite the prolonged use of hematology in equine medicine, interpretation can be a challenge in some cases because it can be influenced by a large number of factors. Hematologic parameters may vary according to breed, sex, age, reproductive status, physical form, training level, feeding, animal handling, blood sampling, degree of excitation and state of health (Jain, 1993; Rose and Hodgson 1994; Messer, 1995; Kramer, 2000). The groups of horses used in our study did not show large variations for most of the parameters according to age and sex. Red blood cell counts, Ht and Hb were within normal range for all groups with slight anemia in group B in females and group H in males. No sex difference has been observed for these indices according to studies of Gupta *et al*. (2005) and Harvey *et al*. (1984, 2005). For others, young horses and young adults had higher values than older ones (Robinson and Sprayberry, 2003; Feldman *et al*., 2006; Reed *et al*., 2010; Satue *et al*., 2012). This low rate of erythrocyte parameters could be due to a low food ration not adapted to their physiological needs. However, a study in pregnant mares of purebred Arabian breed living at the "chaouchaoua" farm in Tiaret under the same conditions showed higher levels of RBC, Ht and WBC (Meliani *et al*., 2014). Our results showed a MCV and an MCHC above normal values (Jain, 1986) for all groups. The low RBC values are compensated by an increase in RBC size (Satue *et al*., 2009), but no differences between males and females, unlike other studies for which females have a higher MCH and MCHC than males.

Table 1. Haematological indices in Barb equids of different age and sex groups (standards Adapted from Jain (1986)).

Groupe	A (n=5)	B (n=5)	C (n=5)	D (n=5)		E (n=5)	F (n=5)	G (n=5)	H (n=5)			
Age	1-2	3-5	5-10	11-23		2-4	5-7	10	11-23			
Parameters	mean ± SD	mean ± SD	mean ± SD	mean ± SD	P / female	mean ± SD	mean ± SD	mean ± SD	mean ± SD	P / male	Standard	P / male / female
RBC (X 10^{12}/L)	7.13± 1.71	6.17± 0.77	7.22± 0.79	6.95± 0.84		6.31± 0.60	6.55± 0.60	6.10± 0.56	6.06± 0.62		6.8-12.9	
Ht (%)	31.4± 6.54	29.66± 4.62	34.92± 2.66	33.88± 4.14		30.7± 2.17	32.32± 3.31	31.96± 1.52	30.9± 2.97		32-52	
Hb (g/dl)	14.62± 4.06	10.46± 0.98	13.42± 1.23	12.86± 1.76		12.36± 2.55	11.64± 1.53	10.88± 1.36	11.8± 1.11		11-19	
MCV (fl)	44.36± 2.05	47.78± 2.63	48.78± 2.30	50.16± 2.04	0.014	48.9± 3.96	49.32± 1.07	52.56± 2.72	51.02± 2.33		37-58	0.011
MHC (g/dl)	45.86± 4.23	35± 5.92	38.3± 1.40	37.53± 1.15	0.005	40.22± 7.78	35.92± 1.11	34± 3.22	35.98± 2.76		31-38.6	
MCHC (pg)	20.34± 2.04	16.64± 2.20	18.64± 0.37	19.04± 0.64	0.028	19.94± 5.48	17.72± 0.78	17.84± 1.87	18.38± 1.84		12.3-19.9	
WBC (/mm³)	5800± 1682.85	5720± 2632.41	8780± 1195.66	6820± 1983.33		5620± 1842.17	5140± 1412.23	4000± 1285.30	4740± 1466.42		5400-14300	
Neut (/mm³)	2882± 1083.59	2674.4± 1145.37	4119.8± 1117.60	3793± 1594.54		2892.8± 1352.54	2410.4± 1167.38	1968.2± 639.01	2352± 858.59		2260-8580	0.0004
Eosi (/mm³)	443.4± 347.94	245.4± 185.43	382.6± 131.60	263.4± 231.25		260.8± 201.34	109.2± 58.33	100.4± 97.62	133.2± 88.38		0-1000	
Baso (/mm³)	11.4± 22.8	14.6± 29.2	0	50± 54.98		45.4± 40.30	47.6± 40.82	53± 47.51	33.6± 28.91		0-290	0.000005
Lymp (/mm³)	1934.8± 540.15	2275± 1520.04	2249.2± 436.05	1843± 761.48		1779.8± 281.61	2048.6± 254.36	1136.8± 468.53	1428.6± 413.77	0.014	1500-7700	
Mono (/mm³)	531.2± 231.82	634± 234.17	2459.8± 1604.17	921.2± 628.48		661.2± 320.59	525.6± 254.36	740± 529.37	643± 180.72	0.05	0-1000	0.0002
Plat (/mm³)	108.6± 32.34	165.2± 47.89	231.2± 52.09ac	171.4± 38.83	0.028	117.2± 56.06	148.6± 59.89	202± 39.37	218.6± 52.84		100-350	0.00000001
MPV (fl)	8± 1.40	6.3± 0.38	6.04± 0.22	6.12± 0.43	0.006	5.98± 0.61	6.22± 0.36	5.92± 0.23	6.14± 0.12		4-8	0.00000001

Hematological differences related to sex seem to be of limited importance in horses. Indeed, minor differences between adult females and males were reported in our study. However, the results of research in this area are controversial. Males have higher red blood cells, Hb and Ht, while females have higher MCH and MCHC (Jain, 1986; Hernández *et al*., 2008; Satue *et al*., 2009). On the other hand, Gill and Rastawicka (1986) observed in Thoroughbred and Quarter horses that RBC, Ht and HB were higher in mares than in males. Persson and Ullberg (1974) reported that hematological values were higher in stallions, probably because of the effect of androgens on erythropoiesis.

In our study the WBC values were normal according to (Jain, 1986) for females and males in groups F, G and H had slightly lower values.The usual values often give fairly wide intervals [5.4 to 10.3 10^3] because some age-related variations are not taken into account, (Ralston *et al*., 1988; McFarlane *et al*., 2001). The number of RBC decreases with age. This significant decrease with age could be linked to a reduction in regeneration capacity (Fermaglich and Horohov, 2002). A similar decrease in age-related RBC and WBC values has been reported for other warm-blooded horses (Feldman *et al*., 2006). Basophils had a low percentage in our study. McFarlane *et al*. (2001) found an average of 49 C / mm³ in young horses and 58 C / mm³ in older horses less than 100 C / mm³. This is similar to our result, however basophil levels were higher in males than females with a significant difference in males and females. The rate of lymphocytes was in the standards for all females , however, it was substandard for older males. McFarlane *et al*. (2001) found a significant decrease in the number of lymphocytes in older horses, there is an alteration age-related immune system in the equine species. Moderate lymphocytosis (6 to 10. 10^3 / mm³) is sometimes found in "physiological" leukocytosis related to fear or pain but also after antigenic stimulation (Nguyen *et al*., 2007). Age did not seem to affect the number of monocytes (McFarlane *et al*., 2001). This is similar to our results. Group C in our study had leukocytosis. it could be a sign of chronic inflammation (Fortier *et al*., 2008). The number of platelets increased with age. Results findings on this topic are controversial. Some authors found platelet decrease in horses (Ralston *et al*., 1988; Jain, 1993; Satue *et al*., 2008), while others found no significant differences in older horses (McFarlane *et al*., 1998).

Conclusions

Neither age nor sex influences hematological values in the Barb horse. They are closer to that of the cold-blooded horses (Jain, 1993) this is probably related to his temperament.

For this reason, many hematological variables in Barb horses may be lower than the reference values described for other equine breeds, making the diagnosis of mild anemia difficult in some cases.

Conflict of interest

The authors declare that there is no conflict of interest.

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