

Haematological and biochemical values of farmed fallow deer (*Dama dama*) after using different methods of capture

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ABSTRACT

Haematological and biochemical examinations have been carried out on different occasions in 12 healthy farmed female fallow deer in order to estimate whether there are differences in blood parameters regarding the method (physically restrained, tranquillized, shot) of sampling. The following parameters (means and standard deviation - SD) were examined on all samples: erythrocyte count (RBC), haemoglobin concentration (Hb), packed cell volume (PCV), mean cell volume (MCV), total leukocyte count (WBC), aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma glutamyltransferase (GGT), glutamate dehydrogenase (GLDH), urea, creatinine, total proteins (TSP), albumin, glucose, iron (Fe), sodium (Na), potassium (K), chlorine (Cl), calcium (Ca), inorganic phosphorus (aP) and magnesium (Mg). No significant differences were found between tranquillized and shot animals. However, significant differences were discovered when non-tranquillized animals were compared with the other two groups.

Key words: haematology, biochemistry, fallow deer, sampling techniques

Introduction

Various authors have found differences in blood values in deer. These may be attributed to farming conditions, management practices and sampling techniques such as collection from pasture, yarding, drafting, confinement indoors, isolation and catheterisation, all of which have been shown to be stressful to deer (MATTHEWS et al., 1990; MATTHEWS and COOK, 1991). These differences can also be due to many reasons, including genetic, environmental, nutritional and physiological factors, as well as the stress of capture (ASHER et al., 1989) and the effect of various blood sampling techniques (CHAPMAN, 1977; ASHER et al., 1989).

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There are some data concerning blood parameters of fallow deer following different blood sampling techniques, such as chemical immobilisation (BUBENIK, 1982; EIBEN, 1984; SCHNARE and FISCHER, 1987; RANUCCI et al., 1996; PEINADO et al., 1999; POLJIČAK-MILAS et al., 2004), physical restraint (ENGLISH and LEPHERD, 1981; REHBEIN et al., 1998; SCHARFE et al., 1998; REHBEIN et al., 1999) or being shot by a rifle (PAV et al., 1975; PRESIDENTE, 1979; CHAPMAN et al., 1980; VENGUŠT et al., 2002a; VENGUŠT et al., 2002b). However, several authors compared blood constituents only in red and white-tailed deer using two different methods: physical and chemical restraint (MAUTZ et al., 1980; CROSS et al., 1988; MARCO and LAVIN, 1999).

This study was performed to establish the range of clinically important haematological and biochemical parameters in farmed fallow deer. In addition, we compared blood values among animals that were either shot, chemically immobilised or physically restrained.

Materials and methods

The blood samples from the first group of four physically restrained female deer were collected from the jugular vein. One day before sampling, the animals were chemically immobilised using a mixture of xylazine and ketamine and placed in a wooden crate provided with the strap system. The second group of four young females of clinically normal fallow deer were immobilised using a mixture of xylazine hydrochloride and ketamine hydrochloride. Blood was collected from the jugular vein after immobilization. The third group of four young females of clinically normal fallow deer were shot in the enclosure during a routine cull. None of the animals were agitated before being shot. Blood from the heart was collected into tubes after the animals had fallen to the ground.

Blood samples were placed in commercial tubes containing an anticoagulant. EDTA K₃, Plain tubes were used for serum collection to perform biochemical tests and lithium heparin tubes were used to collect plasma for electrolytes. For serum collection, plain tubes were left to clot at room temperature and were then centrifuged at 2600 rpm for 10 minutes. Serum samples were stored frozen at -20 °C until analysed.

Blood samples were analysed within 24 hours using standard haematological equipment. Haematological values were measured with Coulter Counter ZF₆, while biochemical values were measured using COBAS MIRA (Hoffman La Roche, Switzerland) biochemical analyser, with the enzyme assay performed at 37 °C and calculated with a suitable factor to 30 °C.

All data are expressed throughout as a mean ± standard deviation (SD). Statistical analysis was performed by means of the SPSS package (SPSS Inc., Chicago, Illinois, USA). The two groups would have been considered significantly different if P was statistically lower than 0.05.

Results

The results obtained are given in Tables 1, 2, 3, 4 and 5. Restraint animals showed significantly higher values of AST, ALT, Na and WBC and significantly lower values of Fe and Ca than tranquillized and shot animals. No significant differences were found between tranquillized and shot animals.

Table 1. Average values (mean \pm SD) of biochemical data in fallow deer (P=P \leq 0.05 Sheffe; NS – no significant; 1 (restraint), 2 (tranquillized), 3 (shot) - significant)

	AST (U/L)	P	ALT (U/L)	P	GGT (U/L)	P	GLDH (U/L)	P
1. Restraint	370 \pm 76	2, 3	106 \pm 43	2, 3	44 \pm 21	NS	19 \pm 15	NS
2. Tranquillized	60 \pm 12	1	35 \pm 14	1	25 \pm 2	NS	3 \pm 1	NS
3. Shot	122 \pm 60	1	45 \pm 8	1	36 \pm 11	NS	17 \pm 14	NS

Table 2. Average values (mean \pm SD) of biochemical data in fallow deer (P=P \leq 0.05 Sheffe; NS – no significant; 1 (restraint), 2 (tranquillized), 3 (shot) - significant)

	Glucose (mmol/L)	P	Urea (mmol/L)	P	Creatinine (μ mol/L)	P	TSP (g/L)	P	Albumin (g/L)	P
1. Restraint	2.9 \pm 0.4	2	9.8 \pm 3.2	NS	98 \pm 27	NS	58 \pm 4	NS	38 \pm 9	NS
2. Tranquillized	8.5 \pm 2.1	1	8.1 \pm 0.7	NS	122 \pm 27	NS	60 \pm 4	NS	51 \pm 4	NS
3. Shot	7.5 \pm 3.2	NS	6.5 \pm 1.6	NS	136 \pm 16	NS	57 \pm 2	NS	31 \pm 2	NS

Table 3. Average values (mean \pm SD) of biochemical data in fallow deer (P=P \leq 0.05 Sheffe; NS – no significant; 1 (restraint), 2 (tranquillized), 3 (shot) - significant)

	Fe (μ mol/L)	P	Na (mmol/L)	P	Ca (mmol/L)	P	K (mmol/L)	P
1. Restraint	5 \pm 0.8	2, 3	149 \pm 1.2	2, 3	1.8 \pm 0.2	2, 3	3.7 \pm 0.3	3
2. Tranquillized	25.5 \pm 4.7	1	144 \pm 2.9	1	2.3 \pm 0.2	1	4.2 \pm 0.6	NS
3. Shot	21 \pm 6.2	1	141 \pm 0.6	1	2.3 \pm 0.1	1	10.7 \pm 2.3	1

Table 4. Average values (mean \pm SD) of biochemical data in fallow deer (P=P \leq 0.05 Sheffe; NS – no significant; 1 (restraint), 2 (tranquillized), 3 (shot) - significant)

	Cl (mmol/L)	P	aP (mmol/L)	P	Mg (mmol/L)	P
1. Restraint	100 \pm 1.8	2	1.6 \pm 0.6	NS	0.9 \pm 0.1	NS
2. Tranquillized	107 \pm 3.3	1	2 \pm 1	NS	0.9	NS
3. Shot	103 \pm 1.8	NS	3.1 \pm 0.1	NS	1.1 \pm 0.2	NS

Table 5. Average values (mean \pm SD) of haematological data in fallow deer (P= $P \leq 0.05$ Sheffe; NS – no significant; 1 (restraint), 2 (tranquillized), 3 (shot) - significant)

	RBC ($\times 10^{12}/L$)	P	Hb (g/L)	P	PCV (L/L)	P	MCV (fl)	P	WBC ($\times 10^9/L$)	P
1. Restraint	9.3 \pm 1.5	NS	131 \pm 19	NS	0.386 \pm 0.53	NS	42 \pm 2	NS	9.1 \pm 1.2	2, 3
2. Tranquillized	10.4 \pm 1.1	NS	136 \pm 29	NS	0.418 \pm 0.91	NS	40 \pm 4.6	NS	3.6 \pm 0.9	1
3. Shot	10.3 \pm 0.5	NS	143 \pm 21	NS	0.441 \pm 0.74	NS	40 \pm 5.5	NS	2.9 \pm 1.3	1

Discussion

The method of capture results in differences in blood constituents in deer, as shown by studies using both physical and chemical means of deer capture (MAUTZ et al., 1980; CROSS et al., 1988; MARCO and LAVIN, 1999). Some authors have even suggested that two ranges of reference blood values should be established for wild animals, according to the method of capture (HARTHOORN, 1982; CROSS et al., 1988).

The results of the present study have shown values for shot fallow deer which were similar to results we published elsewhere for 64 shot animals (VENGUŠT et al., 2002a,b). Only AST and GLDH activities were lower than the means reported previously. Compared to haematological data for chemically immobilised fallow deer reported by RANUCCI et al. (1993), all our values were found to be higher except for WBC, which was not different. Biochemical data were similar to those found in red deer by MARCO and LAVIN (1999).

The serum activities of AST, ALT, GGT and GLDH were greater in the group of animals captured by physical means when compared with the two other groups, although only the increase in AST and ALT were statistically significant. This finding is in agreement with MAUTZ et al. (1980) and MARCO and LAVIN (1999), who also find greater activities of enzymes in the group of animals captured by physical methods when compared with animals captured by chemical methods.

There was no significant difference in the glucose concentration in relation to capture methods. As discussed by KOLB et al. (1995), high glucose levels in deer may be associated with stress, which activates the sympathetic nervous system and therefore increases the secretion of adrenaline. In this study the highest levels were found in tranquillized animals although we expected higher values in restrained animals due to stress. However it is also well known that xylazine in ruminants induce hyperglycemia (BUBENIK, 1982; TRANQUILLI et al., 1984; ALI et al., 1989; RAPTOPOULOS, 1990). KOLB et al. (1995) suggested that the methods used for sample collection and the time of sampling have to be taken into consideration when evaluating blood samples for glucose.

In the present study, the concentration of TSP and albumin in physically restrained animals were in the range of the other two groups. In contrast, MARCO and LAVIN (1999) reported significantly higher values in deer captured by physical methods when compared with deer captured by chemical methods.

KOLB et al. (1995) reported that values for serum Fe from 20 to 35 $\mu\text{mol/L}$ are characteristic for fallow deer. This statement is in agreement with our results for Fe values in tranquilized and shot animals. Significantly lower values of Fe in restrained animals are unusual and may in this case depend on the pasture-feeding management of restrained animals that originated from the same place.

Serum concentrations of Na, Ca, Cl, aP and Mg are comparable with previous reports in fallow and red deer (PRESIDENTE, 1978, 1979; ENGLISH and LEPHERD, 1981; WILSON and PAULI, 1983; KNOX et al., 1988; MÜLLER et al., 1993; FEURICH and MARTENS, 1994; SCHARFE et al., 1998; MARCO and LAVIN, 1999). Significant differences were found in concentrations of Na and Ca between restrained animals and the other two groups of animals. These differences are difficult to interpret but may depend on the methods used for sample collection. This still needs to be evaluated with a large number of animals in another study.

The concentration of serum K varied more than those of the other electrolytes (CHAPMAN, 1977). The mean value for serum K obtained in our research in the group of shot animals is significantly higher than that obtained in restrained animals. A similar value was reported by PRESIDENTE (1979) in shot fallow deer, while FEURICH and MARTENS (1994) and KOLB et al. (1995) in physically restrained animals and EIBEN and FISCHER (1984) reported lower values of serum potassium in those chemically captured that concur with our results. A large variation in concentrations of serum K can be also found in red deer. Different potassium values are probably a reflection of stress during blood collection (CHAPMAN, 1977; PRESIDENTE, 1979).

The RBC, HB and PCV values were unexpectedly lower in the group of animals captured by physical means when compared with the other two groups. In contrast, MARCO and LAVIN (1999) and CROSS et al. (1988) reported higher values in red deer in physically captured animals. Those studies are in agreement with HARTWIG and HARTWIG (1985), who reported that the observed changes might be the result of spleen contraction due to catecholamine release during physical restraint. However the mean WBC value was significantly higher in the deer captured by physical means when compared with the deer captured by chemical means. This finding is in agreement with MARCO and LAVIN (1999) and CROSS et al. (1988).

In this study we found the majority of the blood constituents, which change

significantly in the group of deer captured by physical mean. There are some differences between our results and results reported by MARCO and LAVIN (1999) and CROSS et al. (1988); however more studies are required to elucidate the variations, since many known and unknown factors may affect these parameters.

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SAŽETAK

Hematološke i biokemijske pretrage provedene su na uzorcima prikupljenim od 12 zdravih farmski držanih jelena lopatara, s ciljem procjene učinka različitih metoda uzorkovanja (od fizički obuzdanih, sediranih ili odstrijeljenih jelena) na krvne pokazatelje. U svim su uzorcima određivani sljedeći pokazatelji (srednja vrijednost i standardna devijacija): broj eritrocita (RBC), koncentracija hemoglobina (Hb), ukupni stanični volumen (MCV), ukupan broj leukocita (WBC), aspartat aminotransferaza (AST), alanin aminotransferaza (ALT), gama-glutamilttransferaza (GGT), glutamat dehidrogenaza (GLDH), ureja, kreatinin, ukupni proteini (TSP), albumin, glukoza, željezo (Fe), natrij (Na), kalij (K), klor (Cl), kalcij (Ca), anorganski fosfor (aP) i magnezij (Mg). Nisu uočene značajne razlike između sediranih i odstrijeljenih jelena. Naprotiv, značajne su

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razlike utvrđene pri usporedbi fizički obuzdanih životinja s druge dvije skupine.

Ključne riječi: hematologija, biokemija, jelen lopatar, metode uzorkovanja
