



RESEARCH COMMUNICATION

Reference serum protein and lipoprotein fractions of ostriches (*Struthio camelus*) in Turkey

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ABSTRACT

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The aim of this study was to determine for reference purposes the values of serum albumin, α_1 -globulin, α_2 -globulin, β -globulin, γ -globulin, and α -lipoprotein (high density lipoprotein), pre- β -lipoprotein (very low density lipoprotein) and β -lipoprotein (low density lipoprotein) fractions of normal ostriches (*Struthio camelus*) in Turkey. Five male and five female ostriches, 18 months old, were used. All the ostriches were fed on a diet that contained 15.14 % crude protein and 2 950 Kcal/kg of metabolizable energy. The serum protein and lipoprotein fractions were measured using agarose gel electrophoresis. The fractions were found to be 60.96 % albumin, 0.24 % α_1 -globulin, 15.91 % α_2 -globulin, 13.34 % β -globulin, 9.55 % γ -globulin, 53.77 % HDL, 0.60 % VLDL and 48.09 % LDL.

Keywords: Lipoprotein fraction, ostrich, protein fraction, *Struthio camelus*

INTRODUCTION

A number of clinical and nutritional disorders can be assessed by the use of blood biochemistry. Non-specific avian values are inadequate because biochemical and hematological status is a reflection of many factors including species, age, management and nutrition (Bowes, Julian & Stirtzinger 1989; Okotie-Eboh, Bailey, Hicks & Kubena 1992; Aydin, Ak, Galip & Zaugg 2003).

Serum protein fractions can be separated by electrophoresis which shows that albumin is the largest protein fraction in normal avian serum. Avian albumin is similar in structure to mammalian albumin.

The globulin component of avian serum protein is composed of separate alpha (α), beta (β) and gamma (γ) fractions. Relative and total amounts of serum protein fractions are affected by infections, inflammation, and nutritional and physiological status, and are therefore important health indicators. Serum globulin and immunoglobulin levels can be valuable indicators of the ability of animals to perform the activities of daily living, and may be useful predictors of subclinical diseases (Bell & Freeman 1971; Nozaki, Nohara, Ashitomi, Zukeran, Inafuku, Akisaka & Suzuki 1998). Lipids are transported in the blood as components of lipoproteins, and therefore, changes in plasma lipids should be reflected in the amount and distribution of lipoproteins. Lipid synthesized is transported to adipose tissue mainly in the form of very low density lipoproteins (Whitehead, Hood, Heard & Pym 1984). The aim of this study was to determine for reference purposes serum albumin, α_1 -globulin, α_2 -globulin, β -globulin and γ -globulin, α -lipoprotein (high density lipo-

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protein (HDL), pre- β -lipoprotein (very low density lipoprotein (VLDL)) and α -lipoprotein (low density lipoprotein (LDL)) fractions of normal ostriches (*Struthio camelus*) in Turkey.

MATERIALS AND METHODS

The ostriches used in the study were obtained from the Ostrich Raising Unit, Faculty of Agriculture, Uludag University, which is situated in the Bursa region of western Turkey. Five male and five female ostriches, 18 months old, were used as the study material. All the ostriches were fed a diet that contained 15.14 % crude protein and 2 950 Kcal/kg of metabolizable energy (Table 1). Water was supplied ad libitum. The heads of the birds were covered with a hood to facilitate handling (Spinu, Spinu & Degen 1999). Blood samples were taken from a wing vein using Vacutainer® blood collection tubes and were transported in an ice chest to a laboratory for analyses. The samples were centrifuged at 3000 rpm for 5 min and the serum fraction so obtained was separated and stored at -20°C for later analysis. The composition of the feed of the ostriches was analyzed by the Weende method (A.O.A.C 1984). Serum albumin, α_1 -globulin, α_2 -globulin, β -globulin, γ -globulin and, α -lipoprotein, pre- β -lipoprotein and β -lipoprotein fractions were measured using agarose gel electrophoresis (REP, Helena-Laboratories).

RESULTS AND DISCUSSION

To our knowledge, very little information is available on the protein and lipoprotein fractions of ostriches. Changes in the constituents of the individual protein-lipoprotein fractions and changes in the relative amounts of each fraction in serum occur in many illnesses and nutrition-related problems (Wedler, Prokpo, Kunzi, Meyer, Stocker & Burgi 1998). The present study provides a picture of serum protein and lipoprotein fractions in healthy ostriches maintained under intensive conditions. The composition of the feed of the ostriches used in the study is shown in Table 1 and, serum protein and lipoprotein fractions in Table 2.

Albumin is the most abundant of the serum proteins. In animals it constitutes between 35 % and 50 % of the total serum proteins, in contrast to humans and nonhuman primates in which albumin accounts for 60–67 % of the total (Kaneko 1989). There are species differences in albumin migration in electrophoretic analysis. Cockatiel albumin migrates to a position equivalent to chicken α -globulins, while the

TABLE 1 Composition of mixed feed and nutrient matters of ostriches

Composition of mixed feed (%)		Composition of nutrient matters (%)	
Barley	29.5	Dry matter	89.37
Oat	29.5	Organic matter	81.86
Wheat	19.5	Ether extracts	3.22
Soybean meal	19.5	Crude fiber	7.57
Limestone	1.0	Crude protein	15.14
Salt	0.5	Ash	7.51
Vitamin-mineral premix	0.5	Nitrogen free extra matters	55.93
Total	100.00	Metabolic energy (Kcal/kg)	2 950

TABLE 2 Serum protein and lipoprotein fractions* of the ostrich

Protein and lipoprotein fractions (%) $\bar{X} \pm \text{S.D.}$	
Albumin	60.96 \pm 2.40
α_1 -globulin	0.24 \pm 0.13
α_2 -globulin	15.91 \pm 2.56
β -globulin	13.34 \pm 3.83
γ -globulin	9.55 \pm 1.44
HDL	53.77 \pm 9.55
VLDL	0.60 \pm 0.14
LDL	48.09 \pm 6.99

$n = 10$

* The figures of the ten birds were combined and averaged

migration of cockatiel pre-albumin is similar to that of chicken albumin (Archer & Battison 1997). Decreased albumin concentration has been determined in birds suffering from maldigestion, malabsorption and protein-losing enteropathy. Other causes of hypoalbuminaemia include protein-losing nephropathy and liver failure (Wilson, Greenacre & Howerth 1999; Harr 2002). While Bradley, Naude & Oelofsen (1985) reported that the albumin fraction of ostriches was 71 %, in the present study was found to be 60.96 % (Table 2). The reason for this discrepancy may be the result of differences in such factors as diet, physiological status and age.

The α -globulin fraction is the most rapidly migrating of all the globulins, and in most species, except in ruminants, it migrates as an α_1 (fast) and an α_2 (slow) fraction. In general, the α_1 -globulins are smaller than the α_2 , but there appears to be no functional separation between the two fractions (Kaneko 1989). The α_1 - and α_2 -globulin fractions in this study were 0.24 and 15.94 % respectively (Table 2). Serum α_1 -globulin and α_2 -globulin fractions in human were reported by Wijnen & Van Dieijen-Visser (1996) to be 21 and 19 %.

The β -globulins trail the α_2 fraction and similarly migrate as β_1 and β_2 fractions in most domestic animals, except ruminants. Important proteins of this fraction are complement, haemopexin, transferrin, ferritin and C-reactive protein (Kaneko 1989). The β -globulin fraction in the ostriches in the current study was found to be only one fraction. In this study, β -globulin and γ -globulin fractions were reported as 13.34 and 9.55 % (Table 2). These fractions in human reported by Wijnen & Van Dieijen-Visser (1996) were higher than the data in the present study. The γ -globulin fraction in humans was found to be 21 % (Nozaki *et al.* 1998).

In normal chicken plasma, almost 75 % of lipoprotein is HDL, about 10% is VLDL and the remainder is LDL. Therefore, although triglycerides constitute a much greater percentage of VLDL than HDL, HDL is the major carrier of plasma triglycerides. Also, more than 70 % of the plasma cholesterol of chickens is found in HDL (Bell & Freeman 1971; Gould & Siegel 1985). HDL, VLDL and LDL fractions in this study were found to be 53.77, 0.60 and 48.09% respectively. Lipoprotein fractions in chickens were reported by Gould & Siegel (1985) to be HDL 74 %, VLDL 7 % and LDL 19 %.

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