

Hematological and serum biochemical values of white ibis (*Threskiornis melanocephalus*)

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Abstract

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Hematological and biochemical values are important for diagnosis of clinical signs, showing how disease processes change. This is the first report to demonstrate hematological and serum biochemical values of white ibis (*Threskiornis melanocephalus*) in Thailand, which are rare species in tropical countries. The study was carried out in ten healthy white ibises (male, n=5; female, n=5), at the age of 4 years from Khow Khoew Open Zoo, Chon Buri province, Thailand. The results revealed the following information: total red blood cell, hemoglobin concentration, packed cell volume, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, total white blood cell, percentage of lymphocyte, percentage of heterophil, percentage of monocyte, percentage of eosinophil, percentage of basophil and thrombocyte of white ibis were $2.78 \pm 0.70 \times 10^6$ cells/ μ l, 18.75 ± 1.32 g/dl, $46.00 \pm 3.59\%$, 173.51 ± 38.52 fl, 70.73 ± 15.42 g/dl, 40.82 ± 1.65 pg, $1.49 \pm 0.66 \times 10^4$ cells/ μ l, $89.70 \pm 6.40\%$, $8.50 \pm 6.34\%$, $0.50 \pm 0.97\%$, $0.90 \pm 1.29\%$, $0.30 \pm 0.95\%$ and $16.2 \pm 0.49 \times 10^3$ cells/ μ l, respectively. Serum biochemistry values i.e. serum glucose, serum creatinine, serum glutamic oxaloacetic transaminase, and serum glutamic pyruvic transaminase of white ibis were 12.55 ± 1.90 mmol/dl, 69.95 ± 13.05 mmol/l, 204.82 ± 56.76 IU/L and 30.43 ± 8.66 IU/L, respectively. Hematological and biochemical values between males and females white ibis were not significantly different ($P > 0.05$).

Key words : hematology, serum biochemistry, white ibis (*Threskiornis melanocephalus*)

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บทคัดย่อ

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 ค่าโลหิตวิทยาและชีวเคมีโลหิตในนกช้อนหอยขาว
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ค่าโลหิตวิทยาและชีวเคมีโลหิตมีความสำคัญในการวินิจฉัยอาการทางคลินิก และเพื่อประเมินสภาพสัตว์ป่วยและการพยากรณ์โรค รายงานการศึกษาค่าโลหิตวิทยาและชีวเคมีโลหิตของนกช้อนหอยขาว (*Threskiornis melanocephalus*) นี้เป็นการรายงานครั้งแรกในประเทศไทย ซึ่งในปัจจุบันนกช้อนหอยขาวเป็นนกที่พบจำนวนมากที่สุดในประเทศเขตร้อน ทำการศึกษาค่าทางโลหิตวิทยาและชีวเคมีโลหิตในนกช้อนหอยขาวสุขภาพดี จำนวน 10 ตัว (เพศผู้ 5 ตัว และเพศเมีย 5 ตัว) ที่เลี้ยงในสวนสัตว์เปิดเขาเขียวจังหวัดชลบุรี ผลการศึกษามีดังต่อไปนี้คือ ค่าจำนวนเม็ดเลือดแดงทั้งหมด ค่าความเข้มข้นของฮีโมโกลบิน ค่าเปอร์เซ็นต์เม็ดเลือดแดงอัดแน่น ค่าเฉลี่ยปริมาตรเม็ดเลือดแดง ค่าเฉลี่ยฮีโมโกลบิน ค่าเฉลี่ยความเข้มข้นของฮีโมโกลบิน ค่าจำนวนเม็ดเลือดขาวทั้งหมด ค่าเปอร์เซ็นต์เม็ดเลือดขาวชนิดลิมโฟไซต์ ค่าเปอร์เซ็นต์เม็ดเลือดขาวชนิดเฮมโทฟิล ค่าเปอร์เซ็นต์เม็ดเลือดขาวชนิดโมโนไซต์ ค่าเปอร์เซ็นต์เม็ดเลือดขาวชนิดอีโอซิโนฟิล ค่าเปอร์เซ็นต์เม็ดเลือดขาวชนิดแบซิฟิล และค่าเกล็ดเลือดของนกช้อนหอยขาวมีค่าเท่ากับ $2.78 \pm 0.70 \times 10^6$ cells/ μ l, 18.75 ± 1.32 g/dl, $46.00 \pm 3.59\%$, 173.51 ± 38.52 fl, 70.73 ± 15.42 g/dl, 40.82 ± 1.65 pg, $1.49 \pm 0.66 \times 10^4$ cells/ μ l, $89.70 \pm 6.40\%$, $8.50 \pm 6.34\%$, $0.50 \pm 0.97\%$, $0.90 \pm 1.29\%$, $0.30 \pm 0.95\%$, $16.2 \pm 0.49 \times 10^3$ cells/ μ l ตามลำดับ ค่าซีรั่มกลูโคส ค่าซีรั่มคลีเอตินิก ค่าซีรั่ม glutamic oxaloacetic transaminase และ glutamic pyruvic transaminase ของนกช้อนหอยขาวมีค่าเท่ากับ 12.55 ± 1.90 mmol/dl, 69.95 ± 13.05 mmol/l, 204.82 ± 56.76 IU/L and 30.43 ± 8.66 IU/L ตามลำดับ นอกจากนี้ค่าทางโลหิตวิทยาและชีวเคมีโลหิตระหว่างเพศผู้และเพศเมียของนกช้อนหอยขาวไม่แตกต่างกันทางสถิติ ($P > 0.05$)

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White ibis (*Threskiornis melanocephalus*) is a large, white bird (Lekagul and Crownin, 1974), standing at approximately 76 cm high with a naked head, and long curved black bill. They are found all over the countryside, especially on river sand bars, rice fields and marshes (Lekagul, 1971). Immature birds have mottled heads with brown and conspicuous red patches under their wings (Lekagul and Crownin, 1974). Male and female birds are visually identical. These birds are found in the Republic of China, Taiwan, India, Japan and Southeast Asia. These birds are classified as order Ciconiiformes, in the Family Threskiornithidae (Lekagul and Crownin, 1974; Pettingill, 1956).

At present, white ibises are rare species in Thailand and endangered in other tropical countries. Hematological values are important for clinical pathological diagnosis such as traumatic injury,

parasitism, organic disease, bacterial septicemia and nutritional deficiencies. Besides, treatment of abnormalities in these birds requires biochemical changes, because clinical signs and symptoms in these birds are frequently subtle (Polo *et al.*, 1998). Therefore, the objective of this study is to establish their hematological and serum biochemical values which will be used for clinical pathological diagnosis and other studies.

Materials and Methods

Birds: Ten healthy white ibis (male, n=5; female, n=5), at the age of 4 years, which had been caged at Khao Koew Open Zoo, Chon Buri, Thailand, were separated from the unhealthy ones, and then taken for the study. The wild birds were fed on a commercial diet with a supplement of chopped

frogs or fishes. Blood samples were collected from jugular vein using a 3-ml syringe, 23-gauge needle 1.5 inch in length, then placed in glass tubes with and without EDTA for determining hematological values and other serum biochemical values (Ritchie *et al.*, 1994), respectively. The samples were cooled to approximately 4°C, using icepacks and transferred to the laboratory within 12 hours after blood collection.

Hematological techniques: Differential white blood cell count (WBC) counts were performed on blood films prepared, fixed in 95% ethyl alcohol for 5 min. and then were stained with Giemsa-Wright's Solution. Total red blood cell (TRBC) and TWBC were determined by manual method using hemocytometer (Campbell, 1995), packed cell volume (PCV) was investigated by standard manual technique using micro-hematocrit capillary tubes and centrifuged 2500 rpm for 5 min. Hemoglobin concentration (Hb) was measured by the cyanmethemoglobin method (Ritchie *et al.*, 1994) then mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated (Campbell, 1995).

Serum biochemistry determination: The samples without anticoagulant were allowed to clot at approximately 25°C for 1.5 hours prior to centrifugation at 3000 × g for 10 min.. The serum was separated and transferred into 1-ml cryogenic vials and stored at -20°C until tested Serum glucose, serum creatinine, serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT) were analyzed using the enzymatic method, Jaff's reaction (Settasatian and Teerajettakul, 1992) and Reitman and Frankel method (Department of Physiology, 2000) (Biotech reagent[®]), respectively.

Statistical analysis: The results were given as mean ± SD, hematological and blood biochemistry values between males and females were compared by t-test (Daungjinda, 2001) using SAS system (SAS, 1990) and a level of significance set at P<0.05.

Results

The hematological values of ten healthy white ibis i.e. TRBC, Hb, PCV, MCV, MCH, MCHC, TWBC, percentage of lymphocyte, percentage of heterophil, percentage of monocyte, percentage of eosinophil, percentage of basophil, thrombocyte of white ibis, at the age of 4 years which had been caged at Khao Koew Open Zoo, Chonburi, Thailand were 2.78±0.70 × 10⁶ cells/μl, 18.75±1.32 g/dl, 46.00±3.59 %, 173.51±38.52 fl, 70.73±15.42 g/dl, 40.82±1.65 pg, 1.49±0.66 × 10⁴ cells/μl, 89.70±6.40%, 8.50±6.34%, 0.50±0.97%, 0.90±1.29%, 0.30±0.95% and 16.2±0.49 × 10³ cells/μl, respectively. Serum glucose, serum creatinine, SGOT, and SGPT of white ibises were 12.55±1.90 mmol/dl, 69.95±13.05 mmol/l, 204.82±56.76 IU/L and 30.43±8.66 IU/L, respectively.

Discussion

Ritchie *et al.* (1994) reported that a TWBC of birds greater than 10,000 cells/μl was considered suggestive of leukocytosis, whereas Campbell (1995) suggested that a TWBC of birds greater than 15,000 cells/μl was suggestive of a leukocytosis in tame birds. TWBC greater than 25,000 cells/μl is suggestive of a leukocytosis in birds not accustomed to handling (such as wild birds), owing to physiologic leukocytosis associated with the release of catecholamines and corticosteroids, which was in accordance with white ibis (14.9±0.66 × 10³ cell/μl) of this study that were reared at Khaw Khoew Open Zoo. Whereas, the normal value of TWBC of green winged macaw (16.9±8.9 × 10³ cell/μl), blue and yellow macaw (16.6±9.0 × 10³ cell/μl), herring gulls (15.5±3.1 × 10³ cell/μl) and great blacked gull (15.7±2.8 × 10³ cell/μl) as reported by Polo *et al.* (1998), Averbek (1992) and Lavin *et al.* (1992) were higher, the TWBC of white cockatoo (6.7±7.5 × 10³ cell/μl), yellow amazon (4.2±1.9 × 10³ cell/μl), blue fronted amazon (6.5±2.4 × 10³ cell/μl), orange winged amazon (6.1±3.8 × 10³ cell/μl) that were reported by Polo *et al.* (1998) were lower than 10,000 cells/μl.

Table 1. Hematological and serum biochemical values of white ibis.
(*Threskiornis melanocephalus*)

Values	Males (n=5)	Females (n=5)	Total (n=10)	Range (mean±SD)
Hematology				
Erythrocyte (10^6 cells/ μ l)	2.54±0.71	3.02±0.67	2.78±0.70	2.08 - 3.48
Hemoglobin (g/dl)	19.08±1.65	18.42±0.95	18.75±1.32	17.43 - 20.07
PCV (%)	47.20±4.02	44.80±3.03	46.60±3.59	43.01 - 85.12
MCV (fl)	194.06±39.12	152.96±27.42	173.51±38.52	134.99 - 212.03
MCH (g/dl)	78.52±16.11	62.94±11.12	70.73±15.42	55.31 - 86.15
MCHC (pg)	40.46±1.61	41.18±1.79	40.82±1.65	39.17 - 42.47
White blood cell (10^3 cells/ μ l)	13.5±0.72	16.2±0.66	14.9±0.66	8.30 - 21.50
Lymphocyte (%)	89.00±7.87	90.40±5.37	89.70±6.40	83.33 - 96.10
Heterophil (%)	10.0±8.03	7.00±4.52	8.50±6.34	2.16 - 14.84
Monocyte (%)	0.80±1.30	0.20±0.44	0.50±0.97	0.00 - 1.47
Eosinophil (%)	0.20±0.44	1.60±1.52	0.90±1.29	0.00 - 2.19
Basophil (%)	0.00±0.00	6.00±1.34	0.30±.95	0.00 - 1.25
Thrombocyte (10^4 cells/ μ l)	1.64±0.45	1.60±0.58	1.62±0.49	1.13 - 2.11
Blood biochemistry				
Glucose (mmol/l)	13.32±0.22	11.77±1.76	12.55±1.90	10.64 - 14.45
Creatinine (mmol/l)	74.26±7.91	63.65±15.81	69.95±13.05	56.90 - 83.00
SGOT (IU/L)	209.94±77.15	199.70±35.07	204.82±56.76	148.06 - 261.58
SGPT (IU/L)	31.72±12.32	29.14±3.60	30.43±8.66	21.77 - 39.09

Therefore, the TWBC of white ibis which was higher than 10,000 cells/ μ l might be cause by breed or above reason.

Normally, differential WBC is sensitive to physiological changes and health status in animals (Ritchie *et al.*, 1994). In the present study, differential WBC of white ibis such as monocyte, eosinophil, and basophil had high standard deviation. This phenomenon could be found in the reference values of many captive Psittacine birds such as yellow amazon (monocyte = 1.9±2.7%; eosinophil = 0.2±0.4%; basophil = 0.2±0.4%) and herring gull (monocyte = 1.3±1.4%; eosinophil = 0.9±2.0%; basophil = 2.0±0.8%) as reported by Polo *et al.* (1998) and Averbek (1992).

Generally, glucose is continuously required as an energy source by all body cells and must be maintained at adequate levels in plasma. Glucose levels are maintained principally through the conversion of liver glycogen, with some being derived from non-carbohydrate source (hepatic gluco-

neogenesis). Increases in plasma glucose levels may be due to increased glucose production or release. An abnormality can occur when high levels of glucose occur in blood and this is called diabetes mellitus (Ritchie *et al.*, 1994). Glucose value of white ibis (12.55±1.90 mmol/l) was not different from the normal range of ostriches (13.60±2.78; 9.49-23.31 mmol/l) (Levi *et al.*, 1989; Eboh *et al.*, 1992) and african gray parrot (13.8±1.4; 10.4-17.51 mmol/l) (Lumeij and Overduin, 1990).

Creatinine is derived mainly from the catabolism of creatine found in muscle tissue and its catabolism to creatinine occurs at a steady rate. Severe kidney damage can lead to increased creatinine levels (Ritchie *et al.*, 1994). Creatinine value of white ibis (69.95±13.05 mmol/l) in this study was higher than the normal range of ostriches (35.36±8.84; 17.68-56.58 mmol/l) (Levi *et al.*, 1989), and blue and yellow macaw (49.1±15.1; 26.1-76.8 mmol/l) (Hochleithner, 1989). The higher level of creatinine in white ibis might be caused by

breed, because creatinine production is relatively constant and is minimally affected by catabolism of dietary or tissue protein (Ritchie *et al.*, 1994).

SGOT and SGPT are the two enzymes of greatest clinical importance. SGOT is used to evaluate activity of liver or muscle damage while SGPT was used for evaluation of cell damage (Ritchie *et al.*, 1994). In the present study, SGOT of white ibis (204.82 ± 56.76 IU) was higher than the normal range of emu (104 ± 24.0 ; 78-182 IU) (Eboh *et al.*, 1992) gray parrot (99.3 ± 40.5 ; 39.1-144 IU) and military macaws (97.0 ± 65.5 ; 37.3-22.8 IU) (Levi *et al.*, 1989). While SGPT of white ibis (30.43 ± 8.66 IU) was higher than the normal range of captive psittacine birds such as gray parrot (10.5 ± 3.5 ; 5.4-17.0 IU) (Polo *et al.*, 1998), ostriches (20.0 ± 14.0 ; 3.0-75.0 IU) (Levi *et al.*, 1989), and emu (15.4 ± 4.3 ; 7.1-25.9 IU) (Eboh *et al.*, 1992). The higher level of both SGOT and SGPT in this study might be due to the white ibis food (frog or fish) because both SGOT and SGPT belong to a group of enzymes that catalyze inter-conversion of amino acids and oxoacids by the transfer of amino groups in the liver (Kuchel and Ralston, 1988).

The above documentation indicates that hematological and biochemical values of white ibis are partly the same and partly different from other avian species. Therefore, it is important to investigate hematological and blood biochemical values of each species in order to interpret the results accurately for a particular individual (Polo *et al.*, 1998). Besides, veterinarians must be careful when using these values because of the limitation of this study due to a small number of birds used as subjects. Finally, this is the first report of hematological and serum biochemical values of white ibis in Thailand.

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