Effect of Selenium Deficiency on Zinc and Magnesium Levels in Rat Tissues

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ABSTRUCT

Selenium (Se) deficiency for 2 years affected zinc and magnesium levels in rat tissues. Zinc levels in plasma were significantly higher in selenium deficient rats than in selenium adequate rats but in liver, kidney and testis, zinc levels were significantly lower in selenium deficient rats, but no significant difference in lung. The results of studies of magnesium levels showed similar to these with zinc. The concentration of albumin was significantly decreased in plasma of selenium deficient diet. These data suggest that the selenium may play a role in transport system.

INTRODUCTION

Selenium (Se) has been recognized as an essential trace element for animals and humans[1,2]. Se is an integral component of glutathione peroxidase (GSHPx)[3]. This enzyme plays an important function in antioxidant defense mechanism of the body. Peroxides and free radicals are continuously produced in cells during the course of biological processes. GSHPx is capable of catalyzing the reduction of hydrogen peroxide and organic hydroperoxides with reduced glutathione. Selenium deficiency is responsible for several diseases such as Keshan disease, a cardiomyopathy endemic in certain areas of China, liver necrosis in rat, and myopathy in cattle.

Many studies demonsteated that Se is able to interact with other trace elements in the body. Se increases retention of zinc level in most tissues[4] and shows protective effects against toxic effects of mercury[5].

The present experiment was carried out to examine the effects of feeding selenium deficient diet for 2 years on zinc and magnesium levels in rat tissues. Because zinc is very important for survival of

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animal and human and zinc deficiency causes growth failure and immune depression[6]. Magnesium is an important activator and exerts physiologic effects on the nervous system and acts directly upon the myoneural junction[7].

MATERIALS AND METHODS

Weanling male Wistar rats were divided into 2 groups, and were fed the Torura yeast-based diet (Table 1). One group was fed the selenium deficient (Se(−)) diet and other group the selenium adequate (Se(+)) diet, which contained 0.1 ppm Se as sodium selenite. The diet and distilled water were available *ad libitum*. Each 100 g of both diets contained 57.9 mg magnesium and 2.29 mg zinc. After 2 years rats were killed, blood was collected from abdominal aorta. Plasma, serum and tissues were removed and frozen at −20 °C until used. The amount of magnesium and zinc were assayed by xylidyl blue method[8] and 2-(5-bromo-2-pyridylazo)-5-(N-n-prypyl-N-3-sulfopropylamino)-phenol[9], respectively.

The concentration of serum albumin was confirmed by BCG binding method[10]. All data were analyzed by Student's t-test.

Table 1. Composition of diets (%)

Ingredients	Se(−)	Se(+)
Torula yeast	35.7	35.7
D,L-Methionine	0.3	0.3
Sucrose	44	44
Soybean Oil	13	13
Mineral mixture	4	4
(Zn		2.29 mg/100g)
(Mg		57.9 mg/100g)
Vitamin mixture	1	1
Cellulose powder	2	2
Na_2SeO_3	−	0.000022

RESULTS AND DISCUSSION

Zinc levels in plasma were significantly higher in the rats fed Se(−) diet than in the counterpart rats, but zinc levels in liver, kidney and testis were significantly lower in Se(−) group (Fig. 1). No significant difference was detectable in lung. The magnesium levels were similar to those observed for zinc (Fig. 2). Magnesium level was significantly higher in plasma but significantly lower in liver, kidney, testis and heart of rats fed Se(−) diet than those on Se(+) diet. Also the level in lung didn't

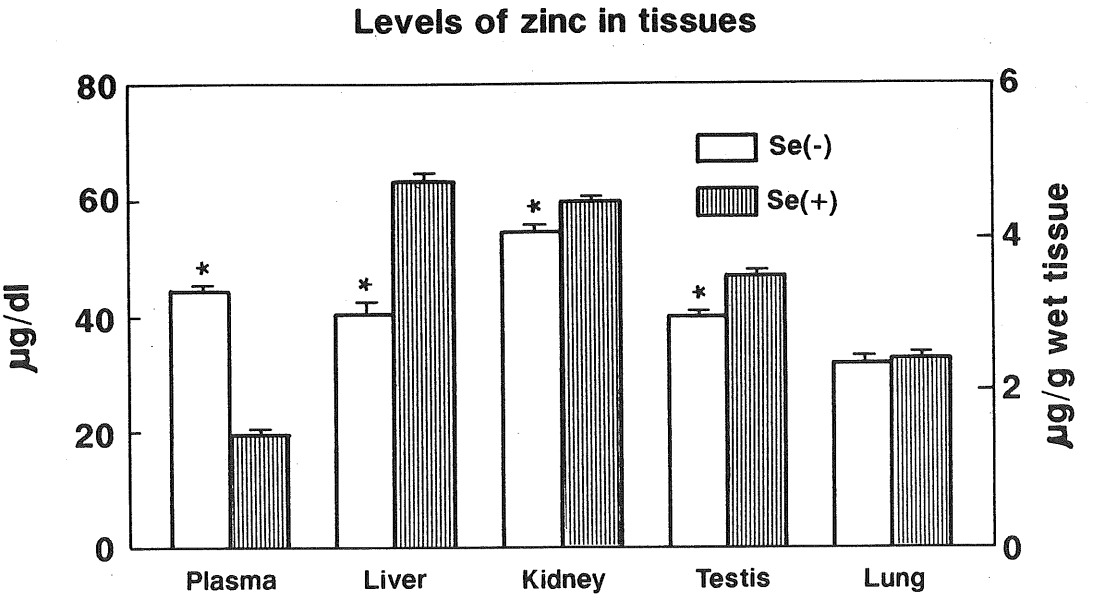

Fig. 1. Zinc Levels in tissues of Se-deficient and Se-adequate rats. Values represent mean±SEM of 6 rats.
* Significant different at $p<0.05$ as compared to Se-adequate rats.

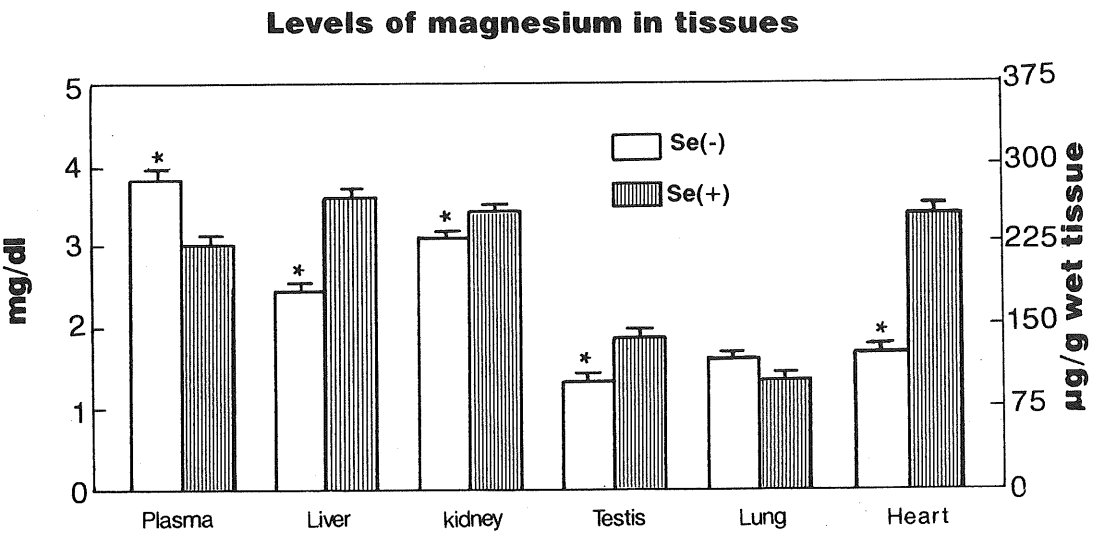

Fig. 2. Magnesium levels in tissues of Se-deficient and Se-adequate rats. Values represent mean±SEM of 6 rats.
* Significant different at $p<0.05$ as compared to Se-adequate rats.

show any significant difference.

A majority of plasma zinc and magnesium are associated with albumin and transported to tissues[11,12]. The concentration of albumin, as assayed by BCG binding method, was significantly decreased in plasma of rats fed Se (−) (Table 2).

Table 2. Albumin levels in plasma of rats fed Se-deficient or Se-adequate diet for 2 years

Se-deficient	Se-adequate
3.455 ± 0.047*	4.249 ± 0.249

Albumin levels determined by BCG binding method, represented as mean±SEM of 6 rats (g / dl).
*significantly different at $p<0.05$ as compared to Se-adequate rats.

The results presented in this paper indicate that selenium deficiency affects zinc and magnesium levels in rat tissues, suggesting that selenium, probably through albumin, plays an important role in transporation of zinc and magnesium. The metabolism of selenium may be sensitive to magnesium and zinc levels in tissues. Further studies are needed to elucidate the interrelationship between Se and Mg / Zn.

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