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Research Article

Effect of Short, Long and Intermittent Photoperiods on Body Weight and Lipid Response in Male and Female Redheaded Bunting, *Emberiza bruniceps*

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Abstract: Body weight and lipid response is studied under artificial photoperiods of 24 hrs and other than 24 hrs. The body weight and lipid profile indicated a close similarity in magnitude and pattern under different photoperiods, The light and dark periods consisting of a total 24 hr divided on 03 hr light and 21hr dark (3L:21D), 6L:18D, 8L:16D, 12L:12D, 16L:8D. Under intermittent photoperiods (3L:3D….,4L:4D….,6L: 6D….,and 8L:8D….) and other combinations of light-dark of 24 hrs cycles such as 12L:12D,8L:16D and 16L:8D was also used in the experiment as control. The observations made in the present investigation are in the agreement with the external coincidence.
Keywords: Short photoperiods, Long photoperiods, Intermittent photoperiods, Body weight, Lipid, Redheaded bunting.

INTRODUCTION

The photoperiodic clock free-runs in constant conditions of light (LL) or darkness (DD) with a period slightly different from 24h [1], hence organism expresses a circadian rhythm of photoperiodic photosensitivity (CRPP), and is fully entrained to precisely 24h by light –dark (LD) cycle of the environment [2].The action of light on photoperiodic clock depends where it interacts with the CRPP [3-6].

Redheaded bunting is a photoperiodic bird that follow the annual solar cycle for gonadal growth [7, 8]; under artificial day lengths, a long photoperiod (>11.5/day) stimulates body fattening, gonadal growth and development, an increase in plasma level of LH [9, 10]. In the present investigation, metabolic (body weight and lipid) response is studied under artificial photoperiods of 24 hrs and other than 24 hrs.

MATERIALS AND METHOD

This work carried out with adult male and female redheaded bunting, *Emberiza bruniceps* Family, Emberizidae, Order Passeriformes. Male Redheaded bunting is beautiful with golden brown head (above) and under part yellow but female is dull looking ashy brown head (above),buffish washed with yellow and under tail-coverts yellow.

Birds were chiefly fed with paddy grains, *Oryza sativa*, sometimes, Kakoon, *Setaria italica* and water *at libitum.*

In this experiment, birds were exposed to artificial photoperiodic treatments in light proof wooden boxes with the fluorescent rods of 20Watt, intensity of 400-500 *lux*, available at perch to floor level in the cages. 'Light On' commenced at 06 hr, in24 hr cycles, light and dark were controlled by automatic time switches.

The light and dark periods consisting of a total 24 hr divided on 03 hr light and 21hr dark(3L:21D),6L:18D,8L:16D,12L:12D,16L:8D.

3L:21D,6L:18D,8L:16D,12L:12D are called short photoperiods and 16L:8D is called long photoperiod, this is with reference to the photoperiodic threshold for induction of gonadal and body weight response in the bird [6, 7].

Besides normal short day and long day photoperiods, the birds were also exposed to certain light dark combination such as intermittent light dark schedules. It consisted of 03 hrs of light and 03 hrs of dark (3L:3D….), 4L:4D…., 6L:6D…., 8L:8D…. and 12L:12D….. .

Body weight was recorded to assess the total fat deposition (both visceral and subcutaneous); birds were

weighed on single pan mechanical balance. In all experiments initial and final body weights were recorded.

The lipid parameters were estimated by the methods described by Meier and Farner in 1964 [11].

EXPERIMENT AND RESULT:

Before placing of the birds under artificial photoperiodic conditions they have already been received the pretreatment of 8L: 16D for more than 04 weeks. This was done to ensure the photosensitivity of the birds. This treatment carried out for 30 days and minimum 05 birds (*n=5*) were maintained during the experiments.

The body weight response of male redheaded bunting indicates that the birds gained weight under 16L: 8D and the value was significantly higher (P<0.01) than other photoperiods (Table no.01) and the gain in lipid also found significantly higher. In female both body weight and lipid was significantly greater under 16L:8D(P<0.001)as compared to other photoperiod(Table no. 02).The body weight under 12L:12D was not altered from its initials in case of female but in case of males there is a little change in the body weight under 12L:12D;however the lipid response in both male and female exhibit similarity under 12L:12D and the mean value was higher than the other non stimulatory photoperiod schedules.

The study under intermittent photoperiods(3L:3D….,4L:4D….,6L:6D….,and8L:8D ….) and other combinations of light-dark of 24 hrs cycles such as 12L:12D,8L:16D and 16L:8D was also used in the experiment as control.

The body weight and lipid was recorded under each photoperiodic schedule. All photoperiodic treatments are given for 30 days and minimum five birds (n=5) were maintained in the experiment.

The body weight in both males and females was found increase under intermittent photoperiods and 16L: 8D. A significant increase(P<0.01) in the body weight of both male and female recorded under intermittent photoperiods and 16L:8D when compared with12L:12D,8L:16D (Table 3, 4).The lipid response in both male and female was also significantly (P<0.001)higher under intermittent photoperiod an 16L:8D,when compared with 12L:12D,8L:16D and initial control. The value of the body weight and lipid among intermittent photoperiod as well as under 16L: 8D did not vary significantly with each other. The body weight and lipid profile indicated a close similarity in magnitude and pattern under different photoperiods.

DISCUSSION

Observation on body weight and lipid under varying artificial photoperiods (Table 1-4) clearly demonstrate that redheaded bunting require long day of above 12hrs to induce the metabolic functions. Birds do not show the increase in body weight under 3L: 21D, 6L: 18D and 12L: 12D by the end of the experiment, but in response to 16L: 8D they exhibit fattening.

Response under artificial in this bird varies in magnitude as compared earlier reports, however the photopriodically induced fattening in the present study is similar to many migratory birds [12-14]. Observation present in table 1-4 indicated photoperiodic metabolic response of redheaded bunting under both 24 hrs. photoperiodic schedules and under intermittent photoperiods. Our reports support the photoperiodic regulation of such activities in migratory birds as described by several workers [7, 15-17]. The observations made in the present investigation are in the agreement with the external coincidence.

The intermittent photoperiodic schedules are fewer attempts in other birds. Our report suggest that the combination of short fraction of light with darkness would provide better response than a single long photoperiod (Table 13-14).The report available on the different species of birds [18-23] are in agreement with our results.

Table 1: Effect of Short and Long Photoperiods on Bodyweight and Lipid Response in Male Redheaded Bunting

Photoperiods	Initial Bodyweight (gm) [Mean ± SE]	Final Bodyweight(gm) [Mean ± SE]	Lipid (gm) [Mean ± SE]
3L:21D	22.21±0.77	22.17±0.79*	1.2±0.10
6L:18D	22.95±0.54	22.64±0.45	1.4±0.28
8L:16D	21.72±0.69	22.05±0.67	1.5±0.30
12L:12D	23.10±1.04	25.76±2.73*b	2.6±0.86
16L:8D	23.87±0.49	28.82±0.76*b	6.8±0.66*a

*: p<0.001, a: Comparison was made with the values of other photoperiods; b: Comparison was made with their own initial and with the final values of other photoperiods.

Table 2: Effect of Short and Long Photoperiods on Bodyweight and Lipid Response in Female Redheaded Bunting

Photoperiods	Initial Bodyweight (gm) [Mean ± SE]	Final Bodyweight(gm) [Mean ± SE]	Lipid (gm) [Mean ± SE]
3L:21D	21.47±0.70	21.24±0.42	1.2±0.10
6L:18D	22.63±0.51	23.89±1.17	1.4±0.28
8L:16D	23.14±0.24	24.07±0.23	1.5±0.30
12L:12D	24.13±0.29	24.41±0.61	2.4±1.26
16L:8D	24.25±0.34	29.62±1.11*a	6.8±0.86**b

*: p<0.01, **: p<0.001, a: Comparison was made with their own initial and with the final values of other photoperiods; b: Comparison was made with the values of other photoperiods.

Table 3: Effect of Intermittent Photoperiodic Treatment on Bodyweight and Lipid Response in Male Redheaded Bunting

Photoperiods	Initial Bodyweight (gm) [Mean ± SE]	Final Bodyweight(gm) [Mean ± SE]	Lipid (gm) [Mean ± SE]
3L: 3D….	22.42±0.27	27.36±0.58*	5.66±1.10**
4L: 4D….	23.24±0.24	28.26±0.56*	6.20±0.86**
6L: 6D….	22.36±0.21	28.82±0.62*	5.86±1.06**
8L: 8D….	22.06±0.24	27.62±0.46*	6.50±1.08**
12L: 12D….	23.28±0.28	24.66±0.76	2.80±0.86
8L: 16D….	22.12±0.22	23.28±0.68	1.24±0.26
16L: 8D….	22.46±0.23	29.12±0.80*	6.62±1.08**
Initial Control			1.36±0.24

*: p<0.01, Compared with their own initial and with the value of 8L: 16D and 12L: 12D; **: p<0.001, Compared with the value of short day control 8L: 16D and 12L: 12D.

Table 4: Effect of Intermittent Photoperiodic Treatment on Bodyweight and Lipid Response in Female Redheaded Bunting

Photoperiods	Initial Bodyweight (gm) [Mean ± SE]	Final Bodyweight(gm) [Mean ± SE]	Lipid (gm) [Mean ± SE]
3L: 3D….	21.87±0.29	26.49±0.39*	5.46±1.23**
4L: 4D….	23.05±0.27	27.97±0.32*	6.31±0.74**
6L: 6D….	22.41±0.21	29.13±0.23*	5.75±1.10**
8L: 8D….	22.39±0.24	26.83±0.81*	6.78±1.27**
12L: 12D….	22.51±0.22	23.79±0.56	3.11±0.79
8L: 16D….	21.98±0.23	22.87±0.67	1.63±0.21
16L: 8D….	23.13±0.21	29.43±0.62*	6.96±1.32**
Initial Control			1.42±0.62

*: p<0.01, Compared with their own initial and with the value of 8L: 16D and 12L: 12D; **: p<0.001, Compared with the value of short day control 8L: 16D and 12L: 12D.

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