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Serum biochemistry of free-ranging black francolins (*Francolinus francolinus*) including sex-related differences

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Black francolin (*Francolinus francolinus*) is a game bird belonging to Phasianidae family. This species is native to Southern Asia, Middle-East and Caspian region including Turkey. Black francolins are popular game animals and they play an important role in biological control of pests. Nevertheless, studies conducted on this species are extremely rare. The objective of this study is to introduce a profile of serum biochemistry for wild black francolins and to determine variations between sexes. We have analysed 13 serum parameters for each gender separately. We sampled 20 clinically healthy, adult black francolins. Analysed biochemical parameters are as follows: aspartate aminotransferase, alanine aminotransferase (ALT), glucose, triglycerides, cholesterol, creatinine, uric acid, total bilirubin, total protein, albumin, globulin, sodium and potassium. Females had significantly higher levels of aspartate aminotransferase and ALT while males had higher cholesterol levels.

Keywords: black francolin; *Francolinus francolinus*; serum biochemistry; sex effects

Introduction

Black francolin (*Francolinus francolinus*) is a well-known game bird involved in Phasianidae family. As a member of this family, they are terrestrial and they show sexual dimorphism. Black francolins have a wide geographic range from Southern Asian countries to Middle-East and Caspian region. Turkey is also a homeland for this bird. The population in Turkey is declining in recent years and special attention must be paid in order to understand and monitor this species more efficiently.

To establish reference values for free-ranging animals can be challenging due to limited access to sufficient numbers of samples and difficulties faced during capturing the animals. Nevertheless, it is very important to have this data since they can provide supportive information on the health status of animals individually or on population level. The number of researches on serum biochemistry of bird species, especially on phasianids, is limited. A few examples can be found on chukar partridges (Suchy et al. 2010; Nazifi et al. 2011), ring-necked pheasants (Schmidt et al. 2007) and Japanese quails (Scholtz et al. 2009). To our knowledge, there are no previous records on serum biochemistry of black francolins.

The main aim of this study is to determine reference values of blood parameters for black francolins and to find out sex-related changes in analytes. Analysed parameters in this study include aspartate aminotransferase (AST), alanine aminotransferase (ALT), glucose, triglycerides, cholesterol, creatinine, uric acid, total bilirubin, total protein, albumin, globulin, sodium and potassium.

Material and methods

Blood samples were collected from 20 (10 from each gender) free-ranging, clinically healthy, adult black francolins. The animals were captured by net traps under the supervision of two veterinarians in October 2011. All the birds were caught in the early hours of morning (between 6.00 am and 8.00 am, GMT + 2) outside the border of 'Kapicam Natural Park' (37° 27′ 29.96″N, 37°.00′ 43.40″E) which is located in East Mediterranean region of Turkey. The birds were put in a dark bag until the samples were received. Sampled animals were weighed and physically examined before blood samples received by the same veterinarian. Gender differentiation has been done according to the morphological features of the individuals. The blood samples were taken from cutaneous ulnar vein into lithium heparin tubes (Isotherm, Istanbul, Turkey). Contamination of the blood samples was avoided by the accurate conduction of the

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sampling procedure (Lumeij 2008). The samples kept still for maximum 2 hours for clotting and centrifuged for 20 minutes at 4.000 × *g* (Hettich Rotina 380, Tuttlingen, Germany). The serum samples were stored at −20°C until they are analysed. Serum samples were evaluated with an automated chemistry analyser (Roche Cobas 6000, Roche Diagnostics, Basel, Switzerland).

The results were recorded on a computer database (Excel, Microsoft Office XP, Microsoft Corporation, Washington, USA). They were then transferred to statistics software on which they analysed statistically using SAS package programme (SAS Institute 2002). Mean, standard deviations and 5th and 95th percentiles for each serum parameter have been calculated. *T*-tests for independent samples were used to compare means and to evaluate significant differences attributable to gender for all measured parameters. *P*-values < 0.05 were considered to be statistically significant.

Results

In this study, we detected mean values and reference intervals for 13 biochemseical parameters in black francolin. Biochemical profiles of black francolin are shown in Table 1. We found evidence for sex-related differences in three parameters. Females had higher activities of AST ($P < 0.05$), and ALT ($P < 0.05$) while males had showed higher levels of cholesterol ($P < 0.05$).

Discussion

No comparison could have been made in terms of black francolins since we could not find any previous record on the serum biochemistry of this wild bird. Therefore, the results have been compared with the findings of taxonomically related species such as chukar partridges (*Alectoris chukar*), ring-necked pheasants (*Phasianus colchicus*), Japanese quails (*Coturnix coturnix japonica*), Indian peafowl (*Pavo cristatus*) and capercaillie (*Tetrao urogallus*). We observed that our results generally comply with the values of other phasianids with the exception of a few parameters.

We observed that serum AST and ALT levels in black francolins are generally lower than the levels shown in capercaillie, ring-necked pheasants, Japanese quails and chukar partridges (Lavin et al. 1992; Schmidt et al. 2007; Scholtz et al. 2009; Nazifi et al. 2011). According to our findings, there is a statistically significant difference between sexes in terms of AST and

Table 1. Serum biochemical reference values for female (F, $n = 10$) and male (M, $n = 10$) black francolins.

Parameter	Sex	Mean	SD	Range	Significance
ALT (IU/L)	F	5.3	1.5	3.5–7.4	$P < 0.05$
	M	4.1	0.9	2.6–5.7	
AST (IU/L)	F	224.6	29.2	178.7–269.3	$P < 0.05$
	M	201.9	20.5	162.9–234	
Glucose (mmol/L)	F	23.0	1.4	21.2–25.9	NS
	M	22.7	1.5	19.9–24.8	
Creatinine (µmol/L)	F	13.2	1.7	10.6–15.9	NS
	M	11.4	2.65	6.1–15	
Bilirubin (µmol/L)	F	0.8	0.34	0.3–1.2	NS
	M	0.5	0.17	0.17–0.8	
Cholesterol (mmol/L)	F	4.6	0.34	4.06–5.08	$P < 0.05$
	M	5	0.41	4.24–5.55	
Triglyceride (mmol/L)	F	0.7	0.12	0.5–0.85	NS
	M	0.6	0.2	0.35–0.92	
Uric acid (µmol/L)	F	424.6	133.2	267.6–624.5	NS
	M	358.6	39.2	309.3–440.1	
Albumin (g/L)	F	14.9	0.6	14.2–15.9	NS
	M	15.2	1.4	12.5–16.8	
Globulin (g/L)	F	28.9	1.9	27–33	NS
	M	27.9	1.9	24–31	
Total protein (g/L)	F	43.8	2.1	41.4–48.2	NS
	M	43.1	2.4	39.4–47.1	
Sodium (mmol/L)	F	157.1	2.38	151–159	NS
	M	155.8	3.52	150–159	
Potassium (mmol/L)	F	3	0.7	2.2–4.6	NS
	M	3	0.7	1.8–4.6	

ALT, alanine aminotransferase; AST, aspartate aminotransferase; NS, not significant.

ALT levels. Scholtz et al. (2009) indicated a sex-related difference in AST and ALT levels in Japanese quails as well. In contrast to their results, female black francolins had higher AST and ALT levels.

Serum glucose levels in black francolins were between the ranges given for wild turkeys (*Meleagris gallopova silvestris*) and Indian peafowl (*P. cristatus*) (Bounous et al. 2000; Samour et al. 2010). The levels reported in other phasianids were lower than the results detected in black francolins (Schmidt et al. 2007; Scholtz et al. 2009; Suchy et al. 2010). Black francolins are timid animals prone to capturing stress. It should be underlined that sampled animals were free-ranging wild animals and the increased levels of glucose can be explained by the stress of capture which ends up with increased levels of catecholamines and glucocorticoids and causes hyperglycemia.

Nazifi et al. (2011) indicated that cholesterol levels in chukar partridges were 4.02 mmol/L in males and 3.94 mmol/L in females. Suchy et al. (2010) reported similar results for chukar partridges. Our findings are generally overlapping with the previous ones. We detected that cholesterol is a sex-dependant analyte in black francolins. This has also been shown in Japanese quail (Scholtz et al. 2009).

The concentration of uric acid was similar to those reported previously in japanese quail and grey partridge (*Perdix perdix*) while higher than the levels indicated in chukar partridge (Suchy et al. 2010; Nazifi et al. 2011).

Albumin and globulin levels as well as total protein values in black francolins were in a harmony with the results belonging to helmeted guinefowl (*Numida meleagris*), chukar partridge and grey partridge (Suchy et al. 2010).

Serum mineral levels studied in this research were involved in narrow intervals. This has been observed in other game birds either. Sodium and potassium levels complied with the results received in helmeted guineafowl, common pheasant and chukar partridge (Suchy et al. 2010).

In conclusion, mean values and reference intervals for 13 serum parameters frequently checked in avian medicine have been calculated in black francolins. ALT, AST and cholesterol are the three analytes which showed statistically significant difference between male and female black francolins. Some of the sexual differences may appear due to metabolic changes in females since female birds lay eggs (Walzem et al. 1999). In general, the results received in this study are coherent with those reported in the members of Phasianidae family. Some of the parameters might have been affected because of the excitability of the black francolins. Nevertheless, this situation applies any case of blood sampling from free-ranging black francolins.

Although sex-related differences have been found in this study, our knowledge on effects of age, circadian rhythm and season is still not enough. It is hoped that the data provided in this study will be valuable for the wildlife veterinarians and biologists in monitoring health status of black francolins.

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