Journal of Agricultural Research Advances

Research Article

Open Access

Metabolism performance of Labeo Rohita fish to findout relation in metabolism in terms of oxygen consumption in various anaesthetics

Acharya MK

College of Veterinary and Animal Science

Navania, Vallabhnagar, udaipur (Rajasthan), India

Corresponding author: drmaheshkumaracharya@gmail.com

Received on: 10/05/2020 Accepted on: 14/06/2020 Published on: 23/06/2020

ABSTRACT

Aim: The study was carried out to evaluate metabolism performance of Labeo Rohita fish to findout relation of metabolism in terms of oxygen consumption in three anaesthetics i.e. Nitrazepam, Pentothal sodium and Ketamine hydrochloride.

Materials and Methods: Three anaesthetics i.e. Nitrazepam, Pentothal sodium and Ketamine hydrochloride were used metabolism performance of Labeo Rohita fish.

Results: Fishes anaesthetised with all the three anaesthetics i.e. Nitrazepam, Pentothal sodium and Ketamine hydrochloride exhibited low oxygen consumption as compared to the control Labeo rohita fish. Besides this, metabolism observation was medium and exhibited notable increase in free carbondixoide and ammonia, and decline in pH of the termination of experiments with nitrazepam, pentothal sodium and ketamins.

Conclusion: It was concluded that oxygen consumption showed more or less a linear relationship with time, whereas the relationship was inverse in case of oxygen consumption rate (OCR) and time.

Keywords: Ketamine, Nitrazepam, Pentothal sodium, Labeo rohita, Fingerlings, Oxygen consumption rate.

How to cite this article: Acharya MK (2020). Metabolism performance of Labeo Rohita fish to findout relation in metabolism in terms of oxygen consumption in various anaesthetics. J. Agri. Res. Adv. 02(02): 24-28.

Introduction

Use of anaesthetics for sedation of fish following advantages are evident i.e. decrease in the rate of oxygen consumption, controlling the excitability of fish and thereby reducing changes of injury and reduction the time of handling. A large number of solid and liquid anaesthetics are available for use in fishery sciences, water soluble anaesthetic are more suitable for fish.

Any effort to reduce metabolic rate of fish during transportation would facilitate transport of higher number of fish for a large distance. Anaesthetics are drugs which have ability to produce loss of sensation and consciousness in the vertebrates exposed to such drugs. The main features of general anaesthetic are i.e. los sensation, sleep (unconsciousness), muscle relaxation and abolition of reflexes. The present day anaesthesiology is a highly developed science both of medical and veterinary use.

Besides the word anaesthetics, other terms such as sedative, hypnotics, narcotics and transquilizers are popularly used even in the scientific literature. However, scientifically, sedative is a drug that subdues excitement and calms the subject without including sleep on the other hand hypnotic is a drug that induces and / or maintain sleep. All the sedative drugs do not have same effect on the animal exposed to such drugs and therefore, the response of animals of these drugs are varies and depend on age, body weight, emotional state and metabolic disease. The tranquilizers are also called as phychotropic drugs or alternatively as "ataractics" such as reserpine. Sedation the activity and oxygen consumption in fish ultimately resulting in the reduction out puts of carbondioxide and waste products. Ideal anaesthetics would be one which besides being economical, should narcotize a large number of fish or varying periods of time without causing mortality or adverse effects.

Materials and Methods

For this study following anaesthetics were used nitrazepam, pentothal sodium and ketamine. Based oxygen consumption in anaesthetised and control fishes was determined by the method of Job (1957). A measured volume of water was delivered to the bottom of the chamber and the outlet which was normally keep plugged was opened so that an equal volume was simultaneously expelled. The water of inlet tube was disconnected from aerial oxygen by putting a drop of turpentine oil over the water surface in the tube. All the experiments were done in triplicates for analysis dissolved oxygen consumption (Fig. 1).

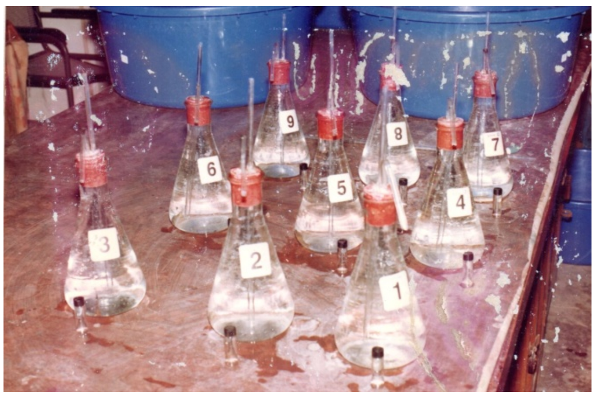

Fig. 1. Series of respiratory chambers with the test fishes.

Results and Discussion

The species of freshwater fish Labeo rohita were used for computing rate of oxygen consumption (OC) using various concentration of anaesthetic i.e. nitrazepam, pentothal sodium and ketamine. The observation pertaining to oxygen consumption of individual fry/fingerlings were presented.

The results of oxygen consumption (OC) and oxygen consumption rate (OCR) of Labeo rohita fry (individual) expressed to nitrazepam (Table 1). As seen from the table the fry consumed less oxygen (OC = 2.619), 3.141 mg/gm with 0.5 and 1.0 mg/l nitrazepam in comparison to control (OC = 4.121 mg/gm during 300 minutes. The fry exhibited an average oxygen consumption rate (OCR) of 0.534 and 0.780 mg/gm/hr in the two doses of nitrazepam. The control fish exhibited higher oxygen consumption rate of 1.093 mg/gm/hr.

A sharp decline in oxygen consumption of Labeo rohita fingerlings were seen under sedation of pentothal sodium (Table 2). The oxygen consumption in experimental fingerlings was 2.714 and 2.201 mg/gm in 240 minutes, whereas, the oxygen consumption was 3.015 mg/gm in control fingerlings. The average oxygen consumption rate of fingerlings were 0.758 and 0.608 mg/gm/hr in 0.005 ml/gm and 0.001 / ml penthothal sodium / gm B.W. fish as compared to the control fish which exhibited higher OCR of 0.944 mg/gm/hr.

Results of oxygen consumption and oxygen consumption rate of individual Labeo rohita fingerling under ketamine sedation were presented (Table 3). The OC in experimental fingerling was 2.282 and 2.443 mg/gm in a period of 240 minutes. Whereas, the oxygen consumption reached to 3.075 mg/gm in the control fishes. The average oxygen consumption rate of individual fingerling were 0.519 and 0.689 mg/gm/hr with 0.002 and 0.004 ml ketamine/gm/ B.W. fish compared to the control (0.941 mg/gm/hr).

As evident from, the nitrazepam treated Labeo rohita fry indicated less oxygen consumption (2.269 and 2.584 mg/gm at 0.5 and 1.0 mg/l nitrazepam) as compared to the control (3.178 mg/gm) after completion of 300 minutes experimental duration (Table 4). The average oxygen consumption rate of nitrazepam treated fry was 0.503 and 0.606 mg/gm/hr at the two nitrazepam doses, where as it was 0.758 mg/gm/hr in the control group.

The experimental freshwater fish Labeo rohita the oxygen consumption as well as oxygen consumption rate were affected in the anaesthetised fishes. Individual fishes consumed relatively higher oxygen and thus depicted higher oxygen consumption rate in comparison to normal fish. Further, the oxygen consumption was relatively lower in group of fishes with the same nitrazepam dose (Durve and Geogre, 1963 and Sharma, 1992).

Jain (1981) reported utility of nine anaesthetics for common carp fingerings and found appreciable decrease in the rate of oxygen consumption with quinaldine and MS-222. Job (1957) estimated oxygen consumption in young milk fish Chanos chanos, similarly, Brett (1964) studied oxygen consumption in Salmon, comparable work on fry and fingerlings of Indian major carps has been done by Basu (1951). The fishes were used individually and in group for each experiment. The rate of oxygen consumption was expressed in mg/liter.

Table 1.1 : Oxygen consumption (OC) and Oxygen consumption rate (OCR) in Labeo rohita fry (individual) using nitrazepam

S. No.	Time (min)	0.00 mg/l (control)		Nitrazepam (0.5 mg/l)		Nitrazepam (1 mg/l)	
		OC (mg/gm)	OCR (mg/gm/hr)	OC (mg/gm)	OCR (mg/gm/hr)	OC (mg/gm)	OCR (mg/gm/hr)
1.	60	1.676±0.144	1.676±0.144	0.629±0.00	0.629±0.00	1.0480±0.00	1.048±0.000
2.	120	2.025±0.100	1.012±0.054	0.942±0.170	0.471±0.083	1.536±0.044	0.767±0.000
3.	180	3.142±0.170	1.047±0.054	1.571±0.000	0.523±0.030	2.165±0.100	0.721±0.054
4.	240	3.631±0.130	0.907±0.310	2.094±0.170	0.523±0.044	2.550±0.100	0.637±0.000
5.	300	4.121±0.100	0.824±0.031	2.619±0.173	0.523±0.031	3.142±0.170	0.628±0.031
Average			1.093		0.534		0.760
pH	I/F		8.06/8.4		8.6/8.5		8.6/8.43
CO_2(mg/l)	I./F		0.0/6.0		0.0/4.0		0.0/4.33

I - Initial F = Final

Table 2: Oxygen consumption (OC) and Oxygen consumption rate (OCR) in Labeo rohita fingerlings (individual) using Pentothal sodium

S. No.	Time (min)	0.00 mg/l (control)		Pentothal Sodium (0.0005 mg/gm)		Pentothal Sodium (0.001 mg/gm)	
		OC (mg/gm)	OCR (mg/gm/hr)	OC (mg/gm)	OCR (mg/gm/hr)	OC (mg/gm)	OCR (mg/gm/hr)
1.	60	1.357±0.000	1.357±0.000	0.935±0.044	0.935±0.044	0.693±0.031	0.693±0.031
2.	120	1.749±0.083	0.874±0.031	1.236±0.102	0.618±0.054	1.176±0.00	0.588±0.000
3.	180	2.382±0.109	0.794±0.031	2.382±0.109	0.794±0.031	1.779±0.031	0.593±0.000
4.	240	3.015±0.109	0.753±0.000	2.714±0.070	0.678±0.000	2.201±0.031	0.550±0.000
Average			0.944		0.756		0.606
pH	I/F		8.2/8.0		8.2/8.13		8.2/8.1
CO_2(mg/l)	I./F		5.0/8.66		5.0/8.0		5.0/7.33
NH_3(mg/l)	I/F		0.823/1.051		0.823/0.983		0.823/0.960

I - Initial F = Final

Table 3: Oxygen consumption (OC) and Oxygen consumption rate (OCR) in Labeo rohita fingerlings (individual) using Ketamine

S. No.	Time (min)	0.00 mg/l (control)		Ketamine (0.002 mg/l)		Ketamine (0.004 mg/gm)	
		OC (mg/gm)	OCR (mg/gm/hr)	OC (mg/gm)	OCR (mg/gm/hr)	OC (mg/gm)	OCR (mg/gm/hr)
1.	60	1.357±0.144	1.357±0.144	0.422±0.031	0.422±0.031	0.874±0.031	0.874±0.031
2.	120	1.810±0.144	0.904±0.070	0.995±0.077	0.497±0.031	1.266±0.070	0.633±0.031
3.	180	2.292±0.031	0.764±0.000	1.779±0.109	0.593±0.031	1.990±0.126	0.663±0.044
4.	240	3.075±0.126	0.768±0.000	2.262±0.000	0.565±0.000	2.443±0.141	0.610±0.000
Average			0.948		0.519		0.687
pH	I/F		8.3/8.1		8.31/8.2		8.3/8.23
CO_2(mg/l)	I./F		5.0/8.66		5.0/630		58.0/6.66
NH_3(mg/l)	I/F		0.891/1.143		0.823/0.937		0.823/1.006

I - Initial F = Final

Table 4: Oxygen consumption (OC) and Oxygen consumption rate (OCR) in Labeo rohita fry (groups) using Nitrazepam

S. No.	Time (min)	0.00 mg/l (control)		Nitrazepam (0.5 mg/l)		Nitrazepam (1 mg/l)	
		OC (mg/gm)	OCR (mg/gm/hr)	OC (mg/gm)	OCR (mg/gm/hr)	OC (mg/gm)	OCR (mg/gm/hr)
1.	60	1.013±0.054	1.013±0.054	0.558±0.044	0.558±0.044	0.838±0.083	0.838±0.083
2.	120	1.606±0.044	0.803±.0.000	1.012±0.054	0.505±0.000	1.257±0.089	0.628±0.044
3.	180	2.095±0.170	0.698±0.109	1.641±0.094	0.547±0.000	1.605±0.214	0.534±0.0701
4.	240	0.583±0.214	0.645±0.054	1.815±0.260	0.453±0.063	2.060±0.130	0.515±0.000
5.	300	3.178±0.214	0.635±0.031	2.269±0.094	0.453±0.031	2.584±0.054	0.516±0.000
Average			0.758		0.503		0.606
pH	I/F		8.4/8.0		8.4/8.3		8.4/8.2
CO_2(mg/l)	I./F		4.0/8.33		4.0/6.0		4.0/6.33
NH_3(mg/l)	I./F		0.617/0.983		0.617/0.914		0.617/0.937

I - Initial F - Final

Table 5: Comparative Oxygen consumption rate (OCR) in Labeo rohita fry (groups) with Nitrazepam

S. No.	Anaesthetic	Concentration (mg/l)	OCRS mg/gm B.W./hr.	'r' values	
				OC	OCR
1.	Nitrazepam	0.00 (control)	0.758	0.5383	-0.6716
		0.5	0.503	0.5673	-0.6594
		1.0	0.606	0.5687	-0.6666

Sharma (1992) reported oxygen consumption for Cirrhinus mrigala and Puntius species i.e. 0.321 and 0.355 ppm/gm/hr respectively which is lower than the present observation for Labeo rohita. Brett (1972) stated that the increase in oxygen demand of maximum sustained activity in usually 5-10 folds of the standard rate in different fishes. However in the respiratory chamber fish movements were restricted and thus oxygen consumption fairly reflected the basel metabolic demand for oxygen. Acharya et al., (2019) also reported alteration in biochemical parameters to Nitrazepam, Pentothal sodium and Ketamine anaesthesia in selected freshwater fishes.

Average oxygen consumption rate 0.57 to 0.80 mg/gm/hr for Lebeo calbasu was reported by Durve et al. (1977). Similarly Sharma (1992) reported average oxygen consumption rates to vary from 0.185 to 1.072 mg/gm/hr for Labeo rohita using diferent anaesthetic.

The marginal increase in carbondioxide and reduction in pH in the nitrazepam treated water of respiratory chamber must have also influenced the oxygen consmption pattern of the individual fishes. In the case of Pentothal sodium and ketamine (individual) and nitrazepam (groups) free carbondioxide, amonium concentration also increased marginally in the experimental water for L. rohita fish. With pentothal sodium oxygem consumption was higher with higher doses in the experimental fishes. However, in the care of ketamine higher dose did not reduce rate of oxygen consumption in Labeo rohita as evident from the average oxygen consumption rate.

Experiments an metabolism were performance to find out reduction in metabolism in term of oxygen consumption. It was found that compared to grouped fishes in the individual fish consumed relatively higher oxygen and also depicted higher oxygen consumption rate with nitrazepam. Moreover, fishes anaesthetised exhibited lower oxygen consumption as compared to the control fish.

Conclusion

It was concluded that anaesthetics i.e. nitrazepam, pentothal sodium and ketamine exhibite low oxygen consumption as compared to the control Labeo rohita fish. Besides this, metabolism observation found medium and exhibite notable increase in free carbondixoide and ammonia, and decline in pH of the termination of experiments with nitrazepam, pentothal sodium and ketamins. Oxygen consumption showed more or less a linear relationship with time, whereas the relationship was inverse in case of oxygen consumption rate (OCR) and time.

References

Acharya MK, Gurjar ML and Meshram BN (2019). Evaluation of various biochemical parameters to Nitrazepam, Pentothal sodium and Ketamine anaesthesia in selected freshwater fishes. J. Vet. Res. Adv., 01 (01):45-50.

Brett JR (1964). The respiratory metabolism and swimming performance of young sockeye salmon. J Fish Res Board Can 21: 1183–1964.

Brett JL (1972). The metabolic demand for oxygen in fish, particularly Salmonids and a comparison with other vertebrates, Resp. Physiol. 14: 151-170.

Basu SP (1951). Physiological requirements of eggs, larvae and fry during transportation. Proc. Indo-Pacif. Fish Coun. 3rd Meeting Ind. 209 pp.

Durve VS and George KV (1963). Some physiological observations on the fry of *Chanos chanos* (FORSKAL) for their transport in plastic containers. Indian Journal of Fisheries, (1): 1-10.

Durve VS and Sharma MS (1977). Oxygen requirements of the early stages of major carp *Labeo calbasu*. J. Anim. Morphol. Physiol. 24(1): 391-393.

Jain SM (1981). Effects of anaesthetics and therapeutic compounds on freshwater fishes. Ph.D. Thesis Univ. of Udaipur (Raj.).

Job SV (1957). The routine active oxygen consumption of the milk fish. Proc. Ind. Acad. Sci. 45(6): 302-313.

Saha KC and Chowdhury NK (1956). Studies on the mortality in spawn and fry of Indian major carps during transport. Partr I.

Investigations relating to the use of specific soil (Read Soil) - water medium in transporting carp spawn (Dimpona) in the existing trade to check mortality during transport, Indian JK. Fish. 3: 119-126.

Sharma SK (1992). Behavioural responses of selected fish species to an anaesthetics and their applicability in aquacultural practices. Ph.D. Thesis, Raj. Agril. Univ. Bikaner, Campus Udaipur, pp. 1-333.

****