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The Effect of Long-term Administration of Green Juice of *Angelica keiskei* Koidz on the Contents of Several Selected Elements of the Mouse Organs

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ABSTRACT

In order to study the content of selected elements in the organs of the mice, mice were fed with green juice of *Angelica keiskei* Koidz for 16 weeks. The results obtained from the experiments are summarized as follows :

1) The element contents(Cr, Mn, Ni, Cu, Zn, Cd, Ba, Pb and Fe)in the whole plant are generally the same as those of the previous reports.

2) The element contents(Cr, Mn, Ni, Cu, Zn, Cd, Ba, Pb and Fe)in the green juice did not exceed those of the edible water standard.

3) The element contents(Cr, Mn, Ni, Cu, Zn, Cd, Ba, Pb and Fe)in the bran is slightly higher than those in the whole plants.

4) The element contents(Cr, Ni, Pb and Fe) in the organs of the mice fed green juice for 16 weeks are the same as those of the previous reports. (*Korean J Nutrition* 30(9) : 1045~1049, 1997)

KEY WORDS : *Angelica keise* Koidz · toxic elements · mineral contents.

Introduction

Human beings have struggled for several centuries to develop nature and have benefited some benefits from the results of those efforts, but the developments result in many kinds of social problems[1]. Among these social problems, environmental pollution which devastes our environment appears as a serious problem that imperils mankind's subsistance. The environmental pollutants not only devastates but also affect our environment. even up to the arctic areas[2]. There is a close relationship among environment, soil, plants and animals. Consequently, if our environment is contaminated, soil, plants and animals will be polluted as a result. Likewise, many kinds of contaminants may enter the food chain in many different ways. natural soil constituents, fertilizer ingredients and contaminants, industrial contaminants, pesticides and environmental chemicals, such as Cadmium, Lead, Selenium, and Chromium from many sources, can enter and accumulate through the food chains not only in animals but also in human bodies.

At the present time 26 of 90 naturally occuring elements are known to be essential for human life. Among these essential elements, there are several essential inorganic elements. These consist of major inorganic elements, namely, Calcium, Phosphours, Potassium Soium, magnesium, and Chlorine, and some other elements generally accepted as trace ele-

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ments such as Zinc, Copper, Manganese, Nikel, Cobalt, Molybdenum, Selenium, Iodine, Fluorine, and other essential elements. In addition, there are also several elements accepted as toxic elements or industrial contaminants such as Mercury, Cadmium, Lead, and Chromium. Lead, Cadmium, Mercury and Chromium are classified as toxic elements because they show the biologically toxic effects at relatively low concentration. On the other hand, Calcium, for example, is a structural element for the major parts of the body and is required in fairly large amounts. Meanwhile, the so-called trace elements function as far as we know either as parts of hormones or enzymes, or as activators of enzymes are required in very small amounts[3)4)]. However, it should be also noted that certain of several nonessential elements occur in animal tissue in concentrations well above those of most of the essential trace elements[5)]. Furthermore, it is very important to know about that even the essential trace elements normally occur and function in living tissues in low concentration, and show adverse effects if they are introduced in certain elevated levels into animals. Moreover, these normal body concentrations and toxic levels vary greatly in magnitude and are characteristic for each element.

The requirements and tolerances of essential elements are normally affected by the level of other dietary minerals or other nutrients which influence the availability or utilization of the elements[6-13)]. Likewise, the tolerance or safe dietary levels of potentially toxic elements are also affected by other dietary nutrients. On the other hand, now-days, due to the environmental pollution, contaminants may easily enter the food sources via many different ways so that contaminants in forages and other feeds or food sources can be transmitted to animals and human beings[14)]. Therefore it is more than important to check regularly the levels of essential or non-essential toxic element contents in the raw food sources or processed foods and the green juice specially smashed and squeezed through the commercial juice maker.

The purpose of this research is to study the contents of several selected minerals of whole plants, commonly-usable resources of green juice and juice of *Angelica keiskei* Koidz. Furthermore, the mineral contents in the internal organs of the mice fed green juice for 16 weeks are also determined.

Materials and Methods

1. Experimental design, diet, operation, and animals

Female ICR mice averaging 35g in initial body weight were used. The mice were housed in plastic cages and a practical diet and water were supplied ad-libitum. Female ICR mice were fed one of two diets : control, to which practical diet were supplied and edible water were administered ; the green juice-administrated group, to which practical diet was supplied and green juice was administered. The green juice and same amount of water for the control group was orally introduced with a ball-tipped gastric inoculation needle for 16 weeks. Mortality occurring during the experiment was recovered, and the surviving mice were weighed weekly. The basal diet used in the study is shown in Table 1. At the end of experiment, after 16 weeks all surviving mice were killed and their livers, kidneys, and pancreases were removed for mineral analysis and saved. The *Angelica keiskei* koidz was purchased from the markets, and green juice was made by a commercial juice maker.

2. Tissue digestion and mineral analysis

Tissue and plastic ware used in storage of samples and analysis for minerals were cleansed 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 deionical water to appropriate volmes. The element(Cr, Mn, Ni, Cu, Zn, Cd, Ba, Pb and Fe) levels were determined by ICP-MAS at Korea Basic Science Center, Seoul Branch.

Chemical reagents were purchased from Junsei chemical, Yakuri pure chemical, and Kokusan chemical. All acids were analytical grade and were obtained from Fisher Scientific(Pittsbugh, Pt).

Results and Discussion

The average body weights for control and green

Table 1. Chemical composition of basal diet for mice

Chemical composition	Amount(%)
Crude protein	22.1
Crude fat	3.5
Crude ash	8.0
Crude fiber	5.0
Moisture	7.5
Calcium	0.6
Phosphours	0.4
Premix	1.3

*Premix : Supplied the following as milligrams per kilogram diet : thiamin HCl 20 : riboflavin 10 ; nicotinic acid 50 ; d-calcium pantothenate 20 ; pyridoxine HCl 6 ; biotin 2.0 ; folic acid 0.4 ; vitamin B_{12} 0.03 ; inositol 250 ; choline chloride 200 ; menadione sodium bisulfite 1.5 ; retinyl palmitate 3 ; dl-a-tocopheryl acetate 100 ; cholecalciferol 0.03. The vaitamins were mixed with glucose so that the mixture could be added at 2% of the diet.

Table 2. The effect of green juice on weight gain nd mortality

Groups	Animals	Period (weeks)	Weight (g)	Mortality (%)
Basal diet	20	16	39.39	0
Basal diet+ Green juice treated	20	16	37.55	0

Table 3. The mineral contents of whole plant, juice and bran of *Angelica keiskei* Koidz

Elements	Component		
	Whole plant	Juice	Bran
		ppb	
Cr	16.78± 0.72	19.95 ± 0.72	339.44± 5.50
Mn	791.3 ±15.39	948.9 ±23.60	1040.55±34.14
Ni	16.5 ± 1.48	17.67 ± 0.53	172.38± 3.56
Cu	40.75± 1.31	28.45 ± 0.90	77.9 ± 1.82
Zn	433.1 ±11.28	322.14 ± 8.10	756.12±10.73
Cd	1.18± 0.04	0.253± 0.040	3.25± 0.06
Ba	1.18± 0.04	0.253± 0.040	3.25± 0.06
Pb	0.00	0.00	16.34± 9.6
Fe	0.72± 0.02^a	0.77 ± 0.02^a	1.76± 0.03^a

a : ppm

juice-administrated mice ranged from 37 to 39g (Table 1). Administration of green juice slightly reduced body weight gain, but there was no significant difference in the growth rate between the two groups. No mortality occured in either treatments.

The mineral contents of whole plant, green juice, and bran of *Angelica keiskei* Koidz and presented in Table 3. The contents of several selected minerals

Table 4. The accumulation of chromium in organs of mice fed with green juice

Organs	Diet	
	Basal	Green juice treated
	ppm	
Liver	0.00	0.00
Pancreas	0.00	0.00
Kidney	0.00	0.00

are presented in Table 3. The Chromium content in the whole part, juice, and bran of *Angelica keiskei* Koidz is 16.78 ppb, 19.95 ppb, and 339.44 ppb, respectively. The reported level of Chromium in the plants ranged from 100 ppb to 500 ppb[15)16)]. Therefore, Chromium levels in the juice and bran did not exceed the general Chromium levels in the plants. The reported levels of Manganese in the food sources ranged from 20 ppm to 100 ppm[17)]. Comparing to the reported Manganese level in the food source, Manganese levels in the whole plant and juice are under safe level. The generally reported levels of selected elements in the plants or grains are as follows : Nickel, 300 to 600 ppb[18)] ; Copper, 1-400 ppm[17)19)] ; Zinc, 15-70 ppm[17)20)] ; Cadmium, 50-100 ppb[21)] ; Barium, 1-90 ppm[22)] ; Lead, 50-200 ppb[21)23)].

Considering the reported level of elements, the levels of several selected elements including Cadmium and Lead in the whole plant and juice of *Angelica keiskei* Koidz did not exceed the general levels of elements in the food sources. In addition, the contents of elements in juice did not exceed the standard levels of elements of the drinking water[24)]. The Chromium contents in the livers of mice fed green juice for 16 weeks is under 0.00 ppm(Table 4), and the reported Chromium levels in animal tissues ranged from 0.01 to 0.8 ppm[25)26)], so, we can suggest that the administration of green juice to mice for 16 weeks did not occur the accumulation of Chromium in liver of the mouse. Furthermore, no Chromium accumulation appeared in the pancreases and kidneys of the mouse administrated green juice for 16 weeks. The average content of pasture plants iron level usually contain 200-400 ppm[27)], even 2,000-5,000 ppm[28)]. Accordingly, we conclude that the element contents(Cr, Mn, Ni, Cu, Zn, Cd, Ba, Pb and Fe)in the whole plant are generally the same as those of

Table 5. The accumulation of lead in organs of mice fed with green juice

Organs	Diet	
	Basal	Green juice treated
	ppm	
Liver	0.00	0.00
Pancreas	0.12±0.04	0.17±0.03
Kidney	0.06±0.04	0.07±0.03

the previous reports.

The Lead conents of the mice fed green juice for 16 weeks are presented in the Table 5. The Lead contents of liver, pancreas, and kidney are 0.00 ppm, 0.12 ppm and 0.06 ppm, respectively. Therefore, the results of this study indicated that the Lead contents in the internal organs of the mice administrated green juice for 16 weeks was under the reported Lead contents. The generally reported Lead levels in animal tissues ranged from 0.1 to 0.25 ppm[21].

Nickel content in livers, pancreases and kidneys of the mouse administrated green juice for 16 weeks is 0.02 ppm, 0.04 – 0.06 ppm and 0.04 ppm, respectively(Table 6). The administration of green juice did not affect the contents of Nickel in the internal organs of the mice. The reported Nickel contents in animal tissues ranged from 2 to 3 ppm[29,30] thus it appeared that the administration of green juice did not result in accumulation of Nickel in the internal organs.

Iron contents in the internal organs of the mice administrated green juice for 16 weeks were not especially elevated(Table 7). The previously reported Iron contents in animal tissues ranged from 60 to 70 ppm[31], therefore, Iron contents in the internal organs of the mouse administrated green juice for 16 weeks were under the previously reported Iron contents in animal tissues except Iron contents in pancreas. Consequently, we can conclude that the element contents(Cr, Ni, Pb and Fe) in the organs of the mice fed green juice for 16 weeks are the same as those of the previous reports.

Table 6. The accumulation of nickel in organs of mice fed with green juice

Organs	Diet	
	Basal	Green juice treated
	ppm	
Liver	0.00	0.02±0.01
Pancreas	0.06±0.01	0.04±0.01
Kidney	0.03±0.01	0.04±0.01

Table 7. The accumulation of iron in organs of mice fed with green juice

Organs	Diet	
	Basal	Green juice treated
	ppm	
Liver	44.57±1.35	55.87±2.08
Pancreas	85.76±2.61	74.32±0.81
Kidney	22.11±0.43	46.12±0.69

In conclusion, green juice adinistration had little effect on mineral tissue levels, and mineral contents in the internal organs of the mice administrated green juice for 16 weeks are in keeping with previous reports. Further study of the mineral contents in the food sources and accumulations of food contaminants and minerals in the internal organs could potentially yield important information concerning human health or human welfare.

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