Influence of the Reproductive Status on Different Haematological Parameters in Pure Bred Arabian Mares Raised in Tiaret Algeria

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Abstract: Normal haematological values need to be defined for each breed and age in order to increase diagnostic precision. No published data on haematology exists for Arabian horses raised in Algeria. This research compares the haematological characteristics of Arabian pure bred mares of different reproductive status. Sixty pure bred Arabian mares divided in three categories, respectively pregnant, post partum and lactating mares were divided into four age groups with five mares each one: A (5-10 years), B (10-15), C (15-20) and D (>20 years). Jugular blood samples were taken and data were pooled for each animal. No significant difference was observed in all haematological parameters between lactating mare's groups. However we found that pregnant mares aged between 10 and 15 years (Group B) presented lower a total leukocyte counts than others ($p < 0.05$) and a significant difference was observed between post partum mares in total erythrocyte counts, Haemoglobin and Packed cell volume. In this study some haematological parameters were influenced by age and reproductive status of mares.

Key words: Horse · Age · Arabian Mares · Haematology · Blood

INTRODUCTION

Haematological analysis in horses is an important aid for clinical diagnosis of systemic infections and some parasitic diseases. It can also provide significant information about the response to treatment, the severity of disease and the metabolic state of animals [1-3]. Despite the extended use of haematology in equine medicine, interpretation may be a challenge in some cases, because it can be significantly influenced by a great number of factors. Haematological parameters may vary according to breed, sex, age, reproductive status, fitness, exercise, feeding, circadian variations, degree of excitement and health state [3-6].

The horse is unique in comparison to most other mammalian species in that the spleen is a very capacious organ, storing up to one third of the red blood cells and this reserve can by mobilized by exercise, stress or excitement [2, 5, 7-9].

Arabian breed horses are considered hot-blooded [10]. These animals are characterized by their higher metabolic requirements and consequently have higher levels of *Red Blood Cells counts* (RBC), *Packed Cell Volume* (PCV) and *Haemoglobin* (Hb), compared to horses of the other breeds, according to findings reported [2, 3, 11]. Physiologically, higher RBC, hematocrit and haemoglobin levels can play a role in better physical condition, such as in sports activities [12].

The influence of age on the haematological parameters has been evaluated in different equine breeds [13-16]. The importance of appropriate ranges of reference for accurate interpretation of clinico-pathological data is well recognized in equine medicine. Most of the studies concerning the haematological parameters focused on foals from birth to four years of age [4, 17, 18], although recently old horses have received more attention, probably because the increase in the population of geriatric animals [14, 19]. As far as we are aware there are no reports concerning haematological parameters in Pure bred Arabian mares, the present paper was planned to present the haematological characteristics of purebred Arabian mares at different ages, sex and reproductive phases and to verify the hypothesis that age induces some haematological modifications in pure bred Arabian mares raised in Tiaret Algeria.

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MATERIALS AND METHODS

The present study was conducted on 60 pure bred mares during 2010-2011 in Tiaret, Algeria. All animals belong to the national Haras of Chawchawa. The history of these animals was recorded since delivery. The animals were fed barley, fodder and seasonal water *ad libitum*. All the mares were subjected to a general clinical examination before collecting blood samples and in all cases, no significant clinical findings were observed. Only mares without evidence of trauma or illness before or during the study were included. Mares were grouped according to their age. The reproductive statute of each mare was determined according to its recorded history, in conjunction with results obtained with rectal examination and the ultrasonography. Mares were assigned to three categories: pregnant, post partum and lactating mares. Each category divided into four groups of five mares each one: A (5-10years), B (10-15), C (15-20) and D (>20 years). Jugular blood samples were collected directly in a clean sterile test tube from each mare early in the morning before feeding. The blood samples were brought to the biochemical laboratory within two hours for analysis. For the studied parameters, data were arranged in 8 x 4 categories. For each category, mean and standard deviation values were determined. Data of various categories were analyzed statistically using ANOVA and the significance level of P<0.05.

RESULTS AND DISCUSSION

This research assesses the haematological differences when comparing Pure bred Arabian mares of different ages. The results of different data are given in Tables 1, 2 and 3.

In this study, no significant difference was observed in all haematological parameters between lactating mare's groups. However we found that pregnant mares aged between 10 and 15 years (Group B) presented lower total leukocyte counts than others (p<0,05) and a significant difference was observed between post partum mares in total erythrocyte counts, Haemoglobin and Packed cell volume (Table 3). In the advanced stage of gestation, there is an endogenous adrenaline release which induces the greater mobilization of neutrophils in the circulation resulting in an increase in total leucocyte count [6]. During the last period of gestation the number of leucocytes increased gradually being higher than the ones described by Vaz *et al.* [12] in Arabian pregnant mares.

The reduction in total erythrocyte counts with ageing has been described already in Standard-bred trotters [13, 17, 25], Lipizzaner [26], Spanish Purebred [16] and feral horses [27]. However, the research performed by McFarlane *et al.* [14] only found a trend of falling total erythrocyte counts when geriatric horses were compared to a control group. The results obtained in the Pure bred

Table 1: Mean ± SD values for blood samples of pregnant mares.

Group of age	A (n=5)5- 10 years	B (n=5)10- 15 years	C (n=5)15- 20 years	D (n=5)☐ 20 years	p
Parameters	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Total leukocyte counts (U/ml)	9178,00±593,03	7400,00±330,15	9880,00±571,84	8940,00± 531,60	0,03
Total erythrocyte counts (X 1012/L)	8,37±0,24	7,42±0,22	7,54±0,86	7,22±0,55	0,15
Haemoglobin (g/dL)	14,00±0,32	13,30±0,38	13,48±0,51	12,44±0,87	0,31
Packed cell volume (%)	38,22±0,83	38,36±1,87	37,90±1,74	34,74±2,40	0,41
MCV (fl)	46,20±0,49	50,60±0,98	50,60±2,54	49,30±2,36	0,13
TCMH (pg)	17,08±0,17	18,00±0,15	18,02±0,65	17,52±0,54	0,18
MCHC (g/dl)	36,70±0,17	35,78±0,43	35,74±0,62	33,86±1,93	0,28
Platelet (U/ml)	177200,00±16,04	185400,00±15,88	150200,00±17,15	194800,00±25,16	0,42

Table 2: Erythrogram of purbred Arabian lactating mares Mean ± SD

Group of age	A (n=5)5- 10 years	B (n=5)10- 15 years	C (n=5)15- 20 years	D (n=5)☐ 20 years	p
Parameters	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Total leukocyte counts (U/ml)	9300,00±569,21	8100,00±571,84	8640,00±1067,99	9100,00±370,14	0,64
Total erythrocyte counts (X 1012/L)	7,97±0,78	7,95±0,86	7,19±0,61	7,61±0,19	0,80
Haemoglobin (g/dL)	14,02±0,42	13,08±0,51	12,34±0,63	12,36±0,45	0,12
Packed cell volume (%)	38,30±1,54	37,22±1,74	36,54±2,01	35,82±1,05	0,72
MCV (fl)	50,10±3,31	49,80±2,54	52,92±1,84	48,08±2,00	0,78
TCMH (pg)	18,24±1,13	18,16±0,65	18,28±0,97	16,74±0,67	0,94
MCHC (g/dl)	37,18±0,75	35,72±0,62	34,24±0,75	35,14±0,94	0,14
Platelet (U/ml)	234000,00±31,55	185800,00±17,15	224400,00±39,32	212400,00±12,76	0,51

Table 3: Erythrogram of purbred Arabian mares with different reproductive states Mean± SD.

Mare's reproductive statues	Pregnant	Post partum	Lactating	p
Parameters	Mean ± SD	Mean ± SD	Mean ± SD	
Total leukocyte counts (U/ml)	8849,5±323,91	9315±422,22	8785±335,78	0,53
Total erythrocyte counts (X 1012/L)	7,63±0,19	7,34±0,28	7,67±0,31	0,64
Haemoglobin (g/dL)	13,305±0,29	13,16±0,39	12,95±0,28	0,74
Packed cell volume (%)	37,30±0,85	36,48±0,70	36,97±0,77	0,75
MCV (fl)	49,17±0,76	51,36±1,36	50,22±1,21	0,40
TCMH (pg)	17,65±0,17	17,66±0,70	17,85±0,42	0,94
MCHC (g/dl)	35,52±0,52	35,62±0,53	35,57±0,43	0,99
Platelet (U/ml)	176900±9,57	197200±11,34	208200±13,47	0,16

Arabian mares are in agreement with the data presented by Plotka *et al.* [27], Ralston, Nockels, Squires [13] and Cebulj-Kadunc *et al.* [26], since Group D of post partum mares presented significantly lower total erythrocyte counts values than Group A of the same category. This fact could be related to a reduced regenerative capacity of the bone marrow, the presence of subclinical chronic diseases and/or pituitary-dependent hyperadrenocorticism (pars intermedia dysfunction). The main reason for the lower total erythrocyte counts in older broodmares was considered to be the degree of activity of the bone marrow [28]. Increased erythrocyte size seems to be a frequent finding associated with ageing in horses [13, 14, 16].

According to Dinevand Khubenov [29], normal values of haemoglobin and erythrocytes of young animals are lower than adults. With aging, the total count of leukocytes shows a lowering trend, while the percent of neutrophils rises. However, Zinkl *et al.* [30] reported that erythrocytes, lymphocytes and fibrinogen decreased with age. Sex and lactation had no effect on haemato-biochemical parameters in healthy animals [29, 30, 18].

In this study no significant difference was observed when the different parameters were compared according to the reproductive statues. Factors such as breed and physiological changes during the pregnancy did not influence the results in this study in difference with Taylor-Macallister *et al.* [31]. Nevertheless, factor such age generates differences in the studied variables agreeing with Vaz *et al.* [12]. hematocrit and haemoglobin diminished during the final period of pregnancy. According to Souza *et al.* [32], fetal growth that occurs in that period of pregnancy produces a greater oxygen demand. This greater need for oxygen is compensated by the endocrine system that stimulates the release of erythropoietin by the renal tissue [33]. The secretion of this circulating glycoprotein stimulates increased production of erythrocytes in the bone marrow [34]. This phenomenon, which has been described in pregnant rabbits [35] and pregnant women [32], has also been observed by Vaz *et al.* [12] in Arabian pregnant mares. There is 40-50% an increase in blood's volume for pregnant women. This means an increase in plasma volume as well the total number of erythrocytes and leukocytes in the blood circulation, which are produced by physiological adjustments in the endocrine and renal systems [32]. It is believed that this expansion in plasma volume is necessary to supply the increasing demands of uterine blood volume, where the standard level increases in pregnancy. The reduction in RBC, hematocrit and haemoglobin, occurs in the third period of gestation, which represents the main cause of "pregnant physiological anemia" a clinical condition described in various species [35, 32].

Another possible physiological cause of the decline in Hb is the reduced average lifespan of circulating erythrocytes in pregnant females compared to non-pregnant ones [34]. According to the author, this condition leads to a hematopoietic emergency, promoting an increase in erythropoietin concentration and erythrocytes. The results found for MCV and RBC suggest an increase in the number of immature erythrocytes, which would be in accordance with findings in pregnant rats, rabbits and women reported by Lurie and Kim [34, 35]. The MCH increased in the two breeds during the third pregnant period. These findings were attributed to the possible presence of immature erythrocytes in the peripheral blood [11].

The values found for lymphocytes were the normal range of horses [31, 11]. However these numbers were closer to those obtained in Arabian pregnant mares [12] which were higher to those found in Thoroughbreds [36].

In this study some haematological parameters was influenced both by age and the mare reproductive status. The results of this investigation show that the variations associated with age in horses occur regardless of the physiological state of the mare. In this way, pregnancy did not mask the changes promoted by the age.

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