幼若および成熟マウスにおける65Znの体内残留率に及ぼす亜鉛欠乏の影響

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Influence of Zinc Deficiency on the Whole-Body Retention of ^{65}Zn in Young and Adult Mice

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Since Zn is an essential trace element for animal growth, its metabolism has been studied extensively by many investigators [2, 9]. In particular, Zn deficiency has been noted to induce not only an adverse effect on animal growth, but also a wide variety of health disorders and fetal malformations in experimental animals [10]. Under Zn-deficient conditions, however, it has been demonstrated that the absorption of Zn from the gastrointestinal tract is remarkably accelerated [3, 8] while the turnover rate of Zn in the body as a whole becomes slower [7].

$^{65}ZnCl_2$ in 0.5*N* HCl solution (Du Pont/NEN Research Products, U.S.A) was adjusted to a concentration of 50 μCi/m*l* (1.85 MBq/m*l*; Zn carrier, 0.3 μg/μCi) with distilled water and its pH was corrected to 5 with NaOH solution. A Zn-deficient diet containing 2 ppm Zn was prepared according to the diet composition reported by Apgar [1]. A control diet (Zn-normal) was made by adding zinc sulfide to the Zn-deficient diet so as to make the Zn content 50 ppm. Twenty young (21 days old) and 20 adult (12 weeks old) male mice of ICR strain were divided into 2 groups: Zn-normal and Zn-deficient, each comprising 10 mice. These 2 groups were maintained on the respective diets from 7 days prior to ^{65}Zn administration until the termination of the experiment. All animals were allowed to drink water (containing 1 ppm Zn) *ad libitum*. A single intraperitoneal or oral dose of 0.1 m*l* (5 μCi) ^{65}Zn solution was given to the animals according to the experimental scheme shown in Table 1. Immediately after ^{65}Zn administration, their initial body burdens were measured by whole-body counting with a scintillation counter having a 3×3-inch NaI (T*l*) crystal. The ^{65}Zn whole-body retentions were measured periodically for a period of 2 weeks after administration of the isotope, and the data obtained were expressed as percentages of the administered dose.

As shown in Fig. 1, the young and adult mice not only in the Zn-normal but also in the Zn-deficient groups showed the similar whole-body retention curves after a single intraperitoneal administration. In the case of oral administration, however, the young mice had higher retention levels than the adults in both the Zn-normal and Zn-deficient groups.

Table 1. Experimental scheme

Group	Age	Route of administration[a] (5μCi of ^{65}Zn solution/mouse)
Zn-normal diet	Young (21-day-old)	i.p. (5)[b]; o. (5)
	Adult (12-week-old)	i.p. (5) ; o. (5)
Zn-deficient diet	Young (21-day-old)	i.p. (5) ; o. (5)
	Adult (12-week-old)	i.p. (5) ; o. (5)

a) Intraperitoneal (i.p.) and oral (o.) administration.
b) Figures in parentheses indicate numbers of animals used.

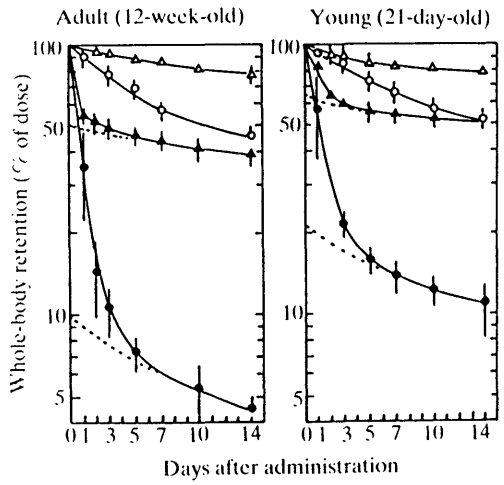

Fig. 1. Whole-body retention of ^{65}Zn after a single oral (o) or a single intraperitoneal (i.p.) administration in adult and young mice fed a Zn-normal or Zn-deficient diet.
Zn-normal diet: ○ i.p., ● o.
Zn-deficient diet: △ i.p., ▲ o.
Vertical bars: ±S.D.

The curves obtained after intraperitoneal administration were shifted straight down until their slow components coincided with the respective components of the curves obtained after oral administration. The intercepts of the curves at time zero (shown by dotted lines in Fig. 1) represent the absorption of ^{65}Zn from the gastrointestinal tract just after administration [4]: the young and adult mice absorbed 21% and 10% of the dose under the supply of the Zn-normal diet, respectively. The present result showing that the younger animals had better gastrointestinal absorption of ^{65}Zn was in good accord with our previous report [6]. In the Zn-deficient groups, however, the young and adult mice absorbed 66% and 50% of the dose, respectively, from the gastrointestinal tract just after its oral administration, showing the slower turnover rate of ^{65}Zn than that in the Zn-normal groups. Therefore, greater amounts of ^{65}Zn were absorbed from the gastrointestinal tract in both the young and adult mice under Zn deficiency. These results confirm the findings of Kollmer and Berg [5] in the rat.

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要　約

幼若および成熟マウスにおける ^{65}Zn の体内残留率に及ぼす亜鉛欠乏の影響（短報）：松坂尚典・伊勢浩昌・坂本秀樹・品川邦汎・Dieter BERG[1]・Willy E. KOLLMER[1]（岩手大学農学部獣医公衆衛生学教室，[1]GSF mbH München）——正常亜鉛飼料および低亜鉛飼料給与下の幼若および成熟マウスに，^{65}Zn を腹腔内あるいは経口的に1回投与して，体内残留率を測定した。正常亜鉛飼料給与の場合に比較して，低亜鉛飼料給与下では ^{65}Zn の体内残留率が上昇した。体内残留率曲線より ^{65}Zn の消化管における吸収率を求めたところ，正常亜鉛飼料給与下では，幼若マウスが高い吸収率を示したが，低亜鉛飼料給与の場合には，^{65}Zn の吸収率は両年齢群ともほぼ同程度促進されることが観察された。さらに，^{65}Zn の代謝回転率は低亜鉛飼料給与によって著しく低下した。