Cation Exchange Properties of Bone Tissue

A very high uptake of ^{51}Cr-β-glycerophosphate by bone tissue has been noticed when the biological behaviour of this proposed tumor localizing agent[1] was studied. The Table shows the values of a typical radioactivity distribution in rats 24 h after i.v. injection. The concentration of radioactivity by the bone does not agree with its glycerophosphate hydrolytic capability (phosphomonoesterase activity). The possibility of a simple cation exchange was assayed by in vitro incubation of bone tissue with ^{51}Cr-β-glycerophosphate.

A duplicate assay was performed with 2 rat femurs from the same animal. One of them was autoclaved 20 min in order to destroy any enzymatic activity. After this, it was ground and washed 5 times with distilled water in order to eliminate all the hydrolyzed proteins. The other femur kept at 4 °C was also ground. 1 g of each was suspended in 5 ml of saline plus 5 ml of lactated Ringer's solution (Hartmann's). After addition of 0.5 ml of ^{51}Cr-β-glycerophosphate complex (2.4 mg Cr/ml), they were incubated for 1 h at 37 °C with occasional stirring. After incubation, they were centrifuged and the residue washed 5 times with normal saline. The radioactivity was measured in both residues and supernatants with a scintillometer. 33.9 and 22.4% of the total radioactivity remained in the residue of preheated and normal femur respectively. The higher exchange with the heated bone can be explained as a consequence of the increase in the active surface of the mineral tissue due to the hydrolysis of the collagen.

In another experiment, the exchange was tested with carbonates and phosphates similar to the mineral part of the bone tissue. To a suspension of 100 mg of $CaCO_3$, $MgCO_3$, $SrCO_3$, $Mg_3(PO_4)_2$ and $Ca_3(PO_4)_2$ in 5 ml of distilled water (buffered to pH 7.2 with KH_2PO_4), 0.2 ml of ^{51}Cr-β-glycerophosphate (8.1 mg Cr/ml) were added and incubated at 37 °C for 1 h. After centrifugation and washing, the radioactivity of both residues and supernatants was counted as described before. The percentages of the used radioactivity remaining in the insoluble (exchanged) were: $CaCO_3 = 4.3$; $MgCO_3 = 81.0$; $SrCO_3 = 5.1$; $Ca_3(PO_4)_2 = 30.4$ and $Mg_3(PO_4)_2 = 87.0$.

These experimental findings indicate that through a simple cation exchange mechanism some of the mineral constituents of bone are able to deposit as an insoluble compound the chromium from a very stable β-glycerophosphate complex.

Radioactivity distribution after i.v. injection of ^{51}Cr-β-glycerophosphate into rats

% dose/g				
Blood	Liver	Spleen	Kidney	Femur [a]
0.02	0.08	0.10	0.48	0.64

[a] Ratio (radioactivity mineral tissue/radioactivity bone marrow) per gram = 20.

Riassunto. È presentato uno studio sulla fissazione del ^{51}Cr-β-glicerofosfato. Il ^{51}Cr di questo composto qui presenta una elevata stabilità chimica è fissato nella parte minerale dell'osso per un meccanismo d'intercambio cationico.

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Pharmacological Studies on Thiamine Deficiency IV. Blood Catecholamine Content and Blood Pressure of Thiamine Deficient Rats

As shown in previous reports from this laboratory, the catecholamine (CA) contents in the brain cortex, in the heart atria and ventricles and in the spleen are significantly increased in thiamine deficient rats as compared with those of thiamine supplemented or pair-fed control group[1] and impairment of tissue monoamine oxidase (MAO) activities plays some role in the CA accumulation[2]. Furthermore, this increase of CA concentration may result in changes in some pharmacological responses[1,3].

In this work, to test whether changes in the spontaneous release of CA from the tissues were involved in the accumulation in deficient animals, the CA concentration in the blood was measured with special reference to its relation to change in blood pressure. In addition, the pressor effects of DL-noradrenaline (NA) and tyramine in thiamine deficient rats were examined.

Materials and methods. Using male Sprague-Dawley rats, weighing 80–100 g, as experimental animals, a thiamine deficient group, a pair-fed and a control groups were prepared and a decision for the deficiency of the animal was done as described previously[1,2].

The blood CA content of rats was measured by a modification of the method of Crout[4]: animals were sacrificed by decapitation and blood from the carotid arteries was taken into a tube containing ice-cold 0.4 *N* perchloric acid. The tube was kept at −20 °C until the following day and then thawed. In addition to the original procedure for elution with alumina, Dowex 1 × 8 column was also employed[5].

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