Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Special Issue [1]2022 : 1439-1444
©2022 Academy for Environment and Life Sciences, India
Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
ORIGINAL ARTICLE **OPEN ACCESS**

Seasonal Variation in Oxygen: Nitrogen Ratio of *Lamellidens Marginalis* from Bhima River at Siddhatek

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ABSTRACT
In the present work, oxygen consumption and ammonia excretion rate of bivalve mollusc Lamellidens marginalis was studied seasonally in freshwater. The rate oxygen consumption in bivalves was superior (more) in every sized group in the season of summer and also in the season of winter lower oxygen consumption rate was detected. Small sized bivalves consumed more amount of oxygen than the large sized groups of bivalve animal. The ammonia excretion was maximum in season of summer and minimum amount in monsoon season. The ammonia excretion and oxygen consumption rate in smaller size bivalve animal was elevated than large sized bivalves. Also the Oxygen: Nitrogen (O: N) ratio value (69.31) was found maximum in smaller size bivalve animals in monsoon season followed by large sized bivalves (51.72), while O: N ratio was recorded minimum in the season of winter for small sized (44.43) and large size bivalves (22.16). The small sized bivalves observed higher O: N ratio than the large sized bivalve animals. The current study shows, Oxygen: Nitrogen (O: N) ratio was used for identify stress in seasonal variation in bivalve animals on the natural population of Bhima River in Siddhatek region.
Keywords: Oxygen consumption rate, rate of ammonia excretion, O –N ratio, Lamellidens marginalis

Received 17.02.2022 Revised 19.03.2022 Accepted 21.04.2022

INTRODUCTION

The word Mollusca means 'soft' and animals are unsegmented soft body with a slimy skin and usually covered with their own secretion i.e. a hard calcareous shell. The study of molluscan animals is known as Malacology and the study of shell of mollusc is known as conchology. The bivalve animals are physiologically, physically and metabolically adapted in unfavorable condition. The scientist Stead and Thompson [1], studies on physiological and metabolic action of marine animals and this study was useful to assess adaptation mechanisms in habitat condition. The excretion, respiration and energy balance in cold blooded marine animal and their distribution are beneath the control of environmental situation was discussed by [2-4]. The scientist Jansen et al., [5] stated that the respiratory restrictions of an organism in altering environmental situations are dependable for shifting of habitat.

By scientist Peck and Conway [6] stated that, for physiological studies, the extra attention towards the Lamellibranchs species of bivalve has been studied by scientist. In filter-feeding bivalves the physiological, metabolic and energetic studies has been recorded in *Katleysia opima* [6], *Macoma balthica* and *Mytilus* spp. [7] *Pinctada spp.* [8], *Acesta spp.* [9] and *Yoldia hyperborean* [10].The excretion ammonia of helps in removal of nitrogenous waste material and preservation of useful metabolites for the maintenance, growth and reproductionin the aquatic animals. The rate of excretion of nitrogen in bivalve animals was tremendously changeable in seasonal changes in the nutritional storage and use of preserve observed [11].

Also by Heilmayer and Portner [12] stated that, the respiration and excretion rate were used to understand physiological or metabolic movement in all the animals. In bivalve animals, connection between ammonia excretion as well as body size can be changeable because of the disproportionate reliance in catabolism of protein for energy manufacture [6-9].But considering the plentiful bivalvemolluscs animals by the side of the Bhima River. Also the paucity of information on the Oxygen: Nitrogen ratio in fresh water bivalve animals, the present study was on *Lamellidens marginalis* for study purpose.

Present investigation observed that, complete information on seasonal variation in ammonia excretion, oxygen consumption and also on Oxygen: Nitrogen ratio of bivalve animal Lamellidens marginalis. The main thing of this work would help in monitor the quality ofenvironment and enchanting proper remedial control measures, where the population of bivalve animals is affected ahead of the significant condition.

MATERIAL AND METHODS

In current experimental work, collection of bivalve animal, *Lamellidens marginalis* was done from the banks of Bhima River near Siddhatek village (Maharashtra), about 90- 95 km from the Ahmednagar during the year 2014 - 2016 in different seasons of that period. The bivalve molluscs were separated into two different sized groups i.e. smaller(75-79 mm in shell length) and larger(90-96 mm in shell length). The samples of bivalve animals were collected during 3.00 pm to 7.00 pm. Then immediately after coming in laboratory, the bivalves was washed by tap water and then the bivalve shell was brushed off and then again washed by freshwater for remove the debris material like algal biomass, mud and other fungal materials. After that bivalve was divided into two sized groups i.e. smaller and larger. Then bivalve animals allowed for defaecication for about 10 – 12 hour in laboratory in continuous aeration. Every sized group contain of about 10 bivalve animals for the experimental work. Physico-chemical characters of habitat and experimental water viz. temperature, pH, dissolved oxygen and hardness were determined through whole work. The oxygen consumption was followed by the Winkler's modified method (Golterman et al., 1978) and ammonia excretion by the phenol- hypochlorite technique (Solarzano, 1969). Actually, rate of oxygen consumption in every bivalve animal were determined in the brown coloured jars with 1 liter capacity. These jars are fitted with rubber corks with an inlet and outlet of glass tubes and these are connected with a rubber tubes and iron clips. The individual bivalves were placed in single jar and steady flows of water were given through inlet to flow through outlet upto 02-03minutes for removing air bubbles from bottle. Then flows of the water were cut slowly. After completion of 1 hour, for the purpose of find out oxygen consumption, the water from brown coloured jar was tapped out in a stoppard bottle (125 ml) and also for find out ammonia excretion, 50ml of water sample was collected in Eryelene's Mayer flask. The fleshes of the each bivalve were taken out carefully from the shell. Then blotted on the filter paper for removing extra water. After that flesh were weighed to obtain the wet-weight of the single bivalve. After that, 5 individual animals of each sized group were used and then mean of triplicate of water sample was estimated for each group of bivalve. Then finally statistical analysis was done for final calculation. For finding the Oxygen: Nitrogen (O: N) ratio,the atomic equivalent values of $O_2$and N calculated by values of oxygen consumption as well as ammonia excretion rate obtained for the same individual animal [7-9]. The oxygen consumption rate was shown by mg O_2/l/h/gm and ammonia excretion rate by mg NH_3-N/l/h.

RESULTS AND DISCUSSION

In present study, physico chemical characters like the temp., pH, hardness and D.O. of habitat water and the experimental water, was determined in experimental work (Table 01). The temperature of water of collection sites was (17.8 – 20.55ºC) in winter season, (28.55-31.6) in summer season and (25.45 – 28.55ºC) on Monsoon season and also temperature of the tap water was (19.1 – 22.4ºC) on winter, (28.05-31.35) in summer and on monsoon it was (26.4 – 28.65ºC). pH was found on winter (8.01-8.24), (8.15-8.50) on summer season and on monsoon (8.45 – 8.90) in habitat water and also in tap water was (7.53 – 8.1) on winter, (6.83- 7.29) on summer and on monsoon (6.25- 6.83). The hardness of water was found on winter (95.9-104.25 ppm), (100.1-1.5.5) on summer and on monsoon (100.7-111.2 ppm), also in tap water was (304 – 310.5 ppm) on winter, (264-269.6) on summer and (359.4 – 366.3 ppm) on monsoon. The dissolved oxygen contents of the water was on winter (5.54-5.57 mg/lit/hr), (5.63-5.89 mg/lit/hr) on winter and on monsoon(6.13-6.52 mg/lit/hr) whereas in tap water was (4.29 – 4.29 mg/lit/hr) on winter, (4.82-5.03 mg/lit/hr) on summer and on monsoon (5.87– 6.07 mg/lit/hr).

Table – 01 Physico - chemical parameters of Habitat and Experimental Water

Sl.No.		Seasons	Temperature (ºC)	pH	Dissolved Oxygen (mg/l/h)	Hardness (ppm)
1	Habitat Water	Winter	17.8-20.55	8.01-8.24	5.54-5.57	95.9-104.25
		Summer	28.55-31.6	8.15-8.5	5.63-5.89	100.1-105.5
		Monsoon	25.45-28.55	8.45-8.90	6.13-6.52	100.7-111.2
2	Experimental Water	Winter	19.1-22.4	7.53-8.10	4.29-4.29	304-310.5
		Summer	25.05-31.35	6.83-7.29	4.82-5.03	264-269.6
		Monsoon	26.4-28.65	6.25-6.83	5.87-6.07	359.4-366.3

In the present work, the oxygen consumption rate in *Lamellidens marginalis* bivalve varied in body size and season. The highest rates of oxygen consumption were observed in summer and also lowest rate is in winter season for the all sized groups of animals. The oxygen consumption was moderate in monsoon season and then reduces in the winter season (Table 02, Fig. 01). Under the changeable nutritive stress and temperature, body conditions were changed and resulted in a fastly turn down in oxygen consumption. Such seasonal changeability in oxygen consumption in bivalve may be due to change in the gametogenic cycle, metabolism, use of various substrates for energy metabolism and inactive materials in mantle region and in the non-mantle tissues [10].

Table- 02 Seasonal variation in oxygen consumption rate, ammonia excretion rate and Oxygen: Nitrogen (O: N) ratio in bivalve *Lamellidens marginalis*

Season	Size of the animal (mm)	Weight of the animal (gms)	Oxygen consumption (mg/l/h/gm)	Ammonia excretion ($mgNH_3$-N/l/h)	Atomic equivalent of O_2	Atomic equivalent of N	O:Nratio
Summer	Small(76-79)	13.74	0.366 ±0.031	0.007±0.000	0.0228	0.0005	49.61±2.346
	Large(90-94)	21.34	0.257 ±0.020	0.006±0.000	0.0160	0.0004	38.89±1.666
Monsoon	Small(75-79)	11.63	0.273±0.038	0.003 ±0.000	0.0170	0.0003	69.31±6.002
	Large(90-93)	19.45	0.184 ±0.01	0.003 ±0.000	0.0115	0.0002	51.72±3.180
Winter	Small(77-79)	13.59	0.208 ±0.019	0.004 ±0.000	0.0130	0.0003	44.43±3.270
	Large(90-96)	22.51	0.139 ±0.013	0.006 ±0.000	0.0087	0.0004	22.16±1.823

Values- mean of three observations standard deviation (±S.D.)

Figure- 01 Size specific changes in the oxygen consumption rate of *Lamellidens marginalis* during different seasons

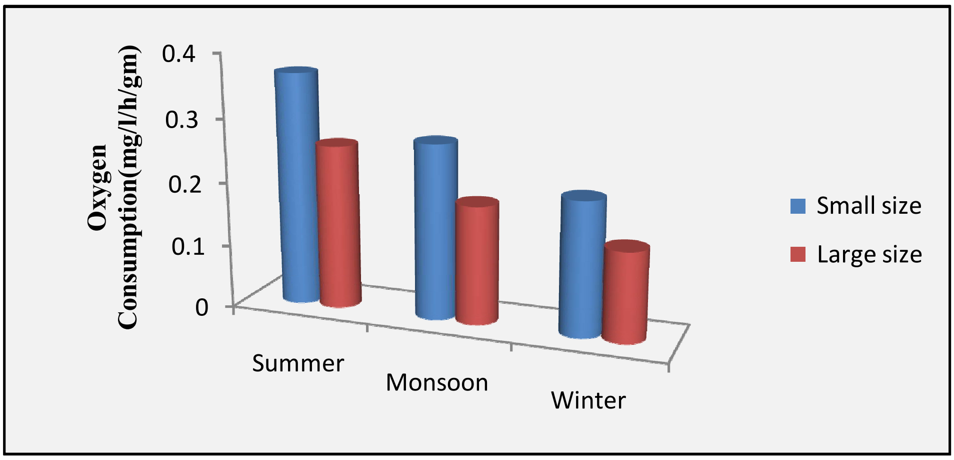

Figure – 02 Size specific changes in the ammonia excretion rate of *Lamellidens marginalis* during different seasons

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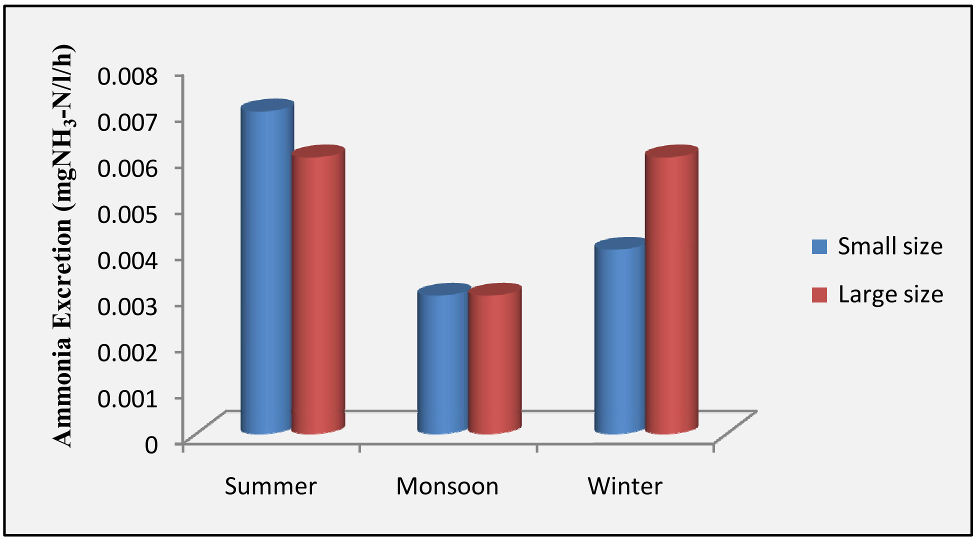
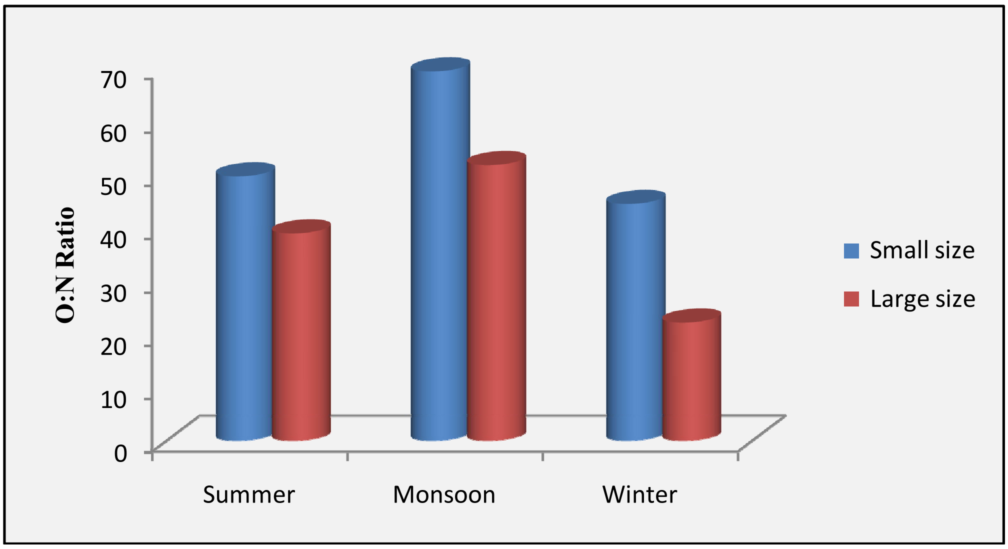


Figure No. 03: Size specific changes in O: N ratio of *Lamellidens marginalis* during different seasons



In the present experimental work, small sized bivalve showed more rate of oxygen consumption than large sized bivalve animals. Also same observation was obtained by the scientist Chandran and Damodaran [11-12] in *K. opima*. Also by a study [13], observed that, oxygen consumption in pearl oyster P. fucata bivalve were considerably increased with increasing the shell length and dry weight. Same observation also showed in *Yoldia hyperborean* [14].

In protein catabolism, ammonia was excretory part in aquatic organism [15]. In research work, ammonia excretion was different considerable all the way through seasons and in different sized groups of bivalve animal same to rate of oxygen consumption. The ammonia excretion was observed maximum in summer season and minimum in monsoon, the same result was observed at all sized bivalve (Table -02, Fig. 02).By scientist Stead and Thompson [16-18] stated that, the rate of ammonia excretion in bivalve animal strongly fluctuates with seasonally while also other factors are dependable to increase or decrease the excretion rate are the temperature of water, food, feeding activity, development and growth of gonad in particular season. The smaller clam bivalve secreted mostly more ammonia than larger sized bivalve animals. A same result was observed in *K. opima* [19-21].

The studies on the physiology and energetic of bivalve animal beneath environmental situation has been observed inthe various scientist such as Pedro [21] and Tang et al. [21-22]. The Oxygen: Nitrogen (O: N) ratio observe ,the proportion of lipid and carbohydrate relative to protein which are breaks down the energy metabolism was stated by Stead and Thompson [22].Also in bivalve animals, the metabolic activities are increase due to some point, after they rapidly decreased [23-25].

During the season of monsoon O:N ratio was showed maximum was 69.31in small sized animals and 51.72 in large sized animals while minimum in winter seasons was 44.43 in small sized bivalves and 22.16 in large sized bivalves (Table 02, Fig. 03).According to sized groups of animals in current working, the higher values were recorded in smaller bivalves than the large sized bivalve animals in O: N ratio [26-31]. The result obtains in current study of O: N ratio was closer to *K. opima* [31]. The O: N ratio varied considerable throughout seasons on the basis of seasonal variation [32-35].

CONCLUSION

The low Oxygen: Nitrogen ratio shows relative increased in use of protein as energy yielding component. The minimum O: N ratio was connected with increase in ammonia because of increased use of protein as energy source. Therefore it is recommended that, energy accumulates in the form of lipid and carbohydrate which changed with a physiological activities induced by seasonal changes in environmental condition. The environmental condition regulates metabolic and physiological actions of animals. That's why, seasonal study is essential for test the physiological index of the animals.

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CITATION OF THIS ARTICLE

P. R. Gugale, S. K. Thorat, A.U. Sutar· Seasonal Variation in Oxygen: Nitrogen Ratio of *Lamellidens Marginalis* from Bhima River at Siddhatek. Bull. Env.Pharmacol. Life Sci., Spl Issue [1] 2022 : 1439-1444