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# EFFECT OF CHLORAL HYDRATE ON METABOLIC RATE OF *LABEO ROHITA* (HAM) AND *POECILIA RETICULATA* (PETERS)

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## ABSTRACT

**Comparative impact of chloral hydrate anaesthesia on the metabolic rate of Indian major carp *Labeo rohita* and larvivorous fish *Poecilia reticulata* was assessed. Observation on the oxygen consumption rate (OCR) revealed that in common guppies OCR was substantially low (1.105 and 1.097 mg/g/hr) at 0.1 and 0.25 g/l concentrations of chloral hydrate as against OCR of 1.487 mg/g/hr in the control. Fry of *L.rohita* in group showed lower metabolic rates in the control as well as treated conditions as compared to the individuals of this fish. This may be due to sympathetic psychophysiological reflex of grouped fish. Higher dose of chloral hydrate (0.25g/l) also caused higher OCR probably due to distress. Application of chloral hydrate also favoured lesser release of metabolic wastes (ammonia and carbon dioxide). There was significant positive correlation between time and oxygen consumption, whereas, for time and OCR this relationship was negative. Regression of chloral hydrate doses for OCR and time has also been calculated.**

The use of anaesthetics in reducing fish metabolism is of great importance in fishery science especially in live fish transport and for various fish physiological studies. Earlier attempts in this direction were made by Basu (1950), McFarland (1959), Durve and Raja (1966) and Brett (1972). In the present study the standard metabolism and effects of chloral hydrate, a known ichthyoanaesthetic, in reducing the metabolic rate have been studied on two test fishes, viz. male *Poecilia reticulata* and fry of *Labeo rohita* (rohu).

Respiratory chambers made up of 1000ml conical flash (Job, 1957) and culture bottles of 500 ml capacity were used in these experiments for group and individual fishes, respectively. The experiments were conducted at a temperature of 28±2°C, keeping respiratory chambers in constant temperature waterbath. The test fishes had total length of 1.6-2.3 cm and body weight of 0.095-0.13 g in case of male guppies and 2.5-5.8 cm and 1.42-2.22 g in case of rohu fry. For these experiments two concentrations of chloral hydrate i.e.

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0.1 and 0.25 g/*l* were tried with simultaneous controls lacking in chloral hydrate. These concentrations are able to induce light sedation in above test fishes and depicted ≤ 5% mortality in 24 hours exposure tolerance test (Sharma, 1992). For experimentation a series of each chloral hydrate level was run in triplicate to determine the metabolic rate of grouped rohu fry, grouped common guppies, and individual rohu fry. The fishes were pretreated for one hour in the same anaesthetic medium before starting the experiments to achieve the required depth of anaesthesia.

The larger respiratory chambers were equipped with one inlet and one outlet tube having the larger inlet in the flask to avoid mixing of medium while sampling. These tubes were closed during the experiment by putting a drop of liquid paraffin to check diffusion of gases in the medium. For group experiments 5-6 pretreated fishes were released in each chamber of the series whereas, the metabolic rate of individual rohu fry were studied keeping a single pretreated fish in each 500 ml bottle. Sampling was conducted every hour putting 10 ml of the medium used in inlet tube for simultaneous collection of the sample through outlet in density bottle of the same capacity. Sampling from individual fishes was conducted by opening one bottle chamber every hour from each series. The samples were analysed for alterations in dissolved oxygen contents following micro Winkler's method (Ellis *et al.,* 1946). The group experiments were continued till the oxygen in respiratory flasks reached a critical level which was exhibited by restlessness of fishes. After completion of experiments the number and weight of fishes were noted.

The initial and final values of pH, free $CO_2$ and ammonia were also determined for each respiratory chamber following APHA (1989). The results are expressed as OCR in mg oxygen consumed/g fish weight/hr. The standard deviation between replicates, correlation coefficient between time and OC/OCR and regression equation between time and OC (oxygen consumption) are the statistical interpretations used during these experiments.

From the results (Table 1) it is seen that the average OCR of experimental guppies was far less (1.105 and 1.097 mg/g/hr) in 0.1 and 0.25 gm/l chloral hydrate media as compared to that of control (1.487 mg/g/hr.) In case of *L.rohita* fry (Table 2) the least OCR was found in the grouped fry (0.294 mg/g/hr) as compared to the highest in the control of individual fry (1.072mg/g/hr). Interestingly, the control as well as treated rohu fry showed lesser metabolic rate in grouped condition (0.294-0.729 mg/g/hr) as compared to their individuals (0.762-1.072 mg/g/hr) This may be explained as due to sympathetic psychophysiological reflex of grouped fishes (Durve and Raja, 1966 and Jain, 1981). In the rohu fry the OCR was higher at 0.25 g/l chloral hydrate as compared to 0.1 g/l concentration. This may be because of compartively higher metabolic cost paid by distress and consequent struggle as observed in the

Table 1 : *Oxygen consumption of P.reticulata under chloral hydrate anaesthesia.*

| Dose of chloral hydrate (g/l) | OCR (mg/g/hr) | % decline in OCR | 'r' value Time Vs | | Regression eq. |
|---|---|---|---|---|---|
| | | | OC# | OCR | Y(Time)=a+bX(OC) |
| 0.00 (Control) | 1.487±0.32 | - | 0.972** | - 0.924* | = 1.4619+0157X |
| 0.1 | 1.105±0.05 | 25.68 | 0.995** | - 0.875 | = 0.2432+0.0167X |
| 0.25 | 1.097±0.29 | 26.23 | 0.976** | - 0.979** | = 1.2828+0.0101X |

* p = 0.05; **p = 0.01; #OC = oxygen consumption

Table 2 : *Oxygen consumption of L.rohita under chloral hydrate anaesthesia.*

| Dose of chloral hydrate (g/l) | OCR (mg/g/hr) | % decline in OCR | 'r' value Time Vs | | Regression eq. |
|---|---|---|---|---|---|
| | | | OC# | OCR | Y(Time)=a+bx(OC) |
| | | | Grouped fry | | |
| 0.00 (Control) | 0.729±0.24 | - | 0.993** | - 0.945* | = 0.8241+0.006X |
| 0.1 | 0.294±0.07 | 59.67 | 0.990** | - 0.889* | = 0.2156+0.0032X |
| 0.25 | 0.379±0.03 | 48.01 | 0.997** | - 0.859 | = 0.0772+0.0057X |
| | | | Individual fry | | |
| 0.00 (Control) | 0.072±17 | | 0.966** | - 0.934** | = 0.7700+0.0125X |
| 0.1 | 0.762±0.20 | 28.91 | 0.986** | - 0.953 | = 0.7360+0.0072X |
| 0.25 | 0.785±0.02 | 26.77 | 0.997** | - 0.834 | = 0.1184+0.0123X |

* p = 0.05; **p = 0.01; #OC = oxygen consumption

fishes when exposed at the higher concentration of chloral hydrate (Sharma, 1992). The maximum reduction in OCR was 26.23% in male guppies at 0.25 g/l chloral hydrate whereas, it was 59.67 and 28.91% respectively in grouped and individual rohu fry at 0.1 gm/l chioral hydrate. Jain (1981) also recorded 22.5 30.5% reduction in OCR of common carp fry at 0.25 and 0.5 gm/l chloral hydrate respectively.

The application of anaesthetic also had a visible impact on the water quality parameters wherein the increase in ammonia was higher in control (0.105-0.26 ppm) as compared to the chloral

hydrate treated fishes (0.055-0.20 ppm) in both the species. Similar is the trend in increase of free $CO_2$ which was higher in control (2.4-3.8 ppm) and lesser in treatments (1.0-2.2 ppm). The pH of the medium declined by 0.2-0.4 in controls whereas, it was less (0.1-0.2) in treatments. The impact of chloral hydrate in reducing metabolic wastes of test fishes as noted in this study has also been reported by Nemoto (1957) and McFarland (1959) with other anaesthetics in fishes.

The statistical processing of data showed a positively significant correlation between time and OC, whereas, this relationship was negative for time and OCR. This indicates the adaptability of fishes in the system showing lesser consumption rate of oxygen with increase in time (Jain, 1981). The regression equations calculated for different chloral hydrate concentrations (Table 1 and 2) may be gainfully used for computing oxygen uptake (OC) and time reletionship which has prime importance in live fish transport. The observations of the present study thus suggest suitability of chloral hydrate in reducing metabolic rate of the male guppies at 0.1 and 0.25 g/l concentrations and for fry at 0.1 g/l level of chloral hydrate which has great implicatons in live fish transport and such other fishery procedures.

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