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TIME DEPENDENT DISTRIBUTION AND HALF-LIFE OF ZINC-65 IN VARIOUS ORGANS OF CHUBS*

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ABSTRACT

Time dependent distribution and half-life of Zinc-65 in various organs of Chub "Leuciscus cephalus L. 1758 (Pisces: Cyprinidae)" have been investigated. Investigations performed on organ and tissue level have shown that absorbtion of Zn-65 varies from organ to organ or from tissue to tissue. The total biological half-life of Zn-65 administered by injection has been found to be 116 days in the fish.

ÖZET

Çinko-65'in tatlı su kefali "Leuciscus cephalus L. 1758 Cyprinidae" nin çeşitli organlarındaki zamana bağlı dağılımı ve yarı ömrü araştırılmıştır. Organ ve doku düzeyinde yapılan araştırmalar sonucunda, Zn-65 absorbsiyonunun balığın çeşitli organ ve dokularında farklılıklar gösterdiği saptanmıştır. Enjeksiyon yolu ile verilen Zn-65'in balıktaki total biyolojik yarılanma süresi 116 gün olarak bulunmuştur.

INTRODUCTION

Zn is present in the composition of many enzymes (carbonic anhydrase, alcohol dehydrogenase, etc.) which play an important role in biological processes /1-4/. Therefore, the presence, absence, or variation in the amounts of zinc in organism, affect all kinds of metabolic activities which are related to these enzymes. As a polluting agent, 21-29 000 tons of zinc from residential and industrial areas flow in to the Mediterranean sea per year /5/. This high level naturally causes an elevation in the amount of zinc in fish /6/. Since stable form of zinc can reach very high concentrations in fish, more information is required about its effect as a polluting agent and its biological role. In view of the information given above, the aim of this work is to investigate:

1. The changes in its time dependent concentration and half-life in various organs and tissues of chub,
2. The total biological half-life of Zn-65 in chub.

In the experiments, 0.5 μCi, Zn Cl_2 (Amersham, specific

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activity 1mCi/ml stable zinc amount 0,777 mg/ml) was injected into the dorsal muscles of each fish. To measure the time dependent concentration of Zn-65 in different organs after 1, 7, 15, 30 and 65 days from injection for each series ten fishes were sacrificed and dissected. These organs and tissues were weighed with the use of sensitive Mettler balance and their radioactivity was measured with standart scintilation counter system having 2x2 inches NaI (Tl) crystal.

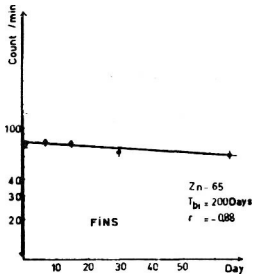


Fig. 1. The biological half-life of Zn-65 in fins.

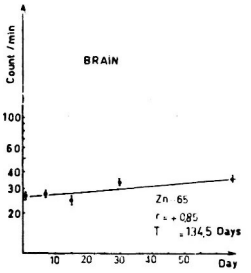


Fig. 2. The biological half-life of Zn-65 in brain.

RESULTS

Accumulation and loss of Zn-65 in various organs were investigated using time dependent graphs of the relative Zn-65 concentration (corrected according to the total body biological half-life) in various organs and tissues and it was observed that these organs and tissues can be considered in 3 groups.

1. The half-life and the doubling period calculated from the semi-logarithmic graphs plotted for the regular variation of Zn-65 in each organ and tissue are shown below:

Fins	: $T_{bi} = 200 \pm 28$	days	(Fig. 1)
Muscles	: $T_{bi} = 100 \pm 10$	days	
Liver	: $T_{bi} = 80 \pm 16$	days	
Air bladder	: $T_{bi} = 59.5 \pm 11$	days	
Brain	: T_{bi}(doubling) = 134.55 ± 20	days	(Fig. 2)

2. The organ in which Zn-65 concentration almost remained stable was the gills. 30 days following the injection, it was observed that the concentration remained constant (Fig. 3).

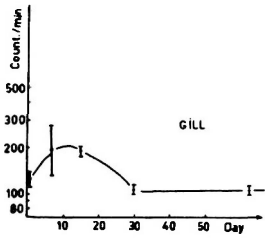


Fig. 3. The biological half-life of Zn-65 in gills.

3. The organs in which Zn-65 concentration showed alternate variations with time; kidney (Fig. 4), stomach-intestine, gall-bladder, spleen, heart, blood-clot and gonad.

Zn-65's $T_{t.ef}$ (Total effective half-life in the living fish) and $T_{t.bi}$ (Total biological half-life in the living fish) were measured and found to be 79 and 116 days respectively (Fig. 5).

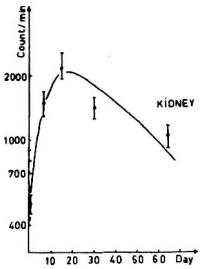


Fig. 4..The biological half-life of Zn-65 in kidney.

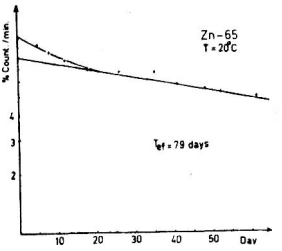


Fig. 5. The total effective half-life of Zn-65 in living fish.

CONCLUSION

The first assembling site of zinc is the body-fluid, which functions as a distribution center in the fish body, whether it is taken up via absorption from the gastro-intestinal tract or via injection into the body. Zinc is bounded to the binding sites, to the specific molecules in the

body-fluid or in the organs and in tissues where it is carried by this fluid. The administration of the polluting or toxic elements to organism via water or nutrients is a natural method to investigate their biological behaviour. But the chemical changes which may occur during the penetration of zinc through gills, gastro-intestinal tract and the skin /7/, have induced the research worker to search for new methods. For this purpose, in order to investigate the biological behaviour or the specific chemical forms of the elements, the elements or their compounds were injected into the organism /8/. In this way, in our case the administered zinc could always be distributed into the body from a specific point /9/. Another reason for using injectable Zn-65 is that, its concentration factor when administered via water and nutrient in fish is small, Hoss /10/, Kameda et al. /11/ according to their results obtained from various sea-organisms, value of the highest concentration factor of zinc was between 10-20 when it was accumulated following administration with water. On the other hand, results of Pentreat /12/ showed that:

a. The loss of Zn-65 by different organs of fish is almost in the same proportion, no matter what method is used and,

b. $T_{t.bi}$ values obtained from the injection method is equivalent to those obtained by other methods.

As a conclusion:

a. Zinc concentration relative to the mean body concentration in brain and gonad, increased by time.

b. Relative zinc concentration in liver, air-bladder, fins, muscles, and kidney, decreased by time,

c. Relative zinc concentration in organs and tissues such as air-bladder, spleen, hart, blood, gall-bladder and stomach-intestine, ondulating by time,

d. After long time of zinc administration, relative zinc concentration in the gills remained constant by time.

e. The measured half-life varies between 200 ± 28 and 59,5 ± 11 days in organs investigated and biological half life in total fish 116 ± 10 days.

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