ISSN: 2689-4246
DOI: 10.33552/CTCMS.2021.02.000540
Current Trends in Clinical & Medical Sciences
Iris Publishers

Research Article

Plasma Biochemical Parameters of The Blood of Captive Adult Male and Female Black-Necked Pheasants (*Phasianus colchicus*), Gray Partridge (*Perdix perdix*) and Chukar Partridge (*Alectoris chukar*) in Bulgaria

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Received Date: January 28, 2021

Published Date: February 05, 2021

Abstract

Blood samples were collected from 36 (12 by species; 6 male and 6 female) captive, adult, clinically healthy Black-necked pheasants or Southern Caucasus pheasants (*Phasianus colchicus*), Gray partridge (*Perdix perdix*) and Chukar partridge (*Alectoris chukar*) for plasma biochemical analyses. The investigated parameters were Total protein, Albumin, Total bilirubin and Glucose. Significant differences ($P<0.05$) among both sexes were found in concentrations of total bilirubin and Glucose in Gray partridges; and Total protein in Chukar. In female Gray and Chukar partridges, the Total protein values were higher than in male ones, but in pheasants it was the opposite. The trend for Albumin and Total bilirubin values in the three game birds were inverted, with higher values observed in male than female birds.

Keywords: Plasma biochemistry; Blood values; Pheasants; Gray partridge; Chukar; Game birds

Introduction

The Black-necked pheasants or Southern Caucasus pheasants (*Phasianus col. colchicus*), Gray partridge (*Perdix perdix*) and Chukar partridge (*Alectoris chukar*) are birds from the order Galliformes, family Phasianidae and native to Europe and Asia. They have been widely introduced as game birds and are one of the world's most hunted birds [1-2]. Over the last few years, industrial pheasant farms have been developed as a new agricultural activity for commercial production of meat in Europe, and the number of the pheasant population reared each year has increased exponentially [3-4]. Although it is well known that plasma biochemistry is important for medical diagnosis of disease in several bird species, limited information is available for pheasants, partridges [5-6] and chukars [7]. There are studies have reported the values of biochemical parameters in pheasants [8-9], and the knowledge of plasma chemistry parameters in pheasants, partridges and chukars still remains incomplete [10]. Therefore, accurate and useful biochemical analyses are needed. In general, blood examination is performed for several reasons as a screening procedure to assess general health [11]. Because the clinical signs of illness in birds are frequently subtle, clinical chemistry is necessary to evaluate cellular damage [12].

Materials and methods

Game birds were allocated in breeding aviaries. The birds were fed a proprietary pellet formulated for pheasants (HL-TopMix OOD Company, Bulgaria) ad libitum and had access to fresh water at all

times. The adult animals were 52-54-week-old on the reproduction season: Black-necked pheasants allocated in families with one male and seven females; Gray partridges in pair; Chukars in families with one male and four females. All the birds were vaccinated against Newcastle disease virus 4 months before blood sampling and were free from any endoparasites or ectoparasites. Blood samples were collected from the ulnar wing vein (vena cutanea ulnaris superficialis) from 36 adult birds: pheasants (6 male and 6 female), Gray partridges (6 male and 6 female) and Chukars (6 male and 6 female). The birds were selected randomly from breeding aviaries. Approximately 0.5-1.0 ml of whole blood was obtained from each bird and immediately placed into blood collection tubes that contained heparin. Samples were processed within 1-3 hours after collection. The plasma biochemical parameters: Total protein, Albumin, Glucose and Total bilirubin were measured using a standard automatic biochemical analyzer (BS-120, Mindray, China). We were got Permission to use animals in experiments №280 aviary-bred wild birds issued by Bulgarian food safety agency. The data were processed with IBM SPSS Statistics (SPSS-Inc., 2019, SPSS Reference Guide 26 SPSS, Chicago, USA) using descriptive statistics with frequency distribution tables. Males and females were analyzed separately as sex may affect the parameters studied. All values were expressed as mean ± standard error, and P≤0.05 was determined as statistically significant.

Results

The mean values of selected plasma biochemical parameters for adult male and female Black-necked pheasants were determined (Table 1). The overall biochemical blood values including Total protein, Albumin, Glucose, and Total bilirubin values were 47.89±1.87, 22.47±0.71, 23.97±1.43 and 4.55±0.25, respectively. All these parameters between adult male and female Black-necked pheasants were no significant (p>0.05).

The mean values of selected plasma biochemical parameters for adult male and female Gray partridges were determined (Table 2). Significant differences in plasma Glucose and Total bilirubin were found among both males and females' values were 20.04±0.78 and 10.99±1.52, respectively. The other blood parameters Total protein, Albumin showed no significant differences between the male and female adult Gray partridges' values were 53.72±1.55 and 21.66±0.78, respectively.

The mean values of selected plasma biochemical parameters for adult male and female Chukar partridges were determined (Table 3). Significant differences in plasma Total protein 60.66±3.23 were found among both males and females. The other blood parameters Albumin, Glucose and Total bilirubin showed no significant differences between the male and female adult Chukars values were 22.32±0.54, 19.27±0.64 and 7.67±0.32, respectively.

Table 1: Plasma biochemical parameters for male and female Black-necked pheasants (n=12) in captivity in Bulgaria.

Parameters	Male (n= 6) Mean ± SE (Min-Max)	Female (n= 6) Mean ± SE (Min-Max)	P-value
Total protein (g/l)	46.47±2.71 (38.20–56.90)	49.32±2.68 (39.10–57.10)	1.00[a]
Albumin (g/l)	21.51±0.72 (19.10–23.50)	23.42±1.15 (20.70–27.20)	0.44[a]
Total bilirubin (µmol/l)	5.15±0.29 (4.47–6.50)	3.94±0.19 (3.25 – 4.53)	0.10[a]
Glucose (mmol/l)	21.03±1.53 (15.13–26.91)	26.91±1.77 (19.82–33.14)	0.55[a]

Note: a = Non-significant (P>0.05); b = Significant (P<0.05); SE = Standard error.

Table 2: Plasma biochemical parameters for male and female Gray partridges (n=12) in captivity in Bulgaria.

Parameters	**Male (n= 6) Mean ± SE (Min-Max)**	**Female (n= 6) Mean ± SE (Min-Max)**	**P-value**
Total protein (g/l)	55.82±1.79 (50.30–60.30)	51.63±2.37 (42.80–57.30)	0.30[a]
Albumin (g/l)	22.62±1.23 (18.20–25.60)	20.7±0.88 (18.80–19.90)	1.00[a]
Total bilirubin (µmol/l)	12.71±2.42 (8.9–24.67)	9.28±1.77 (4.3–10.03)	0.01[b]
Glucose (mmol/l)	18.78 ± 0.61 (17.78–21.78)	21.29±1.28 (18.55–27.30)	0.005[b]

Note: a = Non-significant (P>0.05); b = Significant (P<0.05); SE = Standard error.

Table 3: Plasma biochemical parameters for male and female Chukar partridges (n=12) in captivity in Bulgaria.

Parameters	Male (n= 6) Mean ± SE (Min-Max)	Female (n= 6) Mean ± SE (Min-Max)	P-value
Total protein (g/l)	56.60±5.92 (29.80–72.70)	64.72±2.08 (56.20–69.80)	0.003[b]
Albumin (g/l)	23.23 ± 0.77 (21.20–26.20)	21.40±0.59 (19.30–23.40)	0.24[a]
Total bilirubin (µmol/l)	7.77±0.29 (6.85–8.40)	7.57±0.60 (5.93–10.08)	0.16[a]
Glucose (mmol/l)	21.10±0.59 (19.60–23.79)	17.44±0.34 (16.35–18.46)	0.30[a]

Note: a = Non-significant (P>0.05); b = Significant (P<0.05); SE = Standard error.

Discussion

The mean values of selected plasma biochemical parameters Total protein, Albumin, Glucose, and Total bilirubin for adult male and female Black-necked pheasants were compared/similar to Common pheasants [9-10] and Ring-necked pheasants [12-13]: The results for Total protein (g/l) 49.20±6.800 in Common pheasants [10], significantly approach our values 47.89±1.87 in Black-necked pheasants. The Total protein was found in males 37.50±2.0 and in females 43.00±6.2 [12], similar to males 46.3±0.5 females 36.9±0.7 [13] with Ring-necked pheasants were of lower values, from our results for male 46.47±2.71 and female 49.32±2.68 Black-necked pheasants. Most likely this was due to the fact that our pheasants were studied during the breeding season, unlike other authors. The data in laying Common pheasant hens for the values of Total protein 38.6±1.39 and 41.5±1.55 [9] were close to our Black-necked pheasant hens.

Albumin levels (g/l) in male 28.1±0.4 and female 22.6±0.5 Ring-necked pheasants [13] were elevated in male pheasants compared to our data in male 23.42±1.15 Black-necked pheasants. However, in laying Common pheasant hens were 20.4±0.79 at the initial period and 22.8±1.07 at the end of laying (Hrabcakova et al. 2014), were relatively close to the values obtained by us for females 21.51±0.72 Black-necked pheasants.

Glucose (mmol/l) data were similar 20.08±1.87 in Common pheasants [10] to our results 22.47±0.71 in Black-necked pheasants. The results of Glucose in males 12.9±2.17 and females 12.6±1.96 [12]; and male 12.043±58 and female 11.15±61 [13] Ring-necked pheasants were twice lower than our results obtained male 21.03±1.53 and female 26.91±1.77 Black-necked pheasants, which may be due to the fact that the birds were out of the reproductive season. [9] established Glucose levels in Common pheasant hens in the initial laying period of 20.4±0.26 and at its end 20.8±0.33, which was close to our data of 26.91±1.77 in Black-necked pheasant hens. Nazifi et al. 2011 found higher values of Total bilirubin (µmol/l) in males 8.03±1.02 and significantly higher values in females 15.73±0.34 mature Ring-necked pheasants, in contrast to our data in males 5.15±0.29 and females 3.94±0.19 mature Black-necked pheasants. The difference may be due to the fact that his research received in the off-breeding season for birds.

The mean values of selected plasma biochemical parameters: Total protein and Glucose for adult male and female Gray partridges; Albumin and Total bilirubin together with Chukar partridges were compared to Gray partridges [6,10], Chukars [7] and Ring-necked pheasants [12]: Total protein (g/l) in Gray partridges 38.62±7.99 was much lower than our studies 53.72±1.55, the same trend was observed by sex male 36.52± 5.36 and female 40.76±9.59 [6], respectively our values for Total protein at male 55.82±1.79 and female 51.63±2.37 Gray partridges. While the results for Total protein 45.60±7.086 at Gray partridges [10] were closer to our values.

Albumin values (g/l) in males 23.9±0.221 and females 24.8±0.095 Chukar partridges (Farooq et al. 2019) differ slightly from our data in males 22.62±1.23 and females 20.7±0.88 Gray partridges, but are significantly close to our data male 23.23±0.77 and female 21.40±0.59 Chukar partridges, the difference was most likely determined by latitude and diet. Plasma levels of Glucose (mmol/l) 18.90±2.60 in Gray partridges [6] were quite close to the levels measured by us 20.04±0.78 in the same species, respectively male 18.78±0.61 and female 21.29±1.28 Gray partridges. They were even closer to our Glucose values of 19,260±2,000 in Gray partridges [10].

Our data on Total bilirubin values (µmol/l) at male 12.71±2.42 and female 9.28±1.77 Gray partridges were higher than those at male 7.77±0.29 and female 7.57±0.60 Chukar partridges, data compared to male 8.03 ± 1.02 and female 15.73±0.34 Ring-necked pheasants [12], showed that male pheasants had a closer value of Total bilirubin than those of Chukars, and data of female pheasants with Gray partridges.

The mean values of selected plasma biochemical parameters Total protein and Glucose for adult male and female Chukar partridges were compared to the same species of bird [7,10], Gray partridges [6,10] and Red-legged partridges [5]: The data for Total protein (g/l) 45.70±4.62 for Chukar partridges [10] were lower

than our values of 60.66±3.23 for the same species. Total protein values at 80.5±0.372 male and 102.8±2.19 female Chukar partridges (Farooq et al. 2019) were significantly higher than our data at male 56.60±5.92 and female 64.72±2.08 Chukars, which may be due to the difference in latitude (between Pakistan and Bulgaria) or using a different anticoagulant (EDTA or Heparin). While the data in males 38.0±0.5 and females 51.0±0.9 Red-legged partridges (Alectoris rufa) [5] were closer to our data, in particular to female Chukars.

Plasma levels of Glucose (mmol/l) 20,040±1,702 in Chukar partridges [7] and 22.64±61.26 Red-legged partridges (Alectoris rufa) [5] were slightly higher than our 19.27±0.64 in Chukar partridges, this deviation may be due to the time of counting the blood samples, the type of anticoagulant and the preliminary consumption of food by game birds.

Conclusion

In female game birds: Gray and Chukar partridges, the Total protein values were higher than in male birds, and in Pheasants there was a tendency to increase the levels of Total protein in females, in contrast to males in the breeding period. The trend for Albumin and Total bilirubin values in game birds: Pheasants, Gray and Chukar partridges were inverted, with higher values observed in male than female birds. Plasma Glucose levels were approximately equal in both sexes.

Acknowledgement

The authors would like to thank to the State Forestry "Stara Zagora", especially Dr. Galin Ivanov for his help in the work of game birds, Dr. Ivanka Lazarova for her help in statistical analyses and the Clinical Laboratory at the Faculty of Veterinary Medicine for plasma blood analysis.

Conflict of Interest

No conflict of interest.

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