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# The Effect of Green Juice of *Angelica keiskei* Koidz on the Toxicity of Several Selected Elements

Song, Sook Ja · Eom, Hyun Sook · Lee, Jin Hee*
Choi, Soon Nam · Chung, Keun Hee

*Department of Food and Nutrition, Sahmyook University, Seoul, Korea*
*Department of Food and Technology,* Sahmyook Junior College, Seoul, Korea*

## ABSTRACT

In order to study the effects of green juice of *Angelica keiskei* Koidz on the toxicity of several selected elements, experiments were conducted with mice for a period of six weeks. The results obtained from the experiment are summarized as follows :

1) Mice fed with 50 ppm of cadmium showed no adverse effects on the growth rate and mortality, but cadmium accumulation into the internal organs, liver, kidney and pancreas, was increased. The administration of green juice showed no reduction of Cd accumulation in the internal organs.

2) Mice fed with 500 ppm of lead showed no reduced effect on the growth rate and mortality, but lead accumulation was increased in the internal organs. The administration of green juice slightly reduced lead accumulation in the internal organs.

3) Mice fed with 50 ppm of selenium also showed no serious adverse effect of the growth rate and mortality, but selenium accumulation occured in the internal organs. The administration of green juice slightly reduced selenium accumulation in the internal organs, but the modes and degrees of reduction in selenium accumulation were not consistent with the internal organs, liver, kidney and pancreas.

4) Mice fed with 500 ppm of chromium showed, numerically, an adverse effect on the growth rate, but showed no statistically significant difference. The administration of green juice rather increased the accumulation of chromium instead of reduction of chromium accumulation in the internal organs. (*Korean J Nutrition* 30(9) : 1050~1054, 1997)

KEY WORDS : internal organs · cadmium accumulation · green juice.

## Introduction

In the periodic chart of elements, there are over 100 elements, but about twenty to thirty of the elements are essential for animals to maintain their biological functions in metabolism. Although the contents of these elements in the tissues or organs in the bodies is very low, the roles of these elements are very important. Several elements which are not classified as essential elements also occur in a very small amount in the living bodies[1]. Even an essential element would show an adverse effect if it is introduced in an amount over the pharmacotoxicological level, and non-essential trace elements would produce signs of toxicity even in the minimum levels. The level at which these elements would show toxic signs is different according to the kind of elements involved. Zinc and Copper supplementation did not cause a singnificant toxic effect in the rats that were fed diets containing up to 1,000-2,000 ppm[2-7],

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while on the other hand, so-called toxic elements, such as Cd, Hg, and Se produced signs of toxicity in low levels down to 1,000 – 2,000 ppm units[8-13]. Specifically, Chromium, Cadmium, Lead and Mercury, which are classified as industrial pollutants, produce signs of toxicity when they are administrated into the living body even at relatively low concentrations [14]. However, the toxic effects and the degree of the accumulation in the internal organs of these toxic elements could be different according to the components of a diet. Moreover, the absorption into the small intestine and the secretion of these elements could be varied according to the components of diets. The fiber, mineral and other nutrients in the diet possibly reduce the absorption of these elements and increase the excretion of these elements. Green juice, so-called health food, are well known to be a mineral-rich, vitamin-rich, fiber-rich, nutrient-rich and fiber-contained nutriment. Furthermore, it is reported, recently, that the green juice of *Angelica keiskei* Koidz is relatively rich in vitamins, minerals and contains also a moderate amount of fiber[22]. Therefore, the nutriments in the green juice possibly affect the absorption and excretion of toxic elements in the mouse. The purpose of this research is to study the effects of long-term administration of green juice on the toxicity of the several selected elements in the mouse.

## Materials and Methods

### 1. Experimental design, diet, and animals

Weanling female mice(Daejong Co., ICR mice) were fed one of several experimental diets : Cadmium supplemented to which Cadmium was added at 50mg/Kg diet ; Lead supplemented, to which Lead was added at 500mg/Kg diet ; Selenium supplemented, to which Selenium was added at 50mg/Kg diet ; Chromium supplemented, to which Chromium was added at 500mg/Kg diet. Ten mice were used for each dietary treatment. The mice were housed in plastic cages and the assigned diets and water were supplied ad libitum. A certain amount of green juice was orally introduced with a ball-tipped gastric inoculation needle.

After 6 weeks, the mice from each treatment were killed and their livers, kidneys, and pancreases were removed for the element analysis.

The *Angelica keiskei*, raw material of green juice, was purchased from Canaan Keil Garden, and green juice was made by a commercial juice maker.

### 2. Tissue digestion and mineral analysis

Glass and plastic ware that were used in storage of samples and analysis for minerals(Cd, Pb, Se, and Cr) were cleaned in 3.2 N nitric acid(for 24 hr) and rinsed at least five times with distilled, deionized water. For analysis of diets and tissues, samples were placed in erlenmeyer flasks and 2-4ml of 12 N nitric acid was added. Samples were digested(100℃) and then evaporated and diluted with distilled, deionized water to appropriate volumes. The element levels were determined by ICP-AES at Korea Basic Science Center, Seoul branch. Chemical reagents were purchased from Junsei chemical, Yakuri pure chemical, and Kokusan chemical.

## Results and Dicussion

The average body weight for the mice fed one of the designed experimental diets ranged from 25g to 30g at wk 6(Table 1). The administration of Cadmium(50 ppm), Lead(500 ppm) and Selenium(50 ppm) did not show any adversed effects on the growth rate compared to the each control group. In contrast, the growth rate of the rat fed Chromium 500 ppm was reduced slightly(31g) compared to the control group(39.9g).

The administration of green juice slightly counteracted the growth depression caused by the 500 ppm of Chromium. Although the distinguished recovered effects on the growth rate did not occur, generally, the administration of green juice showed good effects on the growth rate of the rats.

The Cadmium contents of the livers of the rats fed Cadmium 50 ppm ranged from 8 to 9 ppm. On the other hand, the Cadmium contents of the mouse fed control diet(Table 2) ranged from 0.01 to 0.015 ppm. Comparing total average contents of the Cadmium of the animal tissue are about 0.05 ppm[15], the Cadmium contents of the control mice(0.01 – 0.015) are under the average animal tissue levels. Although

the admininstration of green juice showed a positive effect on growth rate, the green juice did not alleviate the accumulation of cadmium in the internal orgaines in the mice.

The Lead contents of the livers in the mice fed Lead 500 ppm ranged from 0.3 to 0.6 ppm(Table 3). On the other hand, the Lead contents of livers of the mice fed control diet ranged from 0.1 to 0.3 ppm. The average Lead contents of the animal tissue ranging from 0.1 to 2-3 ppm[16] are comparable to

**Table 1.** Effects of green juice on the weight gained in mice fed with high levels of selected elements

| Diet and supplement | | Animals | Body weight after 6 weeks | Mortality |
|---|---|---|---|---|
| Exp. I | Basal diet | 10 | 35.3 | 0 |
| | Basal diet+Cd 50 ppm | 10 | 34.1 | 0 |
| | Basal diet+Green juice | 10 | 37.4 | 0 |
| | Basal diet+Cd 50 ppm+ +Green juice | 10 | 39.3 | 0 |
| Exp. II | Basal diet | 10 | 30.8 | 1 |
| | Basal diet+Pb 50 ppm | 10 | 34.3 | 0 |
| | Basal diet+Green juice | 10 | 33.1 | 0 |
| | Basal diet+Pb 50 ppm+ +Green juice | 10 | 28.9 | 0 |
| Exp. III | Basal diet | 10 | 30.7 | 0 |
| | Basal diet+Se 50 ppm | 10 | 29.1 | 0 |
| | Basal diet+Green juice | 10 | 28.1 | 0 |
| | Basal diet+Se 50 ppm+ +Green juice | 10 | 31.0 | 1 |
| Exp. IV | Basal diet | 10 | 39.9 | 0 |
| | Basal diet+Cr 50 ppm | 10 | 31.2 | 1 |
| | Basal diet+Green juice | 10 | 36.2 | 1 |
| | Basal diet+Cr 50 ppm+ +Green juice | 10 | 36.2 | 1 |

**Table 2.** The contents of cadmium in liver, kidney, and pancreas of the mice fed with Cd 50 ppm

| Organ | Diet and supplement | | | |
|---|---|---|---|---|
| | Basal diet | Basal diet+Cd | Basal diet+Green juice | Basal diet+Cd+Green juice |
| | ppm | | | |
| Liver | 0.015±0.00 | 8.17±0.21 | 0.010±0.00 | 9.090±0.27 |
| Kidney | 0.015±0.00 | 5.59±0.17 | 0.010±0.00 | 6.590±0.08 |
| Pancreas | 7.64 ±0.14 | 10.44±0.07 | 33.69±0.20 | 34.69±0.39 |

**Table 3.** The contents of lead in liver, kidney, and pancreas of the mice fed with Pb 50 ppm

| Organ | Diet and supplement | | | |
|---|---|---|---|---|
| | Basal diet | Basal diet+Pb | Basal diet+Green juice | Basal diet+Pb+Green juice |
| | ppm | | | |
| Liver | 0.18 ±0.05 | 0.595±0.03 | 0.255±0.04 | 0.34 ±0.04 |
| Kidney | 0.0135±0.04 | 0.88 ±0.02 | 1.00 ±0.06 | 0.42 ±0.02 |
| Pancreas | 0.125 ±0.00 | 0.245±0.03 | 0.065±0.03 | 1.305±0.03 |

**Table 4.** The contents of Selenium in liver, kidney, and pancreas of the mice fed with Se 50 ppm

| Organ | Diet and supplement | | | |
|---|---|---|---|---|
| | Basal diet | Basal diet+Se | Basal diet+Green juice | Basal diet+Se+Green juice |
| | ppm | | | |
| Liver | 0.22±0.03 | 0.45±0.15 | 0.22±0.01 | 0.31±0.03 |
| Kidney | 0.19±0.03 | 0.32±0.02 | 0.24±0.02 | 0.30±0.04 |
| Pancreas | 0.14±0.05 | 0.29±0.02 | 0.26±0.05 | 0.16±0.02 |

**Table 5.** The contents of Chromium in liver, kidney, and pancreas of the mice fed with Cr 500 ppm

| Organ | Diet and supplement | | | |
|---|---|---|---|---|
| | Basal diet | Basal diet+Cr | Basal diet+Green juice | Basal diet+Cr+Green juice |
| | ppb | | | |
| Liver | 16.91±2.15 | 50.87±6.09 | 373.83±25.40 | 524.68±46.56 |
| Kidney | 49.41±3.96 | 69.29±6.59 | 155.92±10 | 413.03±36.45 |
| Pancreas | 39.37±8.90 | 305.83±7.17 | 326.55±25.74 | 334.34±25.42 |

the Lead contents of the livers of the mice fed a Lead-supplemented diet or control diet. The administration of green juice to the Lead-supplemented group showed a slight reduction of the Lead accumulation in the liver.

The Selenium contents of the livers of the mice fed Selenium 50 ppm are ranged from 0.3 to 0.45 ppm, on the other hand, the Selenium contents of liver of the mice fed control diet ranged from 0.1 to 0.25 ppm(Table 4). The average Selenium contents of the mice livers fed a Selenium-supplement diet or control diet was also contained within the ranges of average levels of the previous reports[17-19]. The administration of green juice also reduced slightly the contents of Selenium in the livers of the mice fed the Selenium-supplemented diet.

The Chromium contents in the livers of the mice fed a Chromium-supplemented diet ranged from 0. 05 to 0.524 ppm. On the other hand, the Chromium contents in the livers of the mice fed the control diet ranged from 0.016 to 0.373 ppm. The administration of green juice did not reduced the Chromium content in the livers of the mice fed Chromium-supplemented diet, rather green juice elevated the Chromium contents in the liver. However, the average Chromium contents in the livers of the mice fed control diet did not exceed the average Chromium contents of the normal animals[20)21)].

The results of the experiment on the effects of green juice on the accumulations of Cadmium, Lead, Selenium and Chromium in the kidney are presented in Table 2, 3, 4, and 5.

The Cadmium contents in the kidneys of the mice fed a Cadmium-supplemented diet ranging from 5.59 ppm to 6.59 ppm(Table 2).

The administration of green juice unfortunately did not reduced the Cadmium accumulation in the kidney. As the concentration of Lead was increased, Lead level increased in the kidney of the mouse. The Lead content in the kidney of the Lead-supplemented mice was depressed by the administration of green juice. On the other hand, the elevated Selenium and Chromium contents in the kidneys of the mice fed a Selenium-supplemented or Chromium-supplemented diet were not reduced by the administration of green juice(Table 4, 5).

In Table 2, 3, 4, and 5, the experimental results on the effects of green juice on the contents of Cadmium, Lead, Selenium, and Chromium in the pancreas are presented. Generally, as the amount of selected elements was increased, the contents of elements in the pancreas were increased. But it was unusual that the content of Selenium in the pancreas of the mice fed a Selenium-supplemented diet was not elevated. The administration of green juice to the mice fed high amounts of Cadmium, Lead, Selenium, or Chromium did not show the reduction of Cadmium, Lead, Selenium or Chromium contents in the pancreas. The accumulation of Cadmium, Selenium, Lead, and Chromium in the internal organs, the liver, kidney, and pancreas, was increased as the dietary levels of these elements were incresed.

The effects of green juice administration of the contents in these elements of the internal organs varied according to the internal organs and the added elements themselves. In conclusion, although, it appeared that the green juice slightly reduced the contents of several elements, such as Cadmium, Lead, and Selenium in the internal organs, still, it was not clear whether green juice, nutrient-rich nutriment[22], always reduce the contents of toxic elements in the internal organs.

In the future, we need to study further about the specific components in green juice that reduced the contents of toxic elements in the internal organs.

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