



**International Journal of Biology, Pharmacy
and Allied Sciences (IJBPAS)**

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

**PHYSIOLOGICAL STUDY ON SOME BIOCHEMICAL PARAMETERS IN TWO
TYPES OF BIRDS**

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ABSTRACT

The present study investigate the effect of running or flying stress on kidney functions, serum total protein , albumin level and glycogen content in liver and muscle tissues on two types of birds (chickens and cattle egrets). Serum urea, creatinine level revealed a significant increase in stressed groups of cattle egret birds. Also asinificant increase in serum uric acid and total protein level in stressed groups of chickens. While insignificant increase in albumin level was recorded in stressed groups in chickens and cattle egrets .on the other hand a significant decrease was showed in glycogen content in liver and muscle tissues in stressed groups of chickens and cattle egret birds.

Keywords: Birds, Chickens, Cattle Egret Kidney Function, Total Protein, Albumin and Glycogen

INTRODUCTION

Birds transport may be associated with a number of different stressors, such as catching, handling, loading, motion, acceleration, impact, withdrawal of water, fasting, restriction of behavior, extremes of temperature and noise, and is known to cause a significant behavioral and physiologic response in various species of animals [1].

Flying is an energy demanding activity that imposes several physiological challenges on birds, such as increase in energy expenditure. Evidence from sports medicine shows that exhausting exercise may cause oxidative stress [2]. Stress can be described as any change in the environment that create a reaction of the hypothalamic pituitary adrenal

axis and the resulting endocrine, immune, and behavioral changes that accompany this response. The stress response has strong individual variation, and the genes responsible for these differences are being investigated [3].

Cattle Egret (*Bubulcus ibis*) has a worldwide distribution. Cattle Egrets are often found associated with cattle and occasionally with pigs, goats, and horses, and also with moving vehicles such as tractors. The birds appear to exploit their beating effect whereby insects and other prey are disturbed by the larger animal and hence are easier to detect and capture. The most preferable habitats were as the following, Grass fields followed by shallow water were the most frequently used habitats throughout the season [4].

Urea concentration rises during periods of fast as a consequence of the use of body proteins as an energy source [5, 6].

Alonso-Alvarez, et al., 2002, [7], found higher level of uric acid and urea in the yellow legged gullus (western pigeon) and concluded that, uric acid and urea levels are correlated to body condition (resting or flying) and could be also resulted from change in diet composition.

Artacho et al., 2007, [8], reported that, elevation of uric acid in birds is as indicator of exercise and reflecting the breakdown of

body protein, it may also increased due to protein catabolism from the nutritional protein.

Bowerman et al., 2000, [9], found higher total protein and uric acid levels in bald eagles (*Haliaeetus leucocephalus*) in comparison with non flying birds.

Dutton et al., 2002, [10], recorded higher total protein, albumin and lactate dehydrogenase levels in bald ibis from birecik zoo and lower uric acid value than jersey zoo. Glycogen plays a major role in supporting the energy demands of skeletal muscles during high intensity exercise. Despite its importance, the amount of glycogen stored in skeletal muscles is so small that a large fraction of it can be depleted in response to a single bout of high intensity exercise. In the absence of food intake, skeletal muscles have the capacity to replenish some of their glycogen. Muscle glycogen stores are replenished in type two a & b fibers while being broken down in type one fibers of active muscles. The ability of type two fibers to replenish their glycogen stores during exercise is considered to be an advantage in maintaining adequate muscle glycogen in these fibers which play a major role in fight or flight responses [11].

Small amount of body glycogen is stored in skeletal muscles and liver, [12]. Half of these

stores can be depleted within a few minutes of a maximal sprint effort [13].

MATERIALS AND METHODS

Experimental Design

Twenty non flying and flying, birds Chickens (*Gallus domesticus*) average weight (480-550 g) and Cattle egrets (*Bubulcus ibis*) average weight (480-520 g) were collected from Abou Rwash area. Then it has transferred to the laboratory of the animal house of Zoology department, science faculty, Al-Azhar university in Cairo, all birds are kept in captivity for seven days after collection with free access to food. For all flying birds, the stress or the exercise was flying for 30 minutes continuously in the laboratory while for non flying birds, the exercise was running for the same time period.

Twenty non flying and flying, birds (chickens and cattle egrets)

are classified into four groups:

- 1) The first group: non stressed chickens (non flying birds).
- 2) The second group: stressed chickens
- 3) The third group: non stressed cattle egrets (flying birds).
- 4) The fourth group: stressed cattle egrets.

Blood samples were collected from the jugular vein of the birds, serum was separated at 3,000 r.p.m. for 15 minutes. To estimate

biochemical parameters. Tissues samples from liver and pectoral muscle were fixed in a buffer solution for glycogen estimation.

Biochemical Analysis

Urea enzymatic was measured according to the method of [14] using bioadwic kits. Colorimetric determination of serum uric acid was determined by the method of [15] using bioadwic kits. Serum creatinine level was measured by the method of [16] using bioadwic kits. Colorimetric determination of serum total protein was calculated by the method of [17] using bioadwic kits. Serum albumin level was determined by the method of [18]. Tissues samples were taken from the liver and pectoral muscle of the birds. Specimens for light microscopic studies were prepared according to [19]. Glycogen content was estimated by using image pro program and this program depends on determination the quantity by measuring the color intensity.

Statistical Analysis

Statistical analysis of the obtained data was done according to [20] using T – test value.

RESULTS

Data in **Table 1**, showed that, means of serum urea and uric acid and creatinine level in non stressed and stressed groups of non flying and flying birds . Statistical analysis clarified that, a significant increase ($p>0.01$) in serum urea and creatinine level in stressed group of

flying birds (cattle egret), while insignificant difference was shown in stressed groups of nonflying (chicken) when compared with the control groups. Serum uric acid level revealed insignificant increase ($p > 0.01$) in stressed group of chicken birds but insignificant increase in cattle egret birds in comparison with the control.

It is clear from **Table 2**, that, means level of serum total protein and albumin level in non stressed and stressed groups of non flying and flying birds. Statistical results recorded insignificant increase in serum total protein and albumin level in stressed groups of non flying and flying birds (Chickens and Cattle egrets), except stressed group of nonflying birds (Chickens) showed insignificant increase ($p > 0.05$) in serum total protein level when compared with the non stressed groups.

Presented data in **Table 3** showed that, means level of glycogen content in liver and muscle tissues in non stressed and stressed groups of non flying and flying birds. From our statistical results insignificant decrease ($p > 0.01$) was recorded in glycogen content in liver and muscle tissues in stressed groups of non flying and flying birds (Chickens and Cattle egrets), when compared with the control groups.

DISCUSSION

Creatinine and urea levels increased significantly in flying birds in comparison with non flying. While uric acid was insignificantly higher in flying birds when compared with non flying. Increased plasma creatinine in the stressed groups might be a result of increased phosphorylation of creatinine in muscles under the influence of creatine kinase to phosphocreatine which was subsequently and spontaneously converted to creatinine.

In the present study, serum urea level in cattle egret was significantly higher than in chicken and this may be due to the food for each one. Cattle egret was feeding on fishes (rich with protein) while for chicken it was feeding on grains. High blood levels of urea were also found in raptors, probably as a result of their protein-rich carnivorous diet [21-22].

Ferrer et al., 1987, [23], found high plasma levels of urea in raptors after a long flight, may be due to an increased exploitation of body protein as an energy source.

High plasma concentrations of uric acid and urea in birds may also result from dehydration or heat exposure [24-25].

In birds, high levels of uric acid may indicate a rich protein diet or dehydration [26] and low levels can indicate short-term food stress [27]. **Alonso-Alvarez, et al., 2002, [7]**, recorded higher level of uric acid and urea in the yellow legged gullus (western pigeon) and concluded that, increase in uric acid and urea levels resulted from change in diet composition. Also Increase in plasma levels of uric acid and urea may reflect mobilization of protein reserves during long term food-shortage periods in birds

Furthermore, the level of urea after exercise was significantly higher than in resting state. This is because rate of urea re-absorption is dependent on a person's state of hydration. Dehydration during exercise causes renal vasoconstriction and redistribution of blood such that there is a decrease in glomerular filtration rate with resultant decrease in urine flow and thereby, causing increased passive tubular re-absorption of urea [28].

Serum total protein and albumin levels were insignificantly higher in non flying and flying birds when compared with the control. This may be due to food intake because cattle egret

as mentioned before was feeding on fishes which will increase total protein level.

In agreement with [29] who reported that, high level of albumin were found in the House Sparrow (*Passer domesticus*) reflecting the higher fat and protein contents of their urban diet. Blood protein concentration is known to be affected by nutrition [23-30] concluded that, elevation of total protein level in flying red knot probably reflect mobilization of stored proteins during flight.

Glycogen content was significantly higher in liver and muscle tissues in flying bird incomparison with non flying. Higher glycogen level in flying bird is due to flight process to afford enough energy for flying. Glycogen content decreased after exercise normally because glycogen is the fuel of muscle during intense physical activity [31].

After exercise, muscle glycogen level has decreased and ingestion of simple carbohydrates immediately following exercise can create an immediate anabolic rebound, stimulating the production of insulin which in turn will increase the absorption of glucose back into the muscle [32].

Table 1: Mean values of Serum Creatinine, Urea and Uric Acid Levels in Stressed and Non Stressed Birds, Chickens (*Gallus gallus domesticus*) and Cattle egrets (*Bubulcus ibis*)

Groups Parameters		Birds			
		Chickens		Cattle Egrets	
		Non stressed	Stressed	Non stressed	Stressed
Urea, mg/dl	Mean±SD	3.62	3.44	3.48	4.72
	Prob.	0.43	0.50	0.41	0.51
		–	N.S	–	P< 0.01
Uric acid, mg/dl	Mean±SD	3.98	5.60	5.00	5.84
	Prob.	0.19	0.93	0.57	0.84
		–	P< 0.01	–	N.S
Creatinine, mg/dl	Mean±SD	0.42	0.52	0.60	1.14
	Prob.	0.08	0.08	0.07	0.17
		–	N.S	–	P< 0.01

NOTE: Non stressed = Control; SD = Standard deviation; Prob. = Probability; N.S. = Non significant; P < 0.01= Highly Significant (**)

Table 2: Mean Values of Serum Total Protein and Albumin Levels in Stressed and Non Stressed Birds, Chickens (*Gallus gallus domesticus*) and Cattle egrets (*Bubulcus ibis*)

Groups Parameters		Birds			
		Chickens		Cattle Egrets	
		Non stressed	Stressed	Non stressed	Stressed
Total Protein, g/dl	Mean±SD	2.08	3.02	2.72	2.92
	Prob.	0.62	0.48	0.50	0.52
		–	P< 0.05	–	N.S
Albumin, g/dl	Mean±SD	0.94	1.26	0.88	1.18
	Prob.	0.26	0.18	0.11	0.31
		–	N.S	–	N.S

NOTE: Non Stressed = Control; SD = Standard Deviation; Prob. = Probability; N.S. = Non Significant P < 0.05 = Significant (*)

Table 3: Means Values of Glycogen Content (Pixel) in Liver and Muscle Tissues of Stressed and Non Stressed Birds, Chickens (*Gallus gallus domesticus*) and Cattle egrets (*Bubulcus ibis*).

Groups Organs		Birds			
		Chickens		Cattle Egrets	
		Non Stressed	Stressed	Non stressed	Stressed
Liver	Mean±SD	245.80	231.60	252.00	240.00
	Prob.	3.49	2.37	1.94	4.27
		–	P< 0.01	–	P< 0.01
Muscle	Mean±SD	245.70	222.60	250.10	239.00
	Prob.	2.91	4.53	1.45	3.37
		–	P< 0.01	–	P< 0.01

NOTE: Non Stressed = Control; SD = Standard Deviation; Prob. = Probability; P < 0.01= Highly Significant (**)

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