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RESEARCH ARTICLE

Effect of oral administration of oxytetra cycline on the oxygen uptake of the Indian major carp, C*atla catla.*

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Abstract

The Indian major carp, *Catla catla* is selected to oral administration of low (0.3mg) and high (0.6mg) doses of oxytetracycline at 24 h intervals for 48-h and its impact on the oxygen uptake of the fish was measured .the high and low doses were selected based on the recommended dosage per kg body weight of fish for treatment of different bacterial and fungal diseases. The results indicated that the metabolic rate of the exposed fish is dependent on the dose as well as the duration of administration of the antibiotic. Because of the health risks associated with the use of antibiotics in animal production, there is a growing awareness the antibiotics should be used with more care. This is reflected in the recent implementation of more strict regulations on the prophylactic use of antibiotics and the presence of antibiotic residues in aquaculture products. The results of the present study are discussed with the available information on the effect of antibiotics on animal systems.

Introduction:-

Aquaculture is the prominent food production sector in the world and provides a significant supplement and substitute of wild fishes. It has been estimated that fisheries and aquaculture supplied the world with about 110 million tonnes of food fishes .per year providing as per capita supply of 16.7 kg. Antibiotics are group of compounds used annually in large quantities to treat bacterial diseases in fish production Oxytetracycline (otc) is a bacteriostatic compound with a broad antibacterial activity against both gram negative and gram –positive microorganisms, and both aerobic and anaerobic species (Alderman ,1988).otc has been approved for use in aquaculture by the us federal drug administration (Bjorklund,1991).

Oxygen consumption has been reported as a valuable index of the overall physiological activity of animals and is generally used as an indicator under stress conditions either due to pathological state of the animal or adverse ambient environmental conditions. Antibiotics are used extensively to treat a number of bacterial infections in fish culture systems. They are administered generally through feed and then consumed by the infected as well as the health fish invariably affect the physiological state of the animals. Antibiotics are reported to influence the respiratory functions directly or indirectly by their involvement in a wide variety of reactions associated with respiration and various oxidative processes in microbial (Johnson and Colmer, 1957; Snell and Chang, 1961) and mammalian systems (Van Meter and Oleson,1951).since, studies on the effect of antibiotics on the respiration of fish are lacking, an attempt was made in the present investigation to study the effect of the oral administration of ox tetracycline on the oxygen uptake of *Catla catla*

Material and methods:-

Collection and maintenance of specimens of catla catla are same as given earlier (Balaparameswara rao and Padmavathi, 2004). Unchlorinated ground water was used for acclimation of fish as well as experiments and controls. The physicochemical parameters of the water used for maintenance, controls and experiments are;d.o.6.0-7.5 mg/l; ph 7.5-8.5; chlorides 37.23 mg/l; total alkalinity 262mg/l; carbonates 61 mg.l and bicarbonates 301 mg/l.

To study the effect of oral administration of oxytetracycline on the respiration of the fish, two test doses were selected i.e. Low (0.3mg) and high (0.6mg) doses. These concentrations were selected based on the recommended dosed of the antibiotic for treatment of different bacterial infections in fishes. Commercially available doxycycline hydrochloride (USV limited, Ratnagiri dt. Ms.) was used in the present study. The antibiotic in solution was orally administered to the fish with the help of a feeding needle and then the fish were transferred to the experimental trough containing tap water without the antibiotic. The test dose was given to the fishes every 24h interval. Respiratory measurements were made at the end of every 24h up to 96h as described earlier (Balaparameswara rao and Padmavathi,2004).all the experiments were performed in triplicate and only the average values are presented. The metabolic rate (mr) is expressed as mg o_2 /g/h wet weight basis and 't' test was performed to compare the mean metabolic rates of control and the antibiotic treated fish.

Table i:- Metabolic rate (mean ± sd) and % decrease in metabolic rate of catla catla administered with low (0.2mg) and high (0.5mg) doses of doxycycline from 24h to 96h (values expressed in mg o_2/g/h)

time (h)	Metabolic rate(control)	Concentration (test solution)	Metabolic rate(exposed)	% (exposed)	' t' Value	Result
24	0.80±0.020	0.3mg	0.72±0.081	4.00	00.46	P>0.05
-	-	0.6mg	0.61±0.017	18.6	09.33	P<0.01
48	0.80±0.025	0.3mg	0.70±0.010	6.60	03.57	P<0.01
-	-	0.6mg	0.51±0.010	32.0	17.10	P<0.01
72	0.80±0.20	0.3mg	0.64±0.017	14.6	07.33	P<0.01
-		0.6mg	0.35±0.014	53.3	30.76	P<0.01
96	0.80±0.20	0.3mg	0.62±0.014	17.3	10.00	P<0.01
-	-	0.6mg	0.30±0.010	60.0	40.90	P<0.01

Table 2:- Percentage decrease in the oxygen uptake of catla catla exposed to low and high external concentrations and oral administration of doxycycline at the end of 24h and 96h.

Period hours	Low		High	
	External0.8mg/l	Oral 0.3mg	Exrernal64mg/l	Oral0.6mg
24	2.5	4.0	42.0	18.6
48	35.0	17.3	68.0	60.0

Result and discussion:-

The mean metabolic rates of control catla catla and those administered with low and high oral doses of doxycycline are presented in table 1.it is evident from the results that the mr decreased from control from 4% to 17.3% in low dose (0.3mg) and 18.6% to 60% in high dose (0.6mg) with an increase in the period of exposure from 24h to 96h,respectively.the results of the ' t' test indicate that the depletion in the metabolic rate of fish treated orally with 0.3 mg dose of oxycycline is not significant at the end of 24h ($p>0.05$) but it is highly significant at the end of 48h,72h and 96h ($p<0.01$) at the end of all the exposure period studied.

The results of the present study percentage decrease in the oxygen uptake of catla catla exposed to low and high external concentrations and oral administration of doxycycline at the end of 24h and 96h**.**is shown in table 2. It is interesting to note from these results that the percentage decrease in the metabolic rate of catla catla exposed for 24h to low oral dosage (0.3mg) of doxycycline is nearly twice that of those exposed to low external concentration (6mg) even though the oral dose is 40 times less than that of the external concentration. At the end of 96h, the difference in the percent decrease in the metabolic rate is almost double to that observed at low dosage. Further, in fishes exposed to high external concentration (64mg), the percentage decrease in the metabolic rate is nearly twice when compared to those administered with high oral dose at the end of 24h while it is more or less same at the end of 96h although the difference between the two concentrations is 128 times.

It is evident from the present investigation that the o_2 uptake is dependent on not only time-concentration combinations but also the type of administration i.e. External exposure or oral administration of the antibiotic. The decrease in the metabolic rate appears to be due to stress and adverse effects of the antibiotic on the fish. Stress induced depression in the oxygen uptake has already been reported in a number of fishes (Ohara, 1971; Singh. And Singh, 1979; Benergi and Patil, 1984; Subbaiah et al. 1984; Wagh et al.1985).Secretion of mucus which is noticed in the present study may be a protective measure and might also be parly responsible for the drop in the oxygen

consumption by affecting the gill permeability as has been reported in other fishes under toxic stress (Rafia Sultana and Umadevi, 1995).

The present study also revealed that low concentration of oral administration of doxycycline has more pronounce effect than external exposure. This can be attributed to the oral administration unlike in external exposure where the quantum of the antibiotic influx into the body through external surfaces is highly unpredictable since it depends on not only a number of physico-chemical factors of the medium but also on the physico-chemical factors of the medium but also on the physiological state of the organisms as suggested by Schaperclaus (1991). Syed Ariful et al., (2014) suggest that otc could be a potential antibiotic to reduce that bacterial load in fish and can be used commercially for maintaining fish health in culture conditions. Kholil et al (2015) concluded that the oxytetracycline is highly effective against pseudomonas. Islam et al., (2015) concluded that the effect of oxyteracycline on thai silver barb on the culture environment.

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