

## Some serum chemistry values of fallow deer (*Dama dama* L.) in Slovenian hunting enclosures

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### ABSTRACT

Some serum constituents of shot fallow deer (n = 52) in Slovenia have been studied and the means of various biochemical parameters have been determined for sex and age groups and the place where blood has been taken. The samples were taken from two hunting enclosures in Upper Carniola (Gorenjska) and Lower Carniola (Dolenjska) during the 2000/01 winter season. Recorded mean values were: aspartate aminotransferase ( $145.6 \pm 73.5$  U/L), alanine aminotransferase ( $49.4 \pm 13.5$  U/L), lactate dehydrogenase ( $1155 \pm 535$  U/L), gamma glutamyltransferase ( $38.7 \pm 19.9$  U/L), urea ( $6.23 \pm 2.39$  mmol/L), creatinine ( $150.9 \pm 36.5$   $\mu$ mol/L), total proteins ( $60.9 \pm 7.7$  g/L), albumin ( $38.3 \pm 8.6$  g/L) and glucose ( $5.1 \pm 3.9$  mmol/L). Only minor significant differences in biochemical parameters were found between groups.

**Key words:** fallow deer, biochemistry, enzymes, Slovenia

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### Introduction

Fallow deer is the most widely spread deer held in game farms around the world, including Slovenia. There are currently 300 breeding and hunting enclosures spread all over the country and containing more than 3000 fallow deer. Only a small number are free in nature.

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The establishment of reference ranges for a variety of enzymes and metabolites is an important prerequisite for the recognition and diagnosis of illness and health problems affecting production in farmed deer (REID and TOWERS, 1985). There is increasing interest in the management and health status of the breeding animals and consequently, knowledge of their blood composition becomes very important.

There is little information available concerning serum biochemistry of shot fallow deer (PAV et al., 1975; PRESIDENTE, 1979; CHAPMAN et al., 1980; SLAVICA et al., 2000). Research on serum biochemistry has also been conducted in fallow deer that were chemically immobilised (EIBEN, 1984; RANUCCI et al., 1996) or physically restrained (ENGLISH and LEPHERD, 1981; SCHARFE et al., 1998; REHBEIN et al., 1999).

This study presents values for the activities and concentration of a range of biochemical values in clinically normal fallow deer, which were shot in wintertime in two hunting enclosures. Results should provide a useful reference of different groups of animals that will help monitoring health status in this species.

### **Materials and methods**

Fifty-two clinically normal fallow deer were shoot during routine culls in hunting enclosures in Upper and Lower Carniola in wintertime. None of the animals was agitated before the shoot and all appeared healthy. Blood was collected from the heart in tubes after the animal had fallen on the ground. Plain tubes were used for serum collection to perform biochemical tests. For serum collection, plain tubes were left to clot at room temperature and then centrifuged at 2600 g for 10 minutes. Serum and plasma samples were stored frozen until analysed. Glucose, urea, creatinine, total serum protein (TSP), albumin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactate dehydrogenase (LDH) and gamma glutamyltransferase (GGT) were measured using COBAS MIRA (Hoffman La Roche) biochemical analyser, with the enzyme assay performed at 37 °C and calculated with a suitable factor to 30 °C. Details of analytical methods were performed as outlined in Table 1.

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Table 1. Details of analytical methods for serum chemistry values of fallow deer in Slovenia

Value	Method
Glucose	Enzymatic UV test with hexokinase and glucose 6-phosphate dehydrogenase
Urea	Enzymatic UV test with urease and glutamate dehydrogenase
Creatinine	Kinetic colorimetric method by Jaffe
Total serum protein	Biuretic method
Albumin	Colorimetric method (Bromcresol green method)
Aspartate aminotransferase (AST)	(EC 2.6.1.1)
Alanine aminotrasferase (ALT)	(EC 2.6.1.2)
Lactate dehydrogenase (LDH)	(EC 1.1.1.27)
Gamma glutamyltransferase ( $\gamma$ -GT)	Kinetic colorimetric method by Szaszu (EC 2.3.2.2)

## Results

Biochemical values for male and female are shown in Table 2. Male animals had significantly higher urea and creatinine concentrations than female animals. Table 3. shows biochemical values of all fallow deer divided into young ( $\leq 2$ ) and old ( $> 2$ ). Younger animals had significantly higher ALT concentration than older ones. There was also a significant increase

Table 2. Average values (mean  $\pm$  s.d. and SE) of biochemical values of fallow deer from both hunting enclosures together in Slovenia, divided into male and female

Serum parameter	Male		Female		P value
	n = 11		n = 41		
	Mean $\pm$ s.d.	SE	Mean $\pm$ s.d.	SE	
AST (U/L)	131.4 $\pm$ 72.3	32.3	134.8 $\pm$ 58.6	11.7	NS
ALT (U/L)	50.6 $\pm$ 14	5.3	49.2 $\pm$ 13.5	2.5	NS
LDH (U/L)	1337 $\pm$ 661	250	1111 $\pm$ 499	92.7	NS
GGT (U/L)	47.4 $\pm$ 23.2	9.5	36.2 $\pm$ 18.4	3.7	NS
Urea (mmol/L)	7.3 $\pm$ 2.2	0.8	5.6 $\pm$ 2.3	0.4	< 0.05
Creatinine ( $\mu$ mol/L)	175.9 $\pm$ 64.2	24.3	149.5 $\pm$ 25.6	4.7	< 0.05
TSP (g/L)	60.4 $\pm$ 4.8	1.8	61 $\pm$ 8.3	1.5	NS
Albumin (g/L)	40 $\pm$ 6.7	2.5	37.8 $\pm$ 9.1	1.7	NS
Glucose (mmol/L)	5.8 $\pm$ 3.5	1.3	4.1 $\pm$ 2.6	0.5	NS

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Table 3. Average values (mean  $\pm$  s.d. and SE) of biochemical values of fallow deer in Slovenian hunting enclosures of all animals, divided into young ( $\leq 2$  years) and adult ( $> 2$  years)

	Age ( $\leq 2$ )		Age ( $> 2$ )		P value
	n=13		n=39		
Serum parameter	Mean $\pm$ s.d.	SE	Mean $\pm$ s.d.	SE	
AST (U/L)	145.8 $\pm$ 65.5	26.7	130 $\pm$ 64.7	13.4	NS
ALT (U/L)	56.6 $\pm$ 14.5	5.1	44 $\pm$ 9.3	1.9	< 0.05
LDH (U/L)	1138 $\pm$ 443	156	1106 $\pm$ 497	101	NS
GGT (U/L)	39.4 $\pm$ 21.1	7	51.1 $\pm$ 37.5	7.6	NS
Urea (mmol/L)	6.3 $\pm$ 2.5	0.8	5.4 $\pm$ 2.3	0.5	NS
Creatinine ( $\mu$ mol/L)	172.5 $\pm$ 61.8	20.6	152.1 $\pm$ 24.7	5	NS
TSP (g/L)	61.3 $\pm$ 5.4	1.8	62.6 $\pm$ 7.5	1.5	NS
Albumin (g/L)	37.5 $\pm$ 12.4	4.1	39.7 $\pm$ 6.9	1.4	NS
Glucose (mmol/L)	4.6 $\pm$ 3.8	1.3	4.6 $\pm$ 3	0.6	NS

in urea and glucose concentrations, and a significant decrease in TSP concentration in fallow deer from Upper Carniola compared with animals from Lower Carniola. See Table 4.

Table 4. Average values (mean  $\pm$  s.d. and SE) of biochemical values of fallow deer in Slovenian hunting enclosures regarding A (hunting enclosure in Upper Carniola) and B (hunting enclosure in Lower Carniola) the site where blood was taken

	Place A		Place B		P value
	n=19		n=33		
Serum parameter	Mean $\pm$ s.d.	SE	Mean $\pm$ s.d.	SE	
AST (U/L)	161.2 $\pm$ 97.5	26	138.1 $\pm$ 59.2	11	NS
ALT (U/L)	53.8 $\pm$ 15.5	3.6	46.8 $\pm$ 11.6	2	NS
LDH (U/L)	1306.2 $\pm$ 703.9	161	1066.7 $\pm$ 390.5	69	NS
GGT (U/L)	44.1 $\pm$ 16.5	4.1	33.7 $\pm$ 18.6	6.3	NS
Urea (mmol/L)	7.4 $\pm$ 1.8	0.4	5.2 $\pm$ 2.3	0.4	< 0.05
Creatinine ( $\mu$ mol/L)	144.3 $\pm$ 21.9	5	161.4 $\pm$ 43.8	7.6	NS
TSP (g/L)	57.2 $\pm$ 7.3	1.7	63 $\pm$ 7.1	1.2	< 0.05
Albumin (g/L)	36.1 $\pm$ 7.2	1.6	39.5 $\pm$ 9.2	1.6	NS
Glucose (mmol/L)	7 $\pm$ 4.9	1.2	4.2 $\pm$ 2.9	0.5	< 0.05

### **Discussion**

Difficulties associated with evaluating results obtained by a variety of techniques and expressed in different units have been previously discussed (CHAPMAN, 1977) and are particularly severe for enzyme analyses. For comparative purposes, enzyme activities quoted in some other reports to have been done at 25 °C, have been converted to 30 °C by applying the conversion factors described by KANEKO et al. (1997).

Comparison of different biochemical parameters between groups of fallow deer has shown some significant differences. It is also clear that differences between parameters from different researchers are present, which confirms previously mentioned differences in techniques of collecting the samples and in individual differences between animals from different places. As discussed by ASHER et al. (1989), differences between animals can be due to many factors, such as genetic, environmental, nutritional and physiological ones, as well as to capture stress and sampling methodology. Comparisons of absolute values must therefore be confined to those produced using similar techniques, if possible.

Serum AST activity in this study was higher than the previously reported values in shot fallow deer by CHAPMAN et al. (1980) and lower than the values reported by PRESIDENTE (1979). A similar mean value was reported by SLAVICA et al. (2000) in shot fallow deer on the Brijuni Islands, while values from continental fallow deer were higher. A higher mean value of serum AST activity was also reported in physically restrained female fallow deer by ENGLISH and LEPHERD (1981), while on the other hand RANUCCI et al. (1996) reported a very low mean value (37 U/L) for all animals. Oscillations in serum AST concentration were also noticed in red deer, depending on how the animal was captured, by various authors (WILSON and PAULI, 1983; MARCO and LAVIN, 1999). The different values of enzyme AST activity from these various authors could be due to dissimilar release of this enzyme following muscle trauma as described by PRESIDENTE (1979).

In the case of ALT concentration, SLAVICA et al. (2000) reported a similar value from continent fallow deer, while animals from the islands had a lower result. ENGLISH and LEPHERD (1981) reported higher values for ALT concentration in sedated young animals and females while EIBIN (1984)

reported a lower value than that shown in our report. In physically captured red deer a similar concentration was found by MARCO and LAVIN (1999).

Mean LDH concentration was slightly lower than the mean ones reported by DHINDSA et al. (1975) in fallow deer but was within the range of mean LDH measurements in red deer (KNOX et al., 1988).

GGT concentrations presented here are higher than the values reported by CHAPMAN et al. (1980) and RANUCCI et al. (1996) in female fallow deer, but are somewhat in the middle of the values reported for red deer (KENT et al., 1980; WILSON and PAULI, 1983; REID and TOWERS, 1985; KNOX et al., 1988).

The wide individual variation in urea concentration concurs with previous reports on fallow deer (EIBIN and FISCHER, 1984; SLAVICA et al., 2000) as well as in red deer (WILSON and PAULI, 1983; KNOX et al., 1988) but the mean urea concentration was lower than the mean reported in fallow and red deer (WILSON and PAULI, 1983; EIBIN and FISCHER, 1984; KNOX et al., 1988; SLAVICA et al., 2000).

Serum creatinine concentration was similar to that found in fallow deer (EIBIN and FISCHER, 1984; SLAVICA et al., 2000) and in red deer (MARCO and LAVIN, 1999).

Mean concentrations of TSP and albumine were similar to those reported by PRESIDENTE (1979), CHAPMAN et al. (1980), ENGLISH and LEPHERD (1981) in fallow deer and in red deer by MARCO and LAVIN (1999). The lowest concentration of TSP (43 g/L) for blood taken from the heart of shot animals was reported by PAV et al. (1975), this value being the lowest one ever recorded in deer of any species (CHAPMAN, 1977).

The value of serum glucose concentration in fallow deer also showed a wide variation between individuals and was similar to those reported elsewhere (PRESIDENTE, 1979; SCHARFE et al., 1998; REHBEIN et al., 1999; SLAVICA et al., 2000). A similar statement and result was reported in red deer by WILSON and PAULI (1983). If compared with domestic ruminants, the level of serum glucose is higher in deer. This may be associated with the nervous temperament or higher metabolic rate in deer in comparison with domestic ruminants WILSON and PAULI (1983).

Besides the differences in sex and age, our research has also disclosed significant differences in urea, TSP and glucose with regard to the site

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where the blood was taken. Research carried out by SLAVICA et al., (2000) also showed certain differences between the values from continental fallow deer and the values of those from the islands. Although we have not noticed such a difference in other literature we consider that the site from which samples were taken can have an impact on the results of the blood samples research. Such causes could be food, weather and health status, especially parasites burdens, of the animals in the area where they live.

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**VENGUŠT, G., A. BIDOVEC: Neke kemijske vrijednosti u serumu jelena lopatara (*Dama dama* L.) iz lovišta u Sloveniji. Vet. arhiv 72, 205-212, 2002.**

**SAŽETAK**

Istraživani su određeni sastojci seruma odstrjeljenog jelena lopatara (n=52). Utvrđene su prosječne vrijednosti za spol i starost životinja te različito mjesto uzimanja krvi. Tijekom zime 2000./01. godine uzeta je krv iz lovišta na Gorenjskem i Dolenjskem. Utvrđene su prosječne vrijednosti slijedećih parametara: aspartat aminotransferaze (AST), alanin aminotransferaze (ALT), laktat dehidrogenaze (LDH), gama glutamiltransferaze (GGT), mokraćevine, kreatinina, ukupnih proteina, albumina i glukoze. Dobiveni rezultati pokazuju da postoje samo neka statistički značajna odstupanja između različitih skupina. Cilj ovog rada je pokazati niz biokemijskih podataka kod odstrjeljenog jelena lopatara u Sloveniji i uspoređivanje podataka s ostalim sličnim istraživanjima, što je od važnosti za laboratorijsku dijagnostiku.

**Ključne riječi:** jelen lopatar, biokemija, enzimi, Slovenija

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