



Age-related Changes in some Blood Parameters of Ostrich (Short Communication)

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Abstract

The aim of this study was to investigate blood parameters of 4-month old blue-neck male ostriches (*Struthio camelus*) after feeding a diet containing 3% sunflower oil for two months. Blood samples were collected from the wing vein of the ostriches at the beginning and end of the study. The plasma was harvested and analyzed to measure cholesterol, triglyceride, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, very low-density lipoprotein cholesterol, total protein, albumin, total immunoglobulin, and the activities of aspartate amino transferase and alanine amino transferase enzymes. From days 0 to 60, concentrations of high-density lipoprotein cholesterol decreased ($P < 0.05$) while very low-density lipoprotein cholesterol and triglyceride increased significantly ($P < 0.05$). Other blood parameters did not change significantly. The results of this study showed that in ostrich, with increasing age from four to six months of age, very low-density lipoprotein cholesterol and triglyceride concentrations increased whereas other factors did not.

Introduction

The ostrich (*Struthio camelus*) is a member of the ratite family of flightless birds and is native to semi-arid and desert areas of Africa (Smit, 1963). Ostrich farming is an activity that has been expanding worldwide for nearly 130 years (Feitosa *et al.*, 2013). In Iran, this economic activity is still very recent, considering that only in 1999 the first ostriches arrived for commercial purposes (Hajibabaei *et al.*, 2005) and present ostrich farms are distributed in all regions and climates of the country, especially in the central regions (Ghasemi *et al.*, 2012). Analysis of blood biochemistry is a tool for the early diagnosis of nutritional and metabolic disorders before the emergence of more serious symptoms (Miranda

et al., 2008). Physiological parameters in blood are known to be influenced by different factors include age, disease, management, and nutrition.

There is little information about blood parameters of ostrich. Evaluation of the ratite hematology and clinical chemistry has become increasingly important in veterinary care. The aim of this study was to investigate blood parameters of 4-month old blue-neck male ostriches (*Struthio camelus*) after feeding a diet containing 3% sunflower oil for two months.

Material and Methods

Animal and diet

The study was carried out on six, 4-month old ostriches with an average weight of 43.3 ± 2.1 kg

in Arak University (Markazi province, Iran). The ostriches were fed *ad libitum* with a standard mash diet which has been formulated according to the recommendations reported by Cooper and Horbanczuk (2004) for 60 days (Table 1). The ostriches were kept in a commercial farm with 150 m² open space and 100 m² covered space and had free access to fresh water throughout the

study. The experiment was approved by the animal group committee of the agriculture faculty of Arak University (Approval No: 2013-07/02 -366). The ostriches were under veterinary care by a veterinarian. They were closely checked twice each day for any signs of illness or behavioral changes throughout the study and did not show any clinical signs of any disease.

Table 1. Ingredients and chemical composition of diet

| Ingredients | (%) |
|-----------------------------|-------|
| Corn, Grain | 37.40 |
| Alfalfa Meal (20% CP) | 28.05 |
| Soybean Meal (44% CP) | 27.58 |
| Dicalcium phosphate | 2.30 |
| Sunflower oil | 3.00 |
| Limestone | 0.69 |
| Common salt | 0.31 |
| Vitamin premix ¹ | 0.23 |
| Mineral premix ² | 0.23 |
| DL-Methionine | 0.14 |
| L-Lysine HCl | 0.07 |
| <i>Chemical composition</i> | |
| ME (Kcal/kg) | 2600 |
| CP (%) | 16 |

¹Vitamin premix supplied per kg of diet: vitamin A: 2.6 mg; vitamin D₃: 0.06 mg; vitamin E: 16 mg; vitamin K₃: 2 mg; thiamine: 1.8 mg; riboflavin: 6.2 mg; pantothenic acid: 10 mg; pyridoxine: 3 mg; cyanocobalamin: 0.015 mg; niacin: 28 mg; biotin: 0.1 mg; folic acid: 1.5 mg; choline chloride: 240 mg; antioxidant: 100 mg.

²Mineral premix supplied per kg of diet: Fe: 40 mg; Mn: 100 mg; Zn: 100 mg; Cu: 10 mg; I: 1 mg; Se: 0.2 mg.

Blood was collected from the ostriches at the beginning and the end of study, each time after 12 hrs of fasting. Blood samples were collected from the wing vein in heparinized tubes and transferred to the central laboratory of Arak city to prepare plasma by centrifugation at 2500 × g for 15 min. Plasma was stored at -21°C until analysis. Twice each day, ostriches were closely observed for any signs of illness or behavioral changes.

Growth performance

All ostriches were weighed in the morning, before drinking and feeding. Feed intake was calculated by measuring the amount of feed offered and residue left after 24 hrs. Feed conversion ratio (FCR) was calculated by dividing feed intake (FI) with weight gain.

Plasma biochemical analyses

Biochemical parameters consisted of total protein, albumin protein, total immunoglobulin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), triglyceride, total cholesterol, high-density lipoprotein cholesterol

(HDL-C), very-low-density lipoprotein cholesterol (VLDL-C) and low-density lipoprotein cholesterol (LDL-C). All analyses were made using commercial kits (Pars Azmoon, Iran) and a standard auto analyzer apparatus (Biotecnica, BT-3000, Rome, Italia). The concentration of VLDL-C was calculated by dividing plasma triglyceride by five. The LDL-C value was calculated using the formula: LDL-C = Total cholesterol - HDL-C - VLDL-C.

Statistical analysis

The data were checked for normal distribution using Kolmogorov-Smirnov method before analysis. Paired t-test was performed using SAS software (2001) for data analysis. A value was considered to be statistically significant if the *P*-value was less than 0.05.

Results and Discussion

Growth performance of ostriches is reported in Table 2. Average daily feed intake (ADFI), water consumption per day, feed conversion ratio (FCR), and weight gain were different from that estimated by Mushi *et al.* (1998). Waugh *et al.*

(2006) reported the average daily weight gain (ADG) as 320 g/day for young ostriches which is slightly more than finding of present experiment (271.3 g/day). However, Cooper (2005) reviewed growth in the ostriches. He reported based on the previous researches that ostrich chicks have a high feed conversion to

body mass ratio. This ratio is 2:1 at hatching to 4 months old and 3.8:1 at 4-6 months old. Also, Kreibich and Sommer (1995) explained that FCR ranged from 1.4:1 to 1.6:1 for younger birds (four to six months old) while older birds ranged from 4:1 to 6:1.

Table 2. Growth performance of ostriches (mean \pm SE)

| Initial Weight (kg) | Final Weigh (kg) | Gain (kg) | ADG (g) | FCR | ADFI (g) |
|---------------------|------------------|-----------------|----------------|-----------------|--------------|
| 43.3 \pm 2.1 | 59.6 \pm 1.1 | 16.3 \pm 1.01 | 271.3 \pm 11 | 2.648 \pm 0.6 | 718 \pm 25 |

No significant differences were observed in blood parameters of ostriches between the beginning and end of the study, except for triglyceride, HDL-C and VLDL-C concentrations (Table 3). These findings showed that ostriches at the end of the study had significantly higher plasma concentrations of VLDL-C, triglyceride, and HDL-C.

Total protein and total immunoglobulin values tended to increase by the end of study but this trend was insignificant. The average value of total protein for the two ages (4 and 6 months) in this study was 4.89 g/dL, which was similar to values reported by Bell and Freeman (1971), Quintavalla *et al.* (2001), and Penninks *et al.* (2012). The values of total immunoglobulin in this investigation were observed to be 0.88 - 0.93 g/dL. However, higher values have previously been reported (Ahmed *et al.*, 2006); Cantu-Martinez *et al.*, 2010; Omid and Ansari nik, 2013), as well as lower (Selvan *et al.*, 2012). Similar to the results of Durgun *et al.* (2005), the

effect of age on total immunoglobulin in this study was not significant, but, Quintavalla *et al.* (2001) and Penninks *et al.* (2012) reported that total protein and total immunoglobulin increased with age in ostriches until 24-36 months. There was no significant difference in serum albumin concentration between the two age groups. The range of blood albumin concentration was 4.27 \pm 0.46 to 4.53 \pm 0.26 g/dL in the two age groups which were similar to findings from Miranda *et al.* (2008), Bonadiman *et al.* (2009), and Omid and Ansari nik (2013). In contrast, higher concentrations of blood albumin were observed by Miranda *et al.* (2008) and Zahid *et al.* (2003).

Age had no significant effect on LDL-C concentration. HDL-C concentration in the two age groups was significantly affected with 4 month old group having 50.95 \pm 1.20 mg/dL and the six month old group having 47.08 \pm 1.13 mg/dL. HDL-C concentration decreased with an increase in age group.

Table 3. Effect of ostrich age on plasma biochemical parameters at beginning and end of the study

| Variable | Day 0 | Day 60 | P-value |
|-----------------------------|-------------------------------|--------------------------------|---------|
| Triglyceride (mg/dL) | 99.33 \pm 3.70 ^a | 114.95 \pm 3.50 ^b | 0.033 |
| Cholesterol (mg/dL) | 101.78 \pm 7.74 | 134.75 \pm 13.44 | 0.125 |
| HDL-C (mg/dL) | 50.95 \pm 1.20 ^a | 47.08 \pm 1.13 ^b | 0.041 |
| LDL-C (mg/dL) | 31.66 \pm 8.39 | 63.28 \pm 14.64 | 0.150 |
| VLDL-C (mg/dL) | 19.86 \pm 0.74 ^a | 22.98 \pm 0.70 ^b | 0.033 |
| Total Protein (g/dL) | 4.67 \pm 0.16 | 5.11 \pm 0.21 | 0.252 |
| Albumin (g/dL) | 4.27 \pm 0.46 | 4.53 \pm 0.26 | 0.710 |
| Total Immunoglobulin (g/dL) | 0.88 \pm 0.22 | 0.93 \pm 0.08 | 0.853 |
| ALT (IU/L) | 32.95 \pm 1.84 | 33.45 \pm 1.72 | 0.468 |
| AST (IU/L) | 34.65 \pm 1.48 | 32.73 \pm 0.84 | 0.284 |

Triglyceride concentration was significantly affected by age which was dissimilar to the findings of Moniello *et al.* (2006). The concentrations of triglyceride in four and six

month old ostriches were 99.33 \pm 3.00 and 114.95 \pm 3.50 mg/dL, respectively. Lower values were observed by Durgun *et al.* (2005), Moniello *et al.* (2006), and Omid and Ansari nik (2013).

Age had no significant effect on blood cholesterol concentration which was similar to the findings of Palomeque *et al.* (1991) and Durgun *et al.* (2005). Cholesterol concentration increased with (101.78±7.74 mg/dL at four months *vs.* 134.75±13.44 mg/dL at six months). Lower values were recorded by Palomeque *et al.* (1991), Durgun *et al.* (2005), and Selvan *et al.* (2012), while a higher value was reported by Omid and Ansari nik (2013).

There were no significant differences in activities of AST and ALT. Their averages were 33.69 and 33.02 IU/L for 4 and 6 month olds, respectively. In other studies, the AST values were reported 131 to 372.2 IU/L (Levy *et al.*, 1989; Angel, 1996), while ALT values were reported from 2 to 26.62 IU/L (Levy *et al.* 1989; Palomeque *et al.* 1991). This result was in disagreement with

the finding reported by Cilliers *et al.* (1995). This variation can include sensitivity of laboratory instruments and age of ostriches.

Conclusion

In summary, as ostriches grew from four to six months of age, VLDL-C and triglyceride concentrations increase while other blood parameters including total protein, albumin, total immunoglobulin, of AST and ALT are not changed.

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