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Original Research Article

Characterisation of the Haematological Profile in the Posavje Horse Breed

Key words

autochthonous breeds,
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Abstract: The aim of this study was to investigate the influences of sex and age on haematological values in the Posavje Horse breed. A total of 163 healthy Posavje horses (30 foals, 94 mares and 39 stallions) were used in this study; their complete blood counts and a leucogram were obtained with a haematological analyser. The horses were classified into five groups: foals (1 to 6 months, n = 30), 3 to 6 years (n = 8 stallions/21 mares), 7 to 9 years (n = 9 stallions/22 mares), 10 to 13 years (n = 8 stallions/20 mares), 14 to 15 years (n = 6 stallions/10 mares) and 16 and over (n = 8 stallions/21 mares). The results obtained show an influence of sex on haematological parameters, with red blood cell count (RBC), haematocrit (HCT) and haemoglobin concentration (HGB) being higher in stallions ($P < 0.001$) and white blood cell count (WBC) being higher in mares. Differences between the age groups of the Posavje horses examined indicate a decrease in RBC and HGB with a compensatory increase in mean corpuscular volume and mean corpuscular haemoglobin, a decrease in WBC and platelet counts (PLT) and proportion of lymphocytes, and an increase of neutrophil to lymphocyte ratio (N/L) with age ($P < 0.001$). Although the Posavje horse is classified as a draft horse breed, its haematological parameters show characteristics common to warm-blooded breeds, with the exception of the N/L ratio. One of the most important findings of this study is a higher neutrophil count in reproductively active breeding stallions. Higher levels of RBC, HGB, HCT and neutrophil count in the Posavje stallions suggest an effect of androgens (testosterone), which may be an effective mechanism to prevent infections, that can affect the survival of the stallions and thus the evolution of the species.

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Introduction

Intensive artificial and natural selection have shaped substantial variation among horse breeds, which are reflected in the differences of haematological and biochemical parameters. In addition to geographical origin, horse breeds can be divided into phenotypic or performance categories. Due to the great diversity of breeds, horses are most often classified as "warm-blooded" breeds including light horses of Arabian descent (such as Arabians, Thoroughbreds, Standardbreds and Quarter Horses), and "cold-blooded" breeds essentially including heavy draft horses (such as the Belgian Horse, the Slovenian Cold Blooded Horse and the Posavje Horse). Several differences in haematological parameters were found between these two groups, such as a lower haematocrit in cold-blooded horses and higher erythrogram values in warm-blooded horses, which should be considered when determining reference values of blood parameters and interpreting blood tests (1-4). In contrast, light horse breeds have a higher red blood cell count (RBC), haemoglobin concentration (HGB), haematocrit value (HCT) and blood volume than draft horses (2, 5, 6). In addition to horse type, haematological parameters may also vary due to numerous internal and external factors, including breed, sex, age, reproductive status, fitness and training status, exercise load, feeding and, circadian variations.

Moreover, handling procedures during blood withdrawal, operating conditions, criteria for selecting healthy subjects, preparation of the subjects for the procedures, level of excitement and health status are also important factors that affect haematological values in horses (1, 6, 7, 8).

Differences in the cellular constituents of the blood are the result of specific changes in an organ or organ system, or a general response of the individual to certain physiological or pathological conditions (6). For example, the total leukocyte count (WBC) and differential leukocyte count in healthy horses are dependent on age, which is associated with a steady decline in leukocyte counts (9-11) while the absolute and relative leucocyte counts, especially neutrophils and lymphocytes, vary considerably (11) to reach a neutrophil to lymphocyte (N/L) ratio of 2:1 in older horses (2). Minor differences in leukocyte counts have been found between the different breeds of horses, with warm-blooded horses having higher WBC counts than to cold-blooded horses (6, 12).

The horse population investigated in this study was the autochthonous Posavje Horse breed, originating from the Lower Sava River flatlands of the southeastern part of Slovenia (especially in the districts of Krsko and Brezice) and in Croatia, this breed resulted from the crossing of local warmblood mares with Norik stallions. In addition, Ardene stallions were used to improve the Posavje horses' abilities for heavy draft work (13). The Posavje horse is the smallest cold-blooded breed in Europe, characterised by a good-natured temperament and a pronounced sexual dimorphism. It was mainly selected for heavy draft work, especially in steep forest areas, but it has also been used for meat production (13). In 1993, a Slovenian breeding and conservation programme was established for this horse breed. Since then, the breed has been bred according to the principles of conservation genetics: narrow relation of breeding stallions (sires) to mares with balanced breeding using different sires and moderate selection (13). Currently, reference values of haematological parameters are widely available for horses in general and for the most common and popular breeds (2, 5, 14). However, literature data for endemic breeds are sparse and only a few reports address haematology in autochthonous draft horse breeds (15-17). The aim of this study was therefore to investigate the characteristics of the haematological parameters in the Posavje Horse breed and to test the hypothesis that age, sex and reproductive status cause some haematological changes in horses. In addition to variations in haematological parameters in the Slovene Posavje Horse breed, the study was particularly focused on the characteristics of differential leucocyte counts and their variations with age gain. The measured haematological values and their variations could serve as guideline values for further haematological investigations and as a basis for the development of an approach to determine haematological reference values for the Posavje breed (1,2, 6, 18).

Materials and methods

The study was conducted as a part of the routine annual breeding and registration procedures of the Slovenian breeding and conservation programme for the autochthonous Posavje horse breed at different locations in the region of south-eastern Slovenia during July and August. The stallions were located as sires in breeding stations and separated from the mares and foals kept on the farms of local breeders. Regardless of category and location, the horses were kept on pasture in natural environmental conditions during the day and stabled in individual boxes during the night. While stabled, they were fed hay, considering the needs of each category, and had free access to water. They were dewormed regularly, clinically sound on the day of sampling and did not receive medication in the last 3 months before blood sampling. The mares included in the study were not pregnant. As the horses were familiar with humans and accustomed to different handling procedures, no restraint was required during sampling.

The study included 39 stallions aged 3 to 22 years (average 11.3 years), 94 mares aged 4 to 22 years (average 11.1 years) and 30 foals aged 30-180 days (average 102 days). The grouping of horses by age and sex is presented in Table 1.

Blood samples were collected from the jugular vein with double-ended needles and evacuated tubes containing K2EDTA as an anticoagulant (Vaccuette; Greiner Labortechnik GmbH, Kreimsmünster, Austria) and stored at 4 °C for haematological analyses (6, 18), which were performed within the next 6 hours at the Laboratory for Clinical Pathology of the Clinic for Reproduction and Large Animals at Veterinary Faculty, University of Ljubljana. Routine haematological analyses included the following: Red blood cell tests (red blood cell count (RBC), haematocrit (HCT), haemoglobin concentration (HGB), red blood cell indices (mean cell haemoglobin concentration (MCHC), mean cell

Table 1: Arrangement of horses to age groups

Age group	Age	Sex		Total (n)
		Mares (n)	Stallions (n)	
Foals	30–180 days	/	/	30
Adults	3–22 years	94	39	134
Group A	3–6 years	21	8	29
Group B	7–9 years	22	9	31
Group C	10–13 years	20	8	28
Group D	14–15 years	10	6	16
Group E	16 and more	21	8	29

Table 2: Haematological parameters in Posavje horse foals, stallions and mares in total ($\bar{x}$ ± SD)

Variable (unit)	Foals (*n*=30)	Stallions (*n*=39)	Mares (*n*=94)
RBC (× 10^{12}/L)	9.84 ± 1.26[a,b]	8.79 ± 0.99[c]	7.45 ± 1.01
HGB (g/L)	124.27 ± 12.82 [a,b]	138.41 ± 14.93[c]	117.08 ± 12.82
HCT (L/L)	0.35 ± 0.04[a,b]	0.40 ± 0.05[c]	0.33 ± 0.04
MCV (fL)	36 ± 1.86[a,b]	45.18 ± 2.76	44.79 ± 3.35
MCH (pg)	12.68 ± 0.66[a,b]	15.78 ± 1.01	15.83 ± 1.25
MCHC (g/L)	351.93 ± 12.49	349.54 ± 8.26	353.52 ± 15.16
PLT (× 10^{9}/L)	350.93 ± 101.08[a,b]	229.54 ± 67.12	242.65 ± 67.62
MPV (fL)	7.48 ± 0.79[a,b]	6.36 ± 0.38[c]	6.61 ± 0.37
RDW (%)	17.86 ± 1.11	17.94 ± 0.74	17.99 ± 0.71

Legend: RBC - red blood cell count; HGB - haemoglobin concentration; HCT - haematocrit; MCV - mean cell volume; MCH - mean cell haemoglobin; MCHC - mean cell haemoglobin concentration; PLT – platelet count; MPV – mean platelet volume; RDW – red cell distribution width. Values in a row with the same superscript show significant differences ([a]differences between foals and mares; [b]differences between foals and stallions; [c]differences between mares and stallions; P < 0.05)

volume (MCV), mean cell haemoglobin (MCH)) and red blood cell distribution width (RDW)), white blood cell tests (total white blood cell count (WBC), absolute differential leukocyte count), platelet count (PLT) and mean platelet volume (MPV) were performed using an automated veterinary haematology analyser (Scil Vet abc Plus+, Horiba, Japan), validated for equine samples and following original instructions for use. The relative differential leukocyte count (neutrophils - NEU, eosinophils - EOS, basophils - BAS, monocytes - MON, lymphocytes - LYM) was measured under the microscope using blood smears stained with the commercial staining kit Hemacolor (Merck Cat. No. 1.11661, Merck KGaA, Darmstadt, Germany). The neutrophil/lymphocyte ratio (N/L ratio) was calculated by dividing the neutrophil proportion by the lymphocyte proportion.

Statistical calculations were performed using the Statistical Package for Social Sciences (SPSS for Windows, release 8.0.0). The normality of the data distribution was assessed using a Shapiro–Wilk test and significance was determined using all pairwise multiple comparisons (Tukey's test). Differences between values calculated for horses grouped by age or sex were statistically analysed by one-way analysis ANOVA. When significant differences were found, a posthoc analysis was performed (Bonferroni–Holm test) to clarify the groups between which these differences existed. Differences were considered significant at P≤0.05. The values measured are presented as the mean ± standard deviation in the text ($\bar{x}$ ± SD) and as mean ± error of the mean ($\bar{x}$ ± SE) in the figures.

Results

Red blood cell tests

The mean values of haematological parameters for all examined foals, stallions and mares of Posavje horses are shown in Table 2. Statistically significant differences between mares and stallions were found for RBC, HCT and haemoglobin concentrations (P < 0.001). In foals, RBC levels were significantly higher (P < 0.001) than in stallions and mares, but HCT, MCV and MCH levels were significantly lower (P < 0.001). The mean HGB concentration was significantly lower in foals than in stallions (P < 0.001) and higher than in mares (P < 0.01). The differences between foals, mares and stallions were not significant for MCHC and RDW (Table 2).

Age-dependent variations in RBC and indices in mares and stallions of the Posavje breed are presented in Fig. 1. The RBC values (Fig.1A) were highest in foals and significantly decreased thereafter in both sexes with age gain (P < 0.001). With the exception from foals and 3 to 4-year-olds, the RBC values in mares were lower than those in stallions (P < 0.001).

The lowest MCV (Fig.1 B) and MCH (Fig.1 D) were measured in foals and increased significantly with age in both sexes (P < 0.001 for both parameters). MCV was significantly lower in mares aged 3 to 6 years than in older animals (P < 0.001). The differences between stallions and mares of all ages were insignificant for MCV and MCH. HCT (Fig. 1C) and HGB (Fig. 1E) values in mares decreased with age (P < 0.001), reaching the lowest values in the 14- to 15-year-old

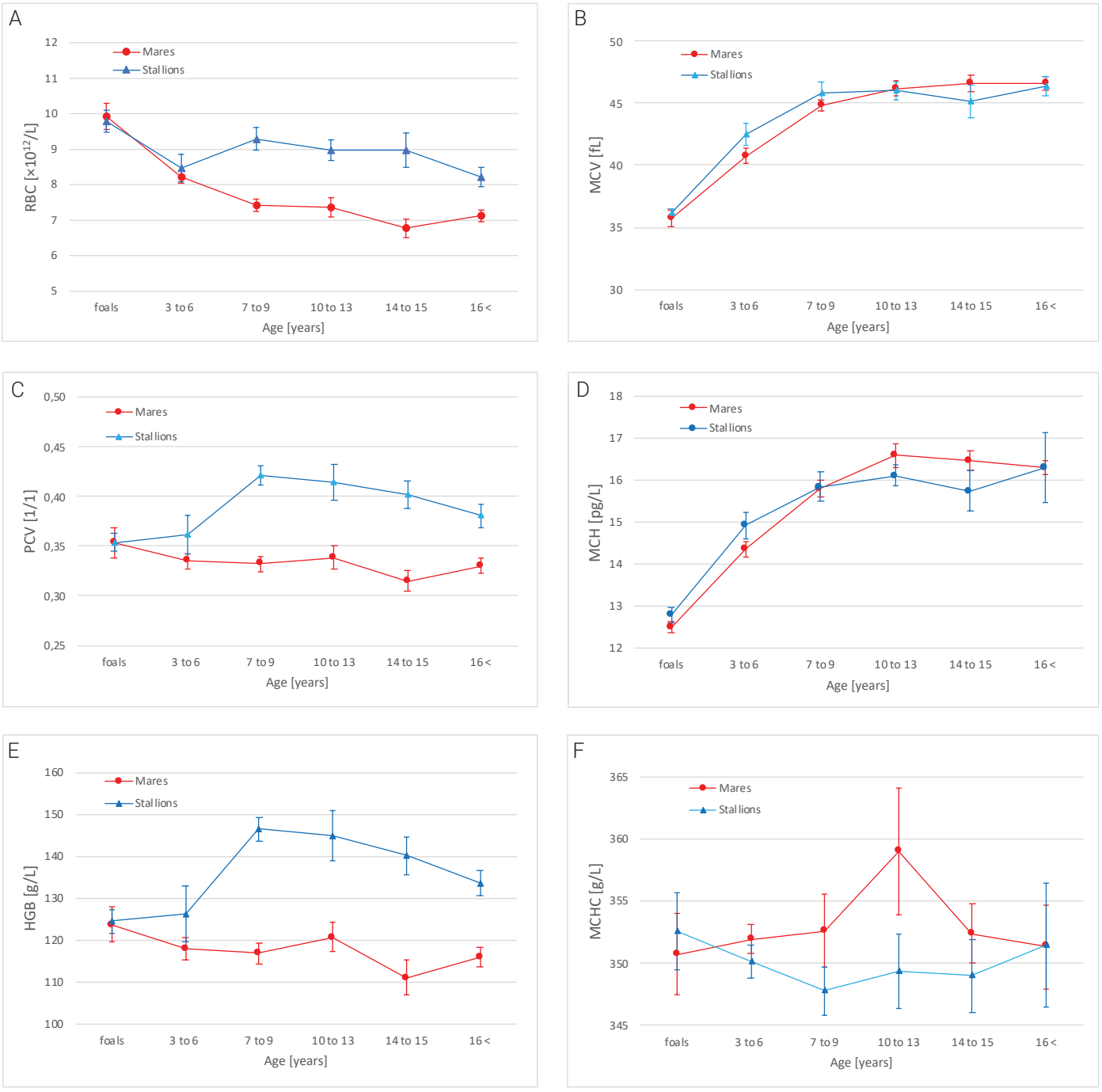

Figure 1: Age-dependent changes of red blood cell number (RBC; Panel A), mean cell volume (MCV; Panel B), Haematocrit (HCT; Panel C), mean cell haemoglobin (MCH; Panel D), haemoglobin concentration (HGB; Panel E) and mean cell haemoglobin concentration (MCHC; Panel F) in Posavje mares and stallions (mean ± SE)

group, while in stallions, a decrease was observed with peak values for HCT and HGB in the 7- to 9-year-old age group, followed by a gradual decrease in both values with age. Stallions aged 7 to 9 years or more had significantly higher HCT and HGB values than mares in the same age group ($P < 0.001$, respectively). The MCHC value (Fig. 1F) in stallions decreased slightly and reached the lowest values at the age of 7 to 9 years and increased thereafter. In mares, MCHC increased with age, peaking at 10 to 13 years of age and decreasing thereafter; the differences in MCHC between mares and stallions of all ages were not significant ($P > 0.05$).

RDW values remained stable with age in both mares and stallions and differences between sexes were not significant (hence, the changes are not shown graphically). The PLT count and MPV were significantly higher in foals than in stallions and mares ($P < 0.001$). The mean platelet volume (MPV) was higher in mares than in stallions ($P < 0.001$).

Table 3: Total WBC count and relative/absolute differential leukocyte count ($\overline{X}$ ± SD) in foals, stallions and mares

Variable	Unit	Foals (*n*=30)	Stallions (*n*=39)	Mares (*n*=94)
WBC	×10⁹/L	11.20 ± 2.03[a,b]	8.76 ± 1.81	9.14 ± 2.03
NEU	%	39 ± 11.42	56.26 ± 12.93	51.9 ± 11.65
	×10⁹/L	4.55 ± 1.57	4.99 ± 1.84	4.71 ± 1.45
LYM	%	52.67 ± 10.39[a,b]	37.26 ± 12.38	39.2 ± 11.62
	×10⁹/L	5.78 ± 1.66[a,b]	3.20 ± 1.11	3.63 ± 1.54
MON	%	0.93 ± 1.27	1.23 ± 1.37	0.85 ± 0.97
	×10⁹/L	0.12 ± 0.15	0.11 ± 0.13	0.08 ± 0.10
EOS	%	3.52 ± 3.20	4.10 ± 3.14	5.66 ± 3.62
	×10⁹/L	0.37 ± 0.25	0.36 ± 0.29	0.50 ± 0.32
BASO	%	0.11 ± 0.42[a]	0.38 ± 0.63	0.79 ± 1.07
	×10⁹/L	0.01 ± 0.04[a]	0.03 ± 0.06	0.07 ± 0.09
Ratio N/L	1/1	0.88 ± 0.54[a,b]	1.86 ± 1.23	1.55 ± 0.84

Legend: WBC – white blood cell count; NEU – neutrophil; LYM – lymphocyte, MON –monocyte; EOS – eosinophil; BAS – basophil; N/L –neutrophil/lymphocyte ratio. Values in a row with the same superscript indicate significant differences ([a]differences between foals and mares; [b]differences between foals and stallions; [c]differences between mares and stallions; P < 0.05)

White blood cell tests

The mean total WBC and the relative and absolute differential leucocyte counts in foals, stallions and mares are shown in Table 3. The mean total WBC and LYM counts (Table 3) were significantly (P < 0.001) higher in foals than in mares and stallions, while the NEU, MON, EOS and BAS counts were significantly lower in foals than in adults (P < 0.05).

The highest WBC value (Fig. 2A) was found in foals of both sexes and then gradually decreased in mares to reach the lowest value in the age group of 16 years and over (P < 0.001). A significant decrease in WBCs was observed in stallions at 3 to 6 years of age (P < 0.01), followed by an increase in WBCs at 10 to 13 years of age and a gradual decrease thereafter. WBC counts were also significantly lower in stallions aged 3 to 6 years (P < 0.01) than in mares of the same age. In mares, WBC counts were significantly higher in the 3- to 6-year-old group than in the older group (P < 0.001). The NEU count increased and the LYM count decreased significantly (P < 0.001 and P < 0.001, respectively) with increasing age in stallions and mares (Fig. 2B). Mares aged 3 to 6 years had a significantly higher NEU count (4.61) compared to stallions of the same age (3.36, P < 0.05; Fig.2B).

The N/L ratio was significantly lower in the foals than in Groups B (7 to 9 years), D (14 to 15 years) and E (16 and more years) (P < 0.001) (Table 4). The interactions between age and sex of NEU and LYM are shown in Fig. 2.

MON did not significantly differ between Posavje foals, stallions and mares (Table 3). The BAS counts in foals were statistically lower than those in mares and stallions (P < 0.001 and P < 0.05, respectively).

Discussion

Red blood cell tests

The mean RBC of Posavje stallions and mares was at the lower end of the normal range for warm-blooded horses (19) but at the upper end of the normal range for draft horses (16, 17) and slightly lower than in warmbloods (9, 20). In general, erythrogram values in this study were mostly comparable to those for warmblooded horses (5, 14, 21), which is surprising considering that the Posavje horse is a cold-blooded breed, although some warmblood characteristics are still present. In Posavje foals, the mean RBC was higher than in adult horses, consistent with the literature (2, 9). However, MCV and MCH were lower than in adult horses, as in warm-blooded foals (19).

The erytrogram values determined in our study were also related to the age of horses as described recently (14, 5, 22), with the RBC decreasing with age, followed by a

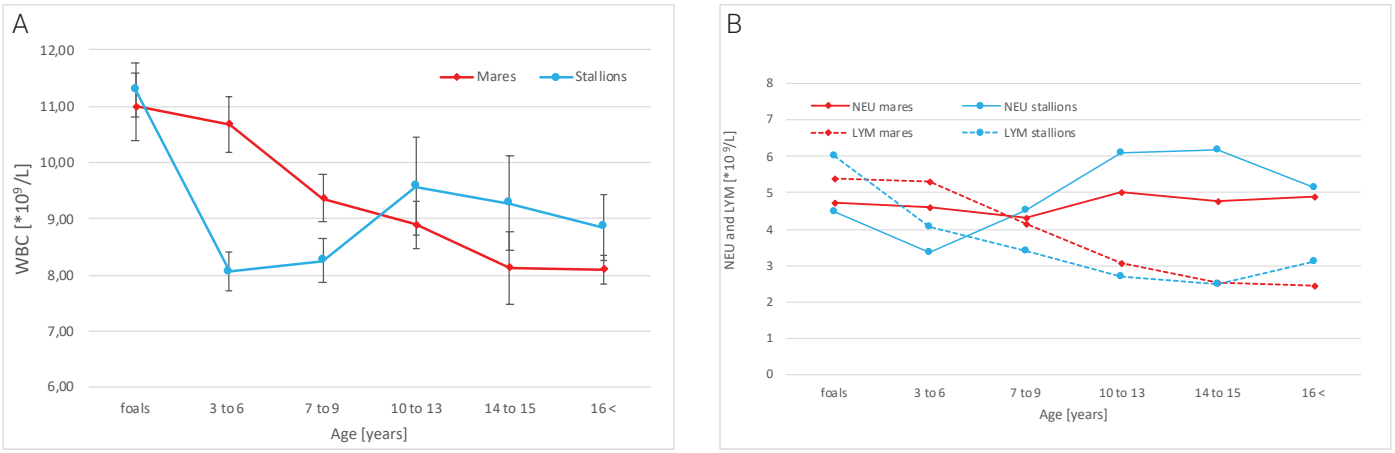

Figure 2: Changes of total white blood cell number ($\bar{x}$ ± SE) (A), and neutrophil (NEU) and lymphocyte (LYM) counts (B) in Posavje mares and stallions with age

compensatory increase of MCV and MCH in both sexes (5, 14, 18, 21, 22, 23, 25, 26). A gradual increase in MCV appears to be a common finding associated with equine ageing (22-24) causing changes in the dynamics of erythrocyte maturation (24). The MCV values of the Posavje horses studied were lower than those in the Przewalski and Kathiawari horse breeds (27, 28) but higher than those in the Zemaitukai horses (21) of comparable ages, while in foals they were consistent with those reported in many other breeds (29, 30).

HGB concentrations differed between sex and age groups of Posavje horses in the present study and were consistent with (15, 31) or higher (32) literature data. In contrast to Lahora working horses (33) and Lipizzans (5), a significant increase in HCT and HGB was observed only in Posavje stallions up to the age of 7 to 9 years, followed by a gradual decrease in older groups, while the values in mares decreased with age. In general, the mean total RBC, HCT and HGB levels were significantly higher in Posavje stallions than in mares, as common for horses (15, 33, 34, 35). This trend is most likely due to the effect of testosterone, which is also known to increase circulating HGB, HCT and RBC in humans (36) stimulating haematopoietic tissue and erythropoiesis in men more than in women (37). The role of testosterone in haematopoiesis was also supported by the study in castrated goats (38).

The mean RDWs of Posavje horses did not differ between age groups and sexes and were lower than (7, 39, 40) or similar to reported values (17, 19, 41, 42, 43, 44). A significant decrease in RDW was previously observed in stallions after exercise (7), but this decrease was not observed in our study. Platelet count in Posavje horses decreased with age, which is consistent with literature data (21, 22, 23), although no differences between age groups were reported (24). MPV was higher in Posavje mares than in stallions; in both sexes, the values were higher than in Shetland ponies (41) and lower than in Holstein horses (7, 44). Elevated MPV has been proposed as an indicator of platelet activation in humans, but the lack of defined limits to distinguish between activated and nonactivated platelets and the failure of platelet aggregation inhibitors to reverse a high MPV limit its utility as a platelet activation marker in human medicine (45).

White blood cell test

In the present study of horses of the Posavje breed, the highest mean WBC value was found in foals, followed by mares, and the lowest in stallions, with the later exhibiting the lowest value (14, 21, 25). In contrast, the WBC levels of Thoroughbred (9) and Lipizzan (46) stallions were higher in than in mares, and some studies failed to find significant differences between the sexes (47). In all age groups of Posavje horses WBC values in mares were higher than those in stallions, although this difference was significant

Table 4: Neutrophil/lymphocyte ratio (N/L) ($\bar{X}$ ± SD) in mares and stallions of various age groups (A: 3–6, B: 7–9, C: 10–13, D: 14–15, E: 16 and more years old)

Sex	Age group					
	Foals	Group A	Group B	Group C	Group D	Group E
Mares	0.84 ± 0.54	0.94 ±0.35	1.14 ±0.53	1.78 ±1.08	1.91 ±0.55	2.20 ±0.82
Stallions	0.75 ± 0.55	0.96 ±0.57	1.43 ±0.47	2.50 ±1.47	2.84 ±1.82	1.86 ± 0.81

only at the age of 3 to 6 years. The in WBC count of Posavje horses decreased with age gain (11, 24, 44) which could be attributed to the gradual decline in immunocompetence and cannot be considered as leukopenia (24, 44).

In Posavje horses, slightly higher NEU and lower LYM counts were measured in stallions than in mares (48). A significant age-related decrease in LYM count, proportional to the decrease in WBC, was observed in both sexes of the Posavje horse, as also reported in other horse breeds (2, 15, 16, 46). This decrease may be the reason for the decreased immunocompetence in older horses (10). The absolute NEU count has been reported to be higher in foals than in adult horses and remains stable with age gain (9, 25, 46), whereas it increased significantly in Posavje horses of both sexes. This increase was also the reason for a steady increase in N/L ratio with age, ranging from 0.84 to 2.01 in mares and from 0.75 to 1.68 in stallions. Similar changes in the N/L ratio in Andalusian horses (11) indicate a natural state reflecting a decreased bone marrow response. The predominance of NEU in the Posavje horses studied reflects the cold-blooded origin of this breeds (12).

In stallions aged 3 to 6 years the NEU count decreased significantly in parallel to the WBC count; however, it remained within physiological limits. In all other age groups, NEU counts were higher in stallions than in mares, as also reported for other horse breeds (32, 48, 49, 50); this difference could be attributed to increased testosterone production in reproductively active stallions. The plasma levels of testosterone are an important regulator of NEU function and the associated inflammatory response in humans (51, 52) which represents the first line of defence against invading pathogens and tissue injury (53, 54). Therefore, the physiological increase in NEU in the blood of the stallions studied could be an evolutionary adaptation to prevent infections caused by injuries of stallions, fighting for mares within a harem. Surprisingly, that the described changes in the NEU counts of stallions have thus far gone unnoticed. Modest increases in NEU counts within the normal range may have been ignored and the stallions in studies that addressed this issue (14, 21, 34, 46) were not sufficiently old or were reproductively inactive. Another reason for leucocytosis in horses with increased NEU and decreased LYM numbers could be increased plasma cortisol levels under stress (53). We can exclude this cause in the Posavje stallions, as all age groups of the examined stallions were housed under similar environmental conditions and treated in the same manner.

Neither age nor sex affected the EOS and MON, confirming the results of previous studies in horses (46, 49). Higher BAS values in older Posavje stallions were likely the result of altered immunological load (14).

Conclusions

In conclusion, our study indicates breed-related differences in haematological parameters of horses, and we have shown that haematological parameters vary with age and sex in the Posavje breed. The haematological traits identified in our study represent interesting breed-, age- and sex-specific adaptations/responses but are of limited diagnostic value. In general, the values of the haematological parameters in our study most closely matched those of warm-blooded horses, although the Posavje horse is a cold-blooded breed. The leucogram values and the N/L ratio determined in our study corresponded to those of cold-blooded horses. Furthermore, the results confirm and extend previous reports on age- and sex-related changes in haematological variables. One of the most important findings of our study is a higher NEU level in active breeding Posavje stallions, indicating an effect of androgens on the defence mechanism to prevent infections, which may influence survival and thus evolution. Further studies are needed to confirm the mechanisms underlying these differences.

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Ethics approval and consent to participate: All samples were obtained through standard breeding and registration procedures, so no approval was needed from the local animal experimentation ethics committee, in accordance with the Resolution on the Protection of Animals Used for Scientific and Educational Purposes and European Directive EU/2010/6. All owners gave their consent to the procedures and to the publication of the results.

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Karakterizacija hematološkega profila pri posavskem konju

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Izvleček: Cilj raziskave je bil proučiti vpliv spola in starosti na hematološke parametre pri pasmi posavski konj. V raziskavo je bilo vključenih 163 konj posavske pasme (30 žrebet, 94 kobil in 39 žrebcev), pri katerih smo v vzorcih krvi določali hematološke parametre s hematološkim analizatorjem. Diferencialna bela krvna slika in razmerje med nevtrofilci in limfociti (N/L) je bilo določeno na krvnih razmazih. Konje smo razdelili v pet starostnih skupin: žrebeta (od 1 do 6 mesecev, n = 30), 3 do 6 let (n = 8 žrebcev/21 kobil), 7 do 9 let (n = 9 žrebcev/22 kobil), 10 do 13 let (n = 9 žrebcev/20 kobil), 14 do 15 let (n = 6 žrebcev/10 kobil) ter 16 in več let (n = 8 žrebcev/21 kobil). Rezultati naše raziskave kažejo vpliv spola na preiskovane hematološke parametre; pri žrebcih so število rdečih krvnih celic (RBC), hematokrit (HCT) in koncentracija hemoglobina (HGB) značilno višji (P < 0,001), pri kobilah pa je višje število belih krvnih celic (WBC). Med starostnimi skupinami posavskih konj smo ugotovili zmanjšanje RBC in HGB in posledično kompenzacijo s povečanjem povprečnega volumna in hemoglobina eritrocitov, zmanjšanjem števila levkocitov, trombocitov (PLT) in limfocitov ter povečanjem razmerja med nevtrofilci in limfociti (N/L) s starostjo (P < 0,001). Posavski konj po zunanjosti spada med hladnokrvne konje, v raziskavi ugotovljeni hematološki profil pa kaže značilnosti, ki so skupne toplokrvnim pasmam konj, z izjemo razmerja N/L. Ena od pomembnejših ugotovitev te študije je večje število nevtrofilcev pri aktivnih plemenskih žrebcih. Višje vrednosti RBC, HGB, HCT in števila nevtrofilcev pri posavskih žrebcih kažejo učinek androgenov (testosterona), kar bi lahko bil učinkovit mehanizem za preprečevanje okužb, ki lahko vplivajo na preživetje žrebcev in s tem na evolucijo vrste.

Ključne besede: avtohtone pasme; posavski konj; hematologija; starost; spol