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## Plasma catecholamines levels in two types of fresh water carp fishes, *Labeo rohita* and *Cirrhinus mrigala* collected in wild from an aquatic body near Kalaburagi situated in the Deccan plateau of India

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### Abstract

Plasma norepinephrine (noradrenaline) and epinephrine (adrenaline) in two types of fresh water carp fishes cultured in an aquatic body and collected in wild was measured by applying enzyme immune assay (ELISA) method in a small volume of plasma to assess the stress response. The mean values obtained for plasma norepinephrine and epinephrine were higher and found to be 334.9 pg/mL and 42.6 pg/mL respectively for *Labeo rohita* and similarly 386.3 pg/mL (norepinephrine) and 27.8 pg/mL (epinephrine) for the fish, *Cirrhinus mrigala*. The values were compared with catecholamine levels in other fish species. The results indicated that norepinephrine is predominant catecholamine than epinephrine in both the fishes. The higher level of these catecholamines indicated that the fishes are in stress condition may be because of problem with capture and transportation method.

**Keywords:** *Labeo rohita*, *Cirrhinus mrigala*, catecholamines

### 1. Introduction

The stress response in vertebrates involves two major classes of hormones such as corticosteroids and catecholamines. In fish, the corticosteroids have been reasonably well studied in variety of fishes [8]. The catecholamine hormones adrenalin and nor adrenalin are released into the circulation in fish from chromaffin cells during numerous stressful situations [10]. However, the changes in catecholamine levels in response to physical and environmental stress conditions especially amongst the Indian fishes are very less studied. Hence, in the present investigation plasma catecholamines such as norepinephrine and epinephrine level was investigated to find out which catecholamine is predominant and also to assess whether the fishes are under stress condition because of rude handling, capturing and their transportation from a aquatic body.

### 2. Materials and Methods

The live fresh water carp fishes of *Labeo rohita* and *Cirranus mrigala* which are cultured in an aquatic body called Khaja Kotnoor reservoir around 25 km. away from Kalaburagi city were captured by cast net by fisherman. Kalaburagi city is an inland city in the Deccan plateau of India laying between longitude 76°-04" and latitude 16 °-12' and 17 °-46'. The city is located on the undulating plain presenting a vast expanse of rich black cotton soil.

The fishes were transported in a vehicle to the market area in live condition. The blood sample was collected immediately after the fishes landed from the vehicle. The size of the fish varied from 26.5 ± 1 cm in length and 105 ± 10 gm in weight. All sexes were used without discrimination. The fish were then placed belly upwards and blood samples obtained from the caudal circulation with the aid of a heparinized 2 cm disposable plastic syringe and a 21 gauge disposable hypodermic needle. The use of plastic syringe is a necessary precaution with fish blood because contact with glass results in decreased coagulation time. The site chosen for puncture (about 3 to 4cm from the genital opening) was wiped dry with tissue paper to avoid contamination with mucus. The needle was inserted at right angle to the vertebral column of the fish and was gently aspirated during penetration. It was then pushed gently down until blood started to enter as the needle punctured caudal blood vessel. Blood was taken under gentle aspiration until about 2 ml has been obtained.

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Thereafter the needle was withdrawn and the blood gently transferred into plastic containers. Blood plasma was obtained by centrifugation and then used for the determination of catecholamines. All the determinations were carried out in duplicates for each sample. The plasma was separated and further processed for the estimation of norepinephrine and epinephrine by following the method of enzyme immunoassay with assistance in Am Path central Reference Laboratory, Hyderabad.

### 3. Results and Discussion

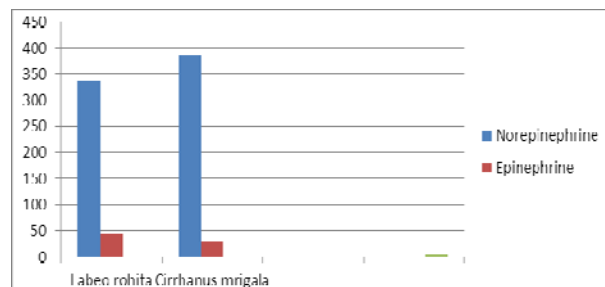
Plasma norepinephrine (noradrenaline) and epinephrine (adrenaline) in two types of fresh water carp fishes cultured in an aquatic body collected in wild. The fish were captured by cast net by local fisherman and transported in a vehicle to the market area in live condition. The catecholamines, norepinephrine and epinephrine were measured by applying enzyme immune assay (ELISA) method in a small volume of plasma to assess the stress condition and response. The mean values obtained for plasma norepinephrine and epinephrine are presented in the table-1 and fig.1 and found to be 334.9 pg/mL and 42.6 pg/mL respectively for *Labeo rohita* and 386.3 pg/mL (norepinephrine) and 27.8 pg/mL (epinephrine) for the fish, *Cirrhinus mrigala*. The values were found to be at higher level and these values are compared with catecholamine levels in other fish species. The results indicated that norepinephrine is a predominant catecholamine than epinephrine in these two fishes. The two fresh water fish found to be under stress condition as both the catecholamine levels were on higher comparing with other reported fishes and this may be attributed to the rude method of capturing, handling and their transportation.

Like in mammals, the medullary cells of fish give positive reaction to dichromate and iodate reactions exhibiting yellow to brown colouration resulting in differentiation of two different types of cells as adrenalin (epinephrine) and noradrenalin (norepinephrine) secreting cells [4]. These cells are sources of catecholamines, adrenaline and noradrenaline which are biochemically shown to be present in the fish adrenal [12, 3]. If severe enough, periods of acute stress in animals may be associated with the release of catecholamine hormones (noradrenaline and adrenaline) into the circulation; a response termed the acute humoral adrenergic stress response and release of catecholamines from chromaffin cells is under neuroendocrine control [10]. In teleost fishes plasma and head kidney has been shown to contain norepinephrine and epinephrine with considerable variation in the concentration of these two catecholamine hormones, the concentration are very low in fish compared to with other vertebrates [7]. The ratio of adrenalin to noradrenalin secreted by the adrenal medulla varies with different species of fish. It has been estimated that plasma norepinephrine and epinephrine of the eel is 1.3 and 3.4 pg/mL respectively [5, 6] whereas in the fish, *Gasterosteus aculeatus*, both these catecholamines were found to be in equal proportions in the head kidney [14]. Stressful conditions invariably cause an increase of these catecholamines but in some species it is epinephrine while in other species it is norepinephrine that is produced in larger amounts following stress stimulus [8]. The elasmobranch fishes have high levels of plasma catecholamines, in the fish, *Scyliorhinus canicula* plasma levels are 1-8 µg/100ml of epinephrine and plasma levels of 2-14µg/100ml of norepinephrine [1]. In rainbow trout and dogfish, the noradrenalin was found to be predominant

catecholamine in the blood of both species of fish [2]. In the present study also it was found that in both *Labeo rohita* and *Cirrhinus mrigala* noradrenalin found to be higher than adrenalin and thus indicating noradrenalin is a predominant catecholamine in these two types of carp fishes. The plasma catecholamines in resting rainbow trout, *Salmo gairdneri* was measured by high pressure liquid chromatography with electrochemical detection and it was found that the values for plasma norepinephrine and epinephrine were 1.83 pmol ml<sup>-1</sup> and 8.95 pmol ml<sup>-1</sup> respectively [15]. The catecholamines measured in the present study is by applying enzyme immune assay and both these catecholamine values were higher possibly, these fishes were under stress condition may be because of rude capture, handling and transportation method. There are some reports on the increased level of catecholamines subjected to hypoxia (low level oxygen availability) and also under experimental conditions of inducing fish to some exercises [13, 2]. It is possible, that in the present study increase in the level of plasma catecholamines in both the fishes may be because of problem with capture method, handling stress and also transportation of the fish under hypoxic condition.

**Table 1:** Showing plasma catecholamines, norepinephrine and epinephrine levels in two fresh water carps collected in wild from a aquatic body.

Sl. No	Name of the fish species	Norepinephrine (plasma)	Epinephrine (Plasma)
1	<i>Labeo rohita</i>	334.9 pg/mL	42.6 pg/mL
2	<i>Cirrhinus mrigala</i>	386.3 pg/mL	27.8 pg/mL



**Fig 1:** Showing plasma levels of catecholamines in two fresh water carps collected in wild from a aquatic body.

### 4. Conclusions

The plasma catecholamines, norepinephrine and epinephrine level were measured in two species of carp fish, *Labeo rohita* and *Cirrhinus mrigala* collected in wild. The norepinephrine is predominant catecholamine than epinephrine in both these carp fishes. However, the results indicated that the both catecholamines were at higher level in comparison to other fishes reported. Thus, indicating that both these fishes are under stressful conditions and this could be because of the method of capture, handling stress and transportation of fish under hypoxic condition.

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