

USE OF ^{65}Zn AS A RADIOACTIVE TRACER IN THE BIOACCUMULATION STUDY OF ZINC BY *POECILIA RETICULATA*

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The bioaccumulation of zinc by *Poecilia reticulata* from water as well as the elimination of the metal previously absorbed were determined by using ^{65}Zn as radioactive tracer. The exposure time varied from 18 days to 30 days. The results obtained show that the absorption and elimination of zinc by *Poecilia reticulata* is slow, 30 days being necessary for the elimination of 70% of the previously absorbed zinc. The same experiment was also carried out by feeding fish with ^{65}Zn contaminated food. The results obtained show that in 30 days only 40% of the zinc previously absorbed is eliminated by the fish.

It is known that several metal ions (such as Co, Cu, Fe, Mn, and Zn) in low concentration play an important role as enzyme activators and are even considered as essential nutritional components of a variety of animals.¹ For that reason these animals tend to accumulate metals to such an extent that they may even become toxic for themselves and for men, if the complete food chain is considered.²⁻⁴

Although several publications throughout the world have been concerned with zinc accumulation by fish,⁵⁻⁷ this is still relevant since zinc is one of the serious pollutants present in the aquatic environment of the urban area of São Paulo city.

The purpose of the present work is to study the absorption and elimination of zinc by *Poecilia reticulata* by using ^{65}Zn contaminated water and food.

Experimental

Fishes ranging in size from 15 to 35 mm and weighing between 50 and 350 mg were obtained from a pond located in the city of Arujá, 30 km from the urban area of São Paulo. The species employed was *Poecilia reticulata*. The fishes were incubated at normal temperature in a water bath during 15 days. Natural lighting occurred throughout the experiment. The animals were placed in a 10 liter aquarium containing soft aerated water (hardness = 44 mg/l CaCO_3 ; pH 6.6; OD = 7.0 mg/l; temperature = 23 °C) and 10 ml of radioactive zinc solution. The top of each aquarium was covered with an

aluminium foil to prevent splashing and also to protect the fish from external stimuli so as to avoid over-exciting them. The final concentration of zinc was around 2 mg/l and the activity did not exceed 3000 cpm/ml.

The fishes were washed free of external activity with running tap water at appropriate time intervals and placed in plastic tubes containing 3 ml of water. They were individually counted by using a NaI(Tl) detector coupled to a monochannel analyzer during 1 minute and results were computed on the basis of counts per minute per gram of fish over counts per minute per milliliter of water.

Whole body clearance was carried out by transferring fishes from the aquarium to zinc-free water. The activity was measured as already described and the results were computed by comparing the activity present in the fish at fixed time intervals with the activity present in the fish in the beginning of the experiment.

Two series of experiments were undertaken to evaluate the absorption and elimination of zinc by the whole fish: the absorption experiment lasted 18 days and the elimination experiment 30 days.

For the study of zinc elimination after ingestion of contaminated food the fishes were placed in a 10 liter aquarium containing soft aerated water and were fed over a period of 30 days with food contaminated with ^{65}Zn . After this period they were transferred from the aquarium to zinc-free water and were fed with uncontaminated food. The activity was measured as already described and the results computed by comparing the activity present in the fish at fixed time intervals with the activity present in the fish in the beginning of the experiment.

Results and discussion

The absorption experiment was carried out by measuring the activity of 30 fishes at fixed time intervals during 18 days. The results obtained (Fig. 1) show that the zinc is absorbed throughout the duration of the experiment. From the tenth day onwards it seems that the absorption has reached an equilibrium. Such behavior was observed also for the absorption of mercury by the same species.^{10,11}

The results concerning the elimination study, presented in Fig. 2, were obtained by transferring fishes to aquaria containing zinc-free water, after a period of 18 days of contact with radioactive zinc. The experiment lasted 30 days and each point represents the average of 24 activity measurements. It is concluded that 30 days are necessary for the elimination of 70% of the previously absorbed zinc.

Such information is relevant if we consider that in the natural environment the fish can move from an area contaminated to others free of pollutants without elimination of the previously absorbed zinc.

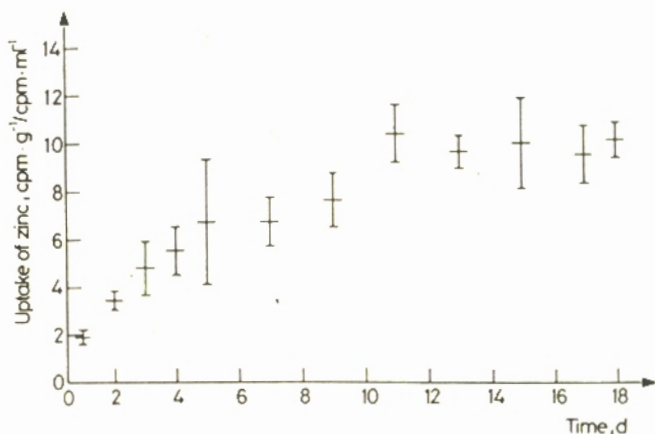


Fig. 1. 1 Uptake of zinc by *Poecilia reticulata* in 18 days of exposure. Points represent the average content of 30 fishes, bars represent one standard deviation

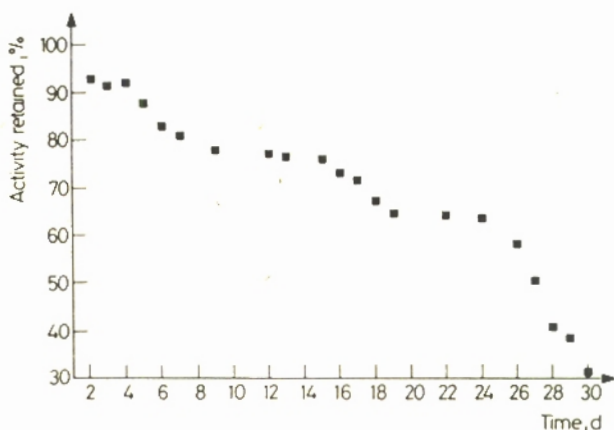


Fig. 2. 2 Elimination of zinc by *Poecilia reticulata* in uncontaminated water, after 18 days of exposure. The experiment lasted 30 days. Points represent average content of 24 fishes

The results presented for the elimination of zinc by *Poecilia reticulata* are in good agreement with results obtained in the literature for the accumulation of zinc by other species.^{5,8,9} Furthermore, the elimination of zinc by *Poecilia reticulata* is slow if compared with the elimination of other toxic elements, such as mercury, which is totally eliminated after 120 hours (5 days) of experiment.^{10,11}

Although several papers have been published concerning the absorption of zinc by different organs of edible fish,^{12,15} the whole body absorption and clearance by a small species is important since it should be considered in the food chain.

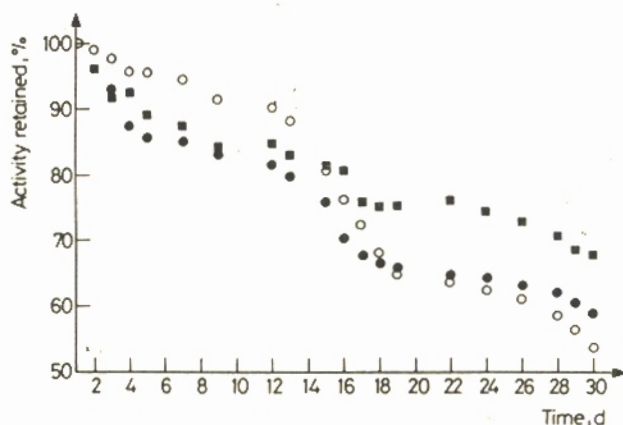


Fig. 3. Elimination of zinc by *Poecilia reticulata* in uncontaminated water, after 30 days of exposure through contaminated food. Points represent average content of 10 fishes with a standard deviation of 15%. Weight of fish: ■ 50 to 80 mg, ● 80 to 190 mg, ○ 190 to 350 mg

The results obtained for zinc elimination, after 30 days of exposure to ^{65}Zn -contaminated food, are presented in Fig. 3. It is concluded that in 30 days only about 40% of the previously absorbed zinc is eliminated by the fish.

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