



ISSN Print: 2394-7500  
ISSN Online: 2394-5869  
Impact Factor: 5.2  
IJAR 2019; 5(1): 371-373  
www.allresearchjournal.com  
Received: 16-11-2018  
Accepted: 23-12-2018

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## Effect of between cyclic changes in blood parameters and oxygen uptake in *Anabas testudineus* (Bloch)

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### Abstract

A Systematic study has been carried out to explore the cyclic changes in oxygen consumption ( $VO_2$ ) and different haematological parameters in an air breathing fish, *Anabas testudineus* (Bloch). Two peaks of activity were marked in both the parameters. A positive correlation occurs between RBC/ $VO_2$ , Hb/ $VO_2$  and PCV/ $VO_2$ , in both the sexes. The increase in  $VO_2$ , seems to be more associated with the increase in RBC counts than with the increase in Hb content and PCV. Cyclic changes in  $VO_2$ , and different blood parameters show parallelism and a physiological balance exists between these two parameters.

**Keywords:** cyclic changes and *Anabas testudineus*

### Introduction

Haematological features are widely used as effective tools to assess the stress responses in fishes. Blood is an important compound for studying the effect of toxicants as it is highly susceptible to environmental fluctuations. The blood serves to carry the oxygen from the respiratory organs to the different tissues of the body in all the vertebrates. In response to the varying metabolic requirements under the influence of environmental factors the oxygen capacity of the blood has been found to change in teleosts. Since, the blood is the carrier of respiratory gases, therefore, any change in the oxygen demand of the body will frequently alter the different Haematological parameters of the body. In the present work an attempt has been made to study the correlation, if any, between seasonal variations in blood and oxygen consumption in an air breathing fish, *Anabas testudineus* (Bloch).

### Material and Methods

Fish species were brought by giving prior order for the approximately the same weight and some size of fishes. Live specimens of *A. testudineus* were procured from the local fish dealers at Muzaffarpur in the first week of every month during the period November, 2018 to October, 2019. Prior to any experiment the fishes were acclimatized for a week in the laboratory condition where they were fed daily with the pieces of goat liver. In every mid-month the oxygen consumption ( $VO_2$ ) of 4 males and 4 females were studied separately after which they were sacrificed for the Haematological studies. The details of the methods employed in the measurement of oxygen consumption and different blood parameters were those of Tabassum and Khan (2015) <sup>[1]</sup>, and Sharma and Kumar (2013) <sup>[2]</sup>. The linear relationships between different variables were studied by the general equation  $Y = a + bX$ . Here X and Y are independent and dependent variables respectively where 'a' (intercept) and 'b' (regression coefficient) are two constants.

### Results and Discussion

Haemoglobin was determined by Sahlimethod based on the principle of making an acid haemating solution of blood in a graduated tube for comparing it with the scaled comparison tube containing the standard acid haematin. The oxygen consumption and different haematological parameters in different months of the year in both the sexes of *A. testudineus* have been summarized in Table 1, and the regression equations with correlation coefficients between the different parameters analyzed have been recorded in Table 2.

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From the study of Table 1 it seems that the  $VO_2$  in this fish showed two peaks, one in June/July and next in October.

**Table 1:** Seasonal variation in RBC counts, Hb concentration, PCV and oxygen consumption of *Anabas tetudineus* in different months of the year. N=10 (5 males + 5 females in each month)

Month	Sex	Av. wt of fish	RBC (millions) counts/mm <sup>3</sup>	Hb g%	PCV g%	VO <sub>2</sub> ml/h	CC/kg/hr VO <sub>2</sub>
Nov. 2018	M	24.05	2.74	1.11	23.7	2.2776	92.94
	F	21.3	2.68	10.6	22.6	1.753	81.96
Dec.	M	24.1	2.23	9.6	22.4	1.810	74.76
	F	23.5	2.20	9.0	21.2	1.631	69.14
Jan, 2019	M	20.4	1.33	7.1	13.6	1.462	71.41
	F	22.5	1.28	6.8	11.7	1.489	65.97
Feb.	M	20.8	1.48	7.4	14.6	1.661	79.48
	F	22.1	1.39	7.0	12.4	1.648	74.30
Mar.	M	24.1	1.52	8.3	15.0	2.011	83.12
	F	24.5	1.66	8.2	16.1	2.071	84.24
Apr.	M	24.1	2.63	12.9	30.0	2.326	96.58
	F	24.2	2.40	12.2	29.9	2.184	89.96
May	M	24.2	3.39	13.4	34.4	2.678	109.80
	F	24.6	2.23	12.6	33.2	2.506	101.16
June	M	22.6	2.15	10.4	21.1	2.868	125.87
	F	24.1	2.01	9.4	18.8	2.824	116.27
July	M	23.1	2.04	10.3	19.4	2.804	120.36
	F	24.3	2.01	9.2	19.3	2.708	110.68
Aug.	M	23.7	2.52	10.7	23.7	2.712	113.52
	F	24.1	2.62	10.1	23.8	2.531	105.07
Sep.	M	23.7	2.86	12.0	25.7	2.738	115.11
	F	24.1	2.85	12.3	25.1	2.664	110.24
Oct. 2019	M	24.1	3.53	13.6	37.1	2.828	121.07
	F	23.6	3.32	13.0	34.5	2.756	115.37

M = Males; F=Females; VO<sub>2</sub> = Oxygen consumption

**Table 2:** Correlation coefficient (c) and equation showing the relationship between blood parameters and oxygen consumption in both the sexes of *A. testudineus*

Parameters analysed	Equations	r=
RBC/Male VO <sub>2</sub>	Y = 1.1718+0.4598x	0.6202 P<0.05
RBC/Female VO <sub>2</sub>	Y= 1.2482+0.3930X	0.5122 NS
Hb/Male VO <sub>2</sub>	Y=0.4043+0.1757X	0.7329 P<0.05
Hb/Female VO <sub>2</sub>	Y=0.6920+0.1452X	0.5943 P<0.05
PCV/Male VO <sub>2</sub>	Y= 1.2596+0.0436X	0.6098 P<0.05
PCV/Female VO <sub>2</sub>	Y=1.3021+0.0387X	0.5372 P<0.05

NS = Non significant

The first peak of  $VO_2$  corresponds with the breeding period of the fish because for the act of reproduction more energy is required. The Second peak in the beginning of winter may be attributed to the period of hibernation. At this period the animal becomes active in a bid to increase their lipid content of the body (Pandey et al., 1976b) [7] which is gradually utilized throughout the entire period of hibernation. The minimum  $VO_2$  was observed in the month of January. It was interesting to note that cyclic changes in  $VO_2$  and seasonal variations in different Haematological parameters (viz., RBC counts, Hb content and PCV) showed parallelism in this animal. Though the correlations between RBC/ $VO_2$ , Hb/ $VO_2$ , were low in both the sexes but most of them were statistically significant at the level of 5% (Table 2) indicating a positive correlation between the different parameters analysed. It can be said here that the oxygen demand and changes in different blood parameters are in complete harmony, and thus there is a physiological balance between the two. Hughes (1954) [5] also showed that in

response to hypoxia oxygen carrying capacity of the blood has been increased increasing rapidly the number of erythrocytes and the concentration of haemoglobin in the blood. Prosser & Brown (1965) [4] are of the opinion that the oxygen capacity is proportional to the amount of haemoglobin or other respiratory pigments in the blood or blood cells. The properties of the haemoglobin of teleostean fishes covers enormous range in oxygen affinity and is temperature dependent. From the regression analysis of the data it seems that in this species the increase in  $VO_2$  is more associated with the increase in RBC number (b values 0.4598 for males and 0.3930 for females) than with the increase in Hb content (b = 0.1707 for males and 0.1452 for females) and PCV (b values 0.0436 and 0.0387 for males and females respectively).

### Conclusion

That a positive correlation exists between the cyclic changes in  $VO_2$  and different Haematological parameters in this fish.

Since, the fluctuations in both the parameters show parallelism, therefore, the physiological status of the animal can be assessed even by counting the number of RBC and Hb content in the blood of the animal in particular month of the year.

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