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INFLUENCE OF SUNLIGHT EXPOSURE ON TOTAL SERUM CALCIUM AND INORGANIC PHOSPHATE LEVEL IN BANK MYNA, *ACRIDOTHERES GINGINIANUS* (LATHAM)

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ABSTRACT

In birds, sunlight exposure to non-feathered skin areas including the leg helps in synthesis of vitamin D_3 and thus calcium regulation. Gradual rise in total serum calcium had been recorded in Bank Myna in response to increasing duration of sunlight exposure with a maximum of 15.13$\pm$ 0.146mg/dl in June. Incongruously, the experimental Bank Myna without direct sunlight exposure did not displayed marked rise in serum calcium level. In Bank Myna with natural day length sunlight exposure, higher values of serum Pi had been recorded in breeding peak (June).

Keywords: Serum Calcium, Serum inorganic phosphate, Bank Myna, Sunlight exposure, Vitamin D_3

INTRODUCTION

Avian seasonal breeders remain reproductively active mostly for a shorter duration. Dawson *et. al.* (2001) suggested that in most non-tropical avian species increasing photoperiod is the predominant factor that stimulates secretion of gonadotropin releasing hormone and consequent gonadal maturation. El-Ghalid (2009) mentioned that gonadal steroids largely affect the serum calcium level in birds. Dhondt and Hochachka (2001) suggested that certain *Passerine* birds acquire calcium shortly before and during laying by extraneous calcium and do not store calcium for egg production.

On the other hand, it is well established that fowl can use UV absorbed by the head and legs to improve their vitamin D and calcium status and egg production (Bjorn, 2015). Sunlight influences conversion of provitamin D_3 ultimately to vitamin D_3 in featherless skin parts of birds (St. Lezin, 1983). Bank myna *(Acridotheres ginginianus)* is one of the commonest wild seasonal breeding *Passerine* birds of North and Central Planes of India (Bose and Das, 2012, 2015; Bose and Singh, 2016). The bird show seasonal changes in total serum calcium (Ca) and inorganic phosphate (Pi) levels. The bird mainly feeds upon kitchen scraps, dumped refuses of food and insects but not known to rely on extraneous calcium source (Bose and Das, 2012). In the present study, an effort has been made to compare the total serum calcium (Ca) and inorganic phosphate (Pi) levels of Bank Myna with that of two different groups of experimental Bank Myna.

MATERIAL AND METHOD

Adult Bank Myna (Weight 55-65 g) were locally captured (with the help of a bird catcher) in urban Sultanpur (Awadh, UP) in the last week of December. In all, 40 birds are acclimatized to laboratory conditions for 10 days. During the period, the birds in cages were hanged on a balcony hook in a way that the birds got day long natural sunlight exposure. They were maintained on gram flour (*Besan*) pellet and tap water.

On the first week of January, the acclimatized birds were divided into two groups.

Group-I: 20 birds in a cage hanged inside balcony in a way that they do not get direct sunlight exposure. However, they can perceive the day length (Natural Photoperiod) only by seeing.

Group-II: 20 birds in a cage hanged on balcony hook with day long natural sunlight exposure. Group I and II birds were fed with gram flour (*Besan*) pellet and tap water.

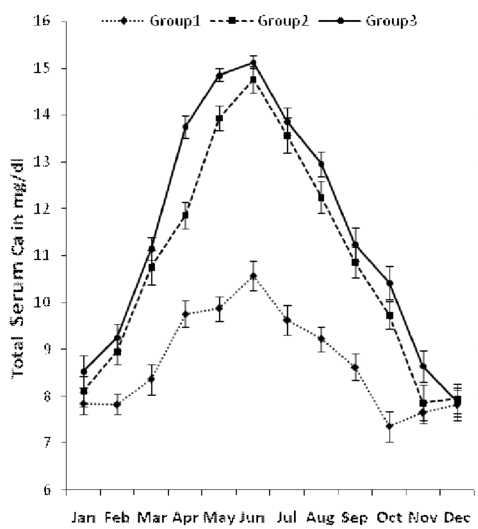
Group-III: In the mid of every month 6-adult wild Bank Myna of both the sexes were locally captured for blood sample collection. The birds were freed near their habitat after sampling.

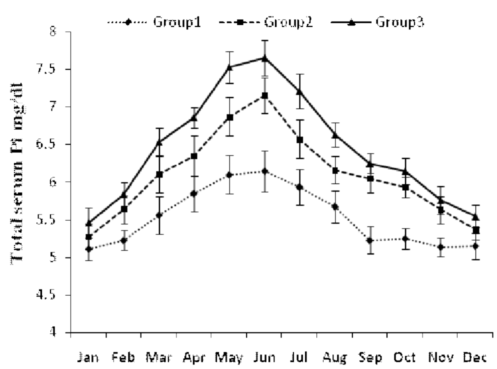
From each group, 6-birds were taken in account in the mid of every month. 0.5ml of blood sample was collected from a wing (Brachial) vein of each bird under ether anesthesia. Sterilized disposable PVC syringes with 30G 5/16 (0.30 × 8 mm) needles were used for them. The syringes with blood samples were kept vertically up for 4h that allowed the coagulated part to settle down, while serum separated above it. Apical part of syringe was then cut with a sterilized sharp blade and serum was taken up for estimation by micropipette. Total serum calcium (Ca) level was estimated by the method described by Moorehead and Biggs (1974) and total serum inorganic phosphate (Pi) was estimated by the method of Daly and Ertingshausen (1972), on Erba Chem-5 plus V2 semi Automatic Photometer using Erba Ca and Pi kits. Student's t-test was used to determine the level of significance for serum Ca and Pi levels.

OBSERVATIONS

Month	Group-I		Group-II		Group-III	
	Total serum Ca mg/dl	Total serum Pi mg/dl	Total serum Ca mg/dl	Total serum Pi mg/dl	Total serum Ca mg/dl	Total serum Pi mg/dl
January	7.85 ±0.236	5.11 ±0.146	8.11 ±0.328	5.20 ±0.164	8.53 ±0.315	5.46 ±0.196
February	7.83 ±0.215	5.23 ±0.136	8.95 ±0.275	5.64 ±0.187	9.26 ±0.275	5.84 ±0.155
March	8.36 ±0.317	5.56 ±0.252	10.75 ±0.367	6.11 ±0.215	11.15 ±0.246	6.53 ±0.184
April	9.76 ±0.281	5.85 ±0.236	11.87 ±0.283	6.35 ±0.263	13.75 ±0.236**a**	6.86 ±0.139
May	9.87 ±0.255	6.10 ±0.258	13.93 ±0.265**a**	6.87 ±0.255	14.85 ±0.137**b**	7.53±0.215**a**
June	10.58 ±0.315	6.15 ±0.276	14.76 ±0.283**b**	7.15 ±0.230**a**	15.13 ±0.146**b**	7.65 ±0.236**b**
July	9.63 ±0.321	5.93 ±0.236	13.57 ±0.369**a**	6.57 ±0.255	13.86 ±0.297**a**	7.21 ±0.230**a**
August	9.22 ±0.263	5.67 ±0.210	12.24 ±0.335	6.16 ±0.182	12.95 ±0.261	6.63 ±0.163
September	8.63 ±0.276	5.23 ±0.175	10.86 ±0.326	6.05 ±0.185	11.24 ±0.356	6.25 ±0.133
October	7.36 ±0.324	5.25 ±0.136	9.73 ±0.287	5.93 ±0.136	10.42 ±0.362	6.15 ±0.173
November	7.65 ±0.224	5.14 ±0.122	7.86 ±0.373	5.63 ±0.176	8.65 ±0.335	5.76 ±0.187
December	7.82 ±0.326	5.15 ±0.175	7.95 ±0.315	5.37 ±0.132	7.88 ±0.298	5.55 ±0.146

Values represented are ± SE of 6 determinations; a=$P<0.05$; b= $P< 0.001$





DISCUSSION

Bakhiet et. al., (2006) reported total plasma Ca of young Sudanese Geese with 7.73+0.11 mg/dl and adult Sudanese Geese with 8.16+0.12mg/dl. This is in consonance with results obtained in non-breeding wild Bank Myna. During the entire non-breeding period and more prominently in winter the total serum Ca level of wild Bank Myna ranged between 7.88+0.298mg/dl to 8.65+0.335mg/dl. However, higher values had been documented by Dhande et. al., (2006) in non-breeding Grey Quail. They reported 9.46+0.15mg/dl to 11.78+0.15mg/dl in female and 8.50+0.11mg/dl to 11.22+0.08mg/dl in male. The total serum Ca level of Group-I and Group-II experimental Bank Myna remain very close to the values of wild Bank Myna during entire non-breeding season. Insignificant low values had been recorded in experimental birds.

With the advent of summer (in March) and increasing sunlight exposure, wild Bank Myna showed a marked rise in serum Ca level and attained a peak level of 15.13+ 0.146 mg/dl in June (the laying period). Tian et. al. (1994) mentioned that in birds the concentration of 7-dehydrocholesterol is 10-fold higher in non-feathered skin areas including the legs, with response to sunlight exposure. St. Lezin (1983) explained that upon exposure of sunlight, the pro-vitamin D_3 in the skin on the legs of bird is converted to pre-vitamin D_3 which in turn is thermally converted to vitamin D_3 to provide an adequate source of this essential vitamin for calcium and bone metabolism. The Group-II experimental Bank Myna with natural sunlight exposure also displayed gradual rise in serum Ca level from March (10.75+0.367 mg/dl) to June (14.76+0.283 mg/dl). The values recorded in each month closely followed the values of serum Ca level of wild Bank Myna. However, the values remain insignificantly low in every month. Probable reason for the same could be the difference in diet of both groups. Wild Bank Myna mainly feed upon kitchen scrap (Bose and Das, 2012) that contain oil with fat soluble vitamins.

Incongruously, with the advent of summer/ breeding season the Group-I experimental Bank Myna without direct sunlight exposure did not displayed marked rise in serum Ca. Moreover, the highest values 10.58+0.315mg/dl recorded in June (the breeding peak) is low, when compared with Group-II and Group-III birds. This justifies the importance of sunlight exposure on serum Ca regulation. However, the rise from least in Nov.7.65+ 0.224mg/dl to following June (10.58+0.315mg/dl) get support from studies of Dawson et. al.(2001). They suggested that in seasonal breeding birds increasing photoperiod is the predominant factor which stimulates secretion of gonadotropin releasing hormone and gonadal steroids largely affect the serum Ca level in birds (El-Ghalid, 2009).

The serum Pi level of wild Bank Myna in non breeding winter season ranged from 5.46$\pm$ 0.196mg/dl to 5.8$\pm$0.155mg/dl is in agreement with results obtained by Dhande et. al. (2006) in non breeding Grey Quail. Male Grey Quail with serum Pi of 5.62$\pm$ 0.120mg/dl and female with 6.52$\pm$ 0.210mg/dl was recorded. In non breeding season Group-I and Group-II experimental Bank Myna displayed serum Pi values close to that of wild Bank Myna. Dhande et. al. (2006) observed higher values of serum Pi in breeding Grey Quail (8.64$\pm$0.22mg/dl). Significant higher values of serum Pi in wild Bank myna has also been recorded during breeding peak with 7.65$\pm$0.236mg/dl in June. Group-II experimental Bank Myna with natural sunlight exposure also displayed higher values of serum Pi in June (7.15$\pm$230mg/dl). Rise in serum Pi level in the birds during breeding season can be attributed to the bone resorption activity influenced by parathyroid hormone (Taylor, 1970) and estrogen (Wilson and Thorp, 1998).

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