

Original Research Article

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Changes in Hematological and Serum Biochemical Values of Emus (*Dromaius novaehollandiae*) Affected with Leg Deformities

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ABSTRACT

Keywords

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The aim of the present study is to estimate the haematological and serum biochemical values and to study the role of calcium in emus affected with leg deformities. Investigations were carried out on ten adult emu birds affected with leg deformities at private emu farm, Proddatur, Y.S.R Kadapa District, Andhra Pradesh, India. The haematological parameters viz., total erythrocyte count, total leukocyte count, haemoglobin, packed cell volume and erythrocyte sedimentation rate were measured, while the serum biochemical values like total protein, calcium, phosphorous, creatinine, cholesterol, glucose, urea, uric acid, alanine amino transferase and aspartate amino transferase were estimated. There is a significant increase in total white blood corpuscles, erythrocyte sedimentation rate, total protein, glucose, uric acid and creatinine and significant decrease in calcium levels in affected emus.

Introduction

The emu (*Dromaius novaehollandiae*) belong to ratite group and the second largest bird by the height in the world, after the ostrich. Emu farming in India is gaining commercial importance (Saivinay *et al.*, 2018), and emu products have attracted attention as alternate medical drugs (Abimosleh *et al.*, 2012; Jeengar *et al.*, 2015). Hence, many poultry farmers have diversified from poultry to emu

farming because of its economic value. Leg deformities are a common problem in emu chicks reared under captive condition (Mehala *et al.*, 2015), leg deformities such as tibiotarsal rotation, slipped tendon, twisted or rolled toes, Osteomalacia and Rickets have been commonly observed. Tibiotarsal rotation is characterized by deformity of the coxo-femoral joint due to rotation of the tibiotarsal bone above the hock joint leading to turning of the foot to the outside (Hahulski *et al.*, 1999).

Blood profiling is a helpful tool in detecting the metabolic diseases, nutritional deficiencies, antioxidant enzyme status, screening of health status, and welfare of animals and blood exams are an indispensable tool in bird medicine (Varaprasad Reddy *et al.*, 2009). Comprehensive health assessments on wild bird productions, as haematology, can be used to assess the effects of many health related problems (Gallo *et al.*, 2015), such as contaminant intoxication, malnutrition and exposure to infection. There is very little information available on the haematological and serum biochemical values of emus affected with leg deformities, tibio tarsal rotation etc. Hence, the objectives of current study was to estimate the haematological and serum biochemical values in both healthy emus and emus affected with leg deformities and to study the role of these values in affected emus.

Materials and Methods

The present study was carried out on ten emu birds of 6-10 months age group. The birds were raised under semi-intensive system in an Emu farm located at Proddatur, Y.S.R Kadapa District of Andhra Pradesh with a night shelter and free access to outdoor space. They were fed a balanced formulated diet. Drinking water was provided *Ad libitum*.

Blood samples were collected from 10 affected birds and 10 healthy birds as control. Sample collection was carried out aseptically by using 21 gauge needles. The Jugular Vein is preferred site for collection of blood from Emus, especially on the right side (Reddy *et al.*, 2003). Blood samples were collected into serum separator tubes, and the serum obtained from the tubes was frozen and stored for subsequent use in estimation of Serum biochemical values. The serum biochemical values like total protein, calcium, phosphorous, creatinine, cholesterol, glucose,

urea, uric acid, alanine amino transferase (ALT) and aspartate amino transferase (AST) were estimated. Whole blood was collected for estimation of total erythrocyte count (TEC), total leukocyte count (TLC), hemoglobin (Hb), packed cell volume (PCV), erythrocyte sedimentation rate (ESR). The blood was analyzed for hematology parameters like TEC, TLC by Neubauer's Hemocytometer method, Hb by Sahli's haemoglobinometer method, PCV by microhematocrit method, ESR by Wintrobe's method by following procedure given in standard methods as described by Schalm *et al.*, 1975. Peripheral blood smears was collected to screen for haemoprotezoans and faecal samples were collected to screen for enteric parasitic ova (Sivajothi and Reddy, 2018). Statistical analysis of the data was analyzed by one student t-test as per Snedecor and Cochran (1994).

Results and Discussion

Mean hematological values of emus affected with leg deformities and healthy emus are presented in Table 1. In this study the mean total white blood corpuscles count was significantly ($p < 0.05$) higher in emus affected with leg deformities than healthy emus. The significant increase in total white blood corpuscles in affected emus could be due to leucocytosis and or mobilization of leucocytes into the general circulation which is triggered by stress and physical disturbances caused by leg deformities.

Total red blood corpuscles, Hemoglobin and PCV values were slightly increased in emus affected with leg deformities but, there was no significant difference in these parameters in both healthy and affected emus. The slight increase in PCV values of affected emus in present study may be due to dehydration as a result of reduction of feed and water intake by the leg deformities affected birds. Severely

affected birds cannot stand and thus injure the hock joint while attempting to stand up. Consequently, affected birds find difficulty to reach food and water troughs and eventually die of starvation or dehydration (Gilslder, 1994). Femoral and tibiotarsal fractures frequently results in severe haemorrhages followed by hypovolemic shock and death (Charuta *et al.*, 2010; Bello *et al.*, 2017). Similarly, Menon *et al.*, (2013) also reported elevated PCV values in dehydrated emu birds. The ESR values in this study were significantly ($p<0.05$) higher in emus affected with leg deformities than healthy emus.

Mean serum biochemical values of healthy and affected emus were presented in Table 2. Total Protein, glucose, uric acid and creatinine values in emus affected with leg deformities were significantly ($p<0.05$) higher than

healthy emus. But, the calcium levels in affected emus were significantly ($p<0.05$) lower than healthy emus. Mean cholesterol, urea, phosphorus, ALT and AST values do not differ significantly in healthy and affected emus. The increase in total protein in emus affected with leg deformities than healthy emus is in agreement with the findings of Charles Noriega (2000) who reported high protein values in birds during severe inflammation. Total serum protein increases when the protein intake exceeds the requirement for growth and maintenance.

A high protein diet is often fed to commercial ratites in order to achieve fast weight gain (Deeming *et al.*, 1993). This high protein diet together with the lack of proper exercise increases the incidence of leg deformity in captive ratites (Mehala *et al.*, 2015) (Fig. 1).

Table.1 Mean hematological parameters in emu birds affected with leg deformities

Parameter	Healthy emus	Affected emus
Total Red blood corpuscles ($\times 10^6/\mu\text{l}$)	3.22 ^a ± 0.03	3.34 ^a ± 0.02
Total White blood corpuscles ($\times 10^3/\mu\text{l}$)	12.14 ^a ± 0.11	13.37 ^b ± 0.24
Haemoglobin (g/dl)	14.21 ^a ± 0.13	14.26 ^a ± 0.14
Packed Cell Volume (%)	38.14 ^a ± 0.19	38.28 ^a ± 0.21
Erythrocyte Sedimentation Rate (mm/hr)	7.19 ^a ± 0.04	8.84 ^b ± 0.05

Values in the same row bearing different superscripts differ significantly ($P<0.05$).

Table.2 Mean serum biochemical parameters in emu birds affected with leg deformities

Parameter	Healthy emus	Affected emus
Total Protein (g/dl)	4.82 ^a ± 0.27	5.14 ^b ± 0.54
Glucose (mg/dl)	148.2 ^a ± 11.4	158.7 ^b ± 10.62
Cholesterol (mg/dl)	120.33 ^a ± 7.6	120.42 ^a ± 8.4
Urea (mg/dl)	8.24 ^a ± 1.5	8.44 ^a ± 1.3
Uric acid (mg/dl)	11.45 ^a ± 1.4	13.17 ^b ± 1.2
Creatinine (mg/dl)	0.12 ^a ± 0.03	0.24 ^b ± 0.06
Calcium (mg/dl)	12.72 ^a ± 1.8	10.68 ^b ± 1.5
Phosphorus (mg/dl)	4.12 ^a ± 0.8	3.96 ^a ± 0.5
ALT (IU/L)	38.45 ^a ± 2.4	39.45 ^a ± 1.4
AST (IU/L)	121.25 ^a ± 11.8	121.45 ^a ± 12.4

Values in the same row bearing different superscripts differ significantly ($P<0.05$).

Fig.1 Leg deformities in Emu bird



In the present study there was a significant increase in serum Glucose values in emus affected with leg deformities than healthy emus. Such elevation in glucose levels was possible as a result of stress and due to release of glucocorticoids in affected birds. This increase in glucose levels were in agreement with the findings of Siegel (1995) who reported high glucose values in birds during handling stress.

There was a significant increase in uric acid and creatinine values in the present study in emus affected with leg deformities than healthy emus. Despite these differences, mean uric acid values remained within normal limits in both healthy and affected emus, according to Campbell (2004), uric acid levels in serum below 15 mg/dl are normal. Uric acid, the major end product of protein metabolism in birds, and its levels can be used to detect dehydration and renal diseases as Uric acid levels can be highly increased in dehydration in birds (Hochleithner, 1994).

The higher Uric acid levels possibly reflect the protein levels in the diet.

In the present study there was a significant decrease in serum Calcium levels in emus affected with leg deformities than healthy emus was in agreement with the finds of Bezuidenhout *et al.*, (1994), who also observed lower calcium levels in birds with leg deformities than healthy birds. Aganga *et al.*, (2003) was reported limb deformities and affected bone structures in birds with low calcium levels. Wyss *et al.*, (2010) reported that calcium deficiencies along with manganese and copper are the potential causes of leg deformities in Ostriches. Some deficiencies in vitamins and minerals are reported to cause leg deformities and slipped tendons in birds especially Vitamin D3, biotin, choline, niacin, folic acid, pyridoxine, calcium, manganese and zinc (Kistner and Reiner, 2002 ; Aganga *et al.*, 2003). In addition to these deficiencies some other factors like food deprivation, a high amino

acid to protein feed ratio, a low dietary calcium level, a high energy feed had been linked to tibiotarsal rotation in birds reported by Hahulski *et al.*, (1999). Genetics, nutrition, excessive growth rates due to over feeding with high protein diet and inadequate exercise are also likely to be involved in leg deformities of ratites (Reece and Buttler, 1984; Bruning and Dolensenk, 1986).

Serum hematological findings and biochemical values in emu birds were determined in both healthy and emus affected with leg deformities. The findings from our study showed that levels of total white blood corpuscles, ESR, total protein, glucose, uric acid and creatinine are significantly higher in leg deformities affected emus than healthy emus. But, calcium levels in affected emus are significantly lower than healthy emus. These results clearly indicate that deficiency of calcium even with higher total protein content leads to leg deformities in emus. It is concluded that the leg deformities of the emus seem to be a multifactorial problem. Calcium deficiency can be a potential cause but also the elevated total protein levels are an additional factor in leg deformity problem in emu birds.

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