J. KOREAN SOC. FOOD NUTR.
16(2) 105~109 (1987)

A Study on the Mineral Contents of Dolwoe Tea (*Gynostemma pentaphyllum* Makino)

Young-Hee Park, Youn-Ho Hong and Won-Ki Park*

Department of Food Science and Nutrition, Chonnam National University, Kwangju
**Department of Food Science and Nutrition, Chosun University, Kwangju 500, Republic of Korea*

(*Received. March. 20 1987*)

돌외차(*Gynostemma pentaphyllum* Makino)의 무기성분에 관한 연구

朴英姬 · 洪潤鎬 · 朴圓記*

全南大學校 食品營養學科, *朝鮮大學校 食品營養學科

(1987, 3. 20 접수)

요 약

돌외를 채취해서 잎과 줄기로 나누어 각각 실험실에서 차로 제조한 것과 제품으로 시판되고 있는 국산품과 일본산 제품 및 국산품 볶은것에 대해 무기성분의 함량을 측정하고 비교하였다.

돌외차에 함유된 무기성분은 잎에서 Mg, Mn, Ca 및 Cu의 함량이 많았고 줄기에서 K, Na 및 Fe이 많이 함유되어 있었으며 특히 줄기중 총회분의 K의 함량이 33.4%로서 가장 높았다. 제조된 돌외차와 시판제품에서 차 4g을 1ℓ의 끓는물에 넣어 5분간 우려냈을 때 무기성분의 침출율은 K이 83.2~96.3%로 가장 높았으며 다음 Mg이 44.8~62.2% 이었고 Ca은 23.1~64.4%, Na은 6.3~55.6% 순이었으나 Mn, Fe 및 Cu등은 극히 미량만 침출되었다.

Abstract

The mineral content of Dolowe, which were prepared in the labortory and marketed Korean products of Dolwoe, Japanese product of Dolwoe and Korean-roasted products of Dolwoe were analyzed and compared.

Dolwoe-leaf tea had high mineral content of Ca, Mg, Mn and Cu, while Dolwone-stem tea had high mineral content of K, Na and Fe. Especially, in the ash of Dolwoe-stem tea showed the highest mineral content of K (33.4%). Dolwoe teas were extracted for 5 minutes as ratio of 1,000mℓ boiling water to 4g Dolwoe tea (250:1, v/w). Comparing the ratio of extraction of minerals in Dolwoe tea made by us and marketed Dolwoe products, K was the most abundant element of all extractions with the rate of 83.2%~96.3% followed by Mg with 44.8%~62.2%, Ca with 23.1%~64.4% and Na with 6.3%~55.6%. On the other hand Mn, Fe and Cu were extracted in extremely small quantities.

Acknowledgement

The authors wish to express their appreciation to professor T. Takemoto and professor N. Nishimoto of Tokushima Bunri University, Japan for their valuable information and kind assistance.

Introduction

Dolwoe belongs to the Cucurbitaceae family and has been called Deongulcha, Kamcha as a winding perennial plant and in recorded as Amacha-Zuru, Chilhubdan and Kyogonam[1]. According to Manchurian plant journal[2], the Dolwoe is distributed in Korea, China, the Soviet Union and Japan. Park[3] reported that a kind of Dolwoe is growing naturally in Korea, Japan and Malaysia. Chung[4] and Lee[5] reported that Dolwoe is growing naturally at Namhae, Goeje, Gosung, Jejudo and Wooleungdo in Korea.

In the study of Dolwoe constituents, Takemoto, et. al[6] identified 50 kinds of gypenoside in Dolwoe. They also found ginsenoside-Rb1, Rb3, Rd and F2-which are contained in Korean Ginseng. Park, et. al[7]. and Lim, et. al[8]. investigated the ingredients of saponin in Dolwoe and Ginseng to see whether they were the same in Dolwoe as in Korean Ginseng.

The objective of this study is to examine mineral content of Dolwoe tea which is an important constituent in Dolwoe tea.

Materials and Methods

Sample Preparation

The Dolwoe for this study was cultivated at Haenam-Gun, Chonnam, Korea. The length of vine of the samples was 100±20㎝(11±3 knots) and the average weight was 11.2gm. After dividing the plants into leaf and stem, the samples were steamed at 100℃ for 2 min. and dried[9] at 70℃ for 12 hours. The dried samples were ground to a size of 0.5㎜ with the cyclone sample mill. The ground Dolwoe tea(steamed and dried in the laboratory) was sealed tightly and stored in a cool place.

The Korean product and The Japanese one of mixed leaf and stem of Dolwoe were purchased from the market and used for the investigation. As for the Korean prodoct, half of the sample was roasted slightly, sealed and then stored in a cool place.

Chemical Analysis

Moisture content was determined by the method[10] of the Japanese Research Institute of Tea. The content of ash was measured by the AOAC procedures[11]. Crude proteins were determined by the micro-kjeldahl method using a conversion factor of 6.25. Crude lipids were determined by the Soxhlet method. Total carbohydrate was calculated by subtracting the content of moisture, ash, crude lipids and crude proteins from 100. Total sugars and reducing sugars were determined by the phenol-sulfuric acid method of Dubois, et. al[12] and the DNS method[13], respectively.

Mineral Component Analysis

Four grams of sample was ashed at 500℃ for 18 hours in a muffle furnace and dissolved by the dry ashing method.[14] Minerals of the residue and extract of Dolwoe tea were also determined. Four grams of sample were extracted from 1ℓ of water boiled for 5 min. and the residue was oven-dried at 105±5℃ and then prepared by the above-mentioned method. The extract of Dolwoe tea was used for determination of minerals. The content of the minerals in Dolwoe tea was measured by AAS(Hitachi 170-30 Atomic Absorption Spectrophotometer) with the conditions as shown in Table 1. The standard solutions used were stock solution (1,000 ppm) from Junsei Chemical(Japan).

Table 1. Analytical conditions of atomic absorption spectrophotometer

Elements	Lamp current (mA)	Slit	Wave length (nm)	Gas	Air flow (l/min)	Acetylene (l/min)
K	15	0.15	766.5	Fuel	8.0	2.7
Na	10	0.15	589.2	Fuel	8.0	2.7
Mg	10	0.15	280.4	Fuel	8.0	2.7
Mn	10	0.15	280.2	Fuel	8.0	2.7
Fe	15	0.15	248.8	Fuel	8.0	2.7
Ca	10	0.15	423.0	Fuel	8.0	2.7
Cu	10	0.15	325.2	Fuel	8.0	2.7

Result and Discussion

Proximate Compositions

The proximate composition of Dolwoe tea is shown in Table 2. The content of crude proteins of leaf in prepared Dolwoe tea was higher than that of stem. The content of curde proteins of the Korean-roasted sample was about 1.1% less than that of the Korean manufactured sample. The content of total carbohydrates of stem in prepared Dolwoe tea was higher than that of leaf and the content of total carbohydrates of the manufactured sample was in the range of 53.7~59.1%. The values of moisture and crude lipids in leaf were higher than those of prepared Green tea.[15] The ash content of Dolwoe tea was 2.5 times that of green tea. The value of crude proteins of green tea was 1.5 times that of Dolwoe tea and the content of total carbohydrates in both was similar.

Minerals

The content of minerals of prepared Dolwoe tea and products is shown in Table 3.

The content of K and Na of prepared Dolwoe stem tea was approximately 1.5 times and 2.3 times, respectively, that of leaf tea. The average content of K in products was approximately 2 times as much as that in Chung[16] which analyzed mineral of green tea and found the mean K content of Korean green tea to be 2,160*mg*/100*g*. The content of Na of the Korean product and the Japanese one was 32*mg* and 34*mg*, respectively, and was 63*mg* in the Korean-roasted sample. This result for Na in leaf tea was similar to the result of Takeo[17] who analyzed Na content of 31 kinds of steamed tea.

The content of Mg and Ca in prepared Dolwoe leaf tea was approximately 2.2 times and 3.8 times than that of stem tea. The content of Mn, Fe and Cu was measured in extremely

Table 2. Proximate composition of Dolwoe tea (%)

Samples \ Constituents		Moisture	Total carbohydrate	Crude Protein	Crude lipid	Ash
Prepard	leaf	4.1	55.4	19.4	7.5	13.5
	stem	9.6	60.0	11.4	6.0	13.1
Products	Korean	12.8	53.7	16.9	5.4	11.2
	Japanese	6.0	59.0	18.4	3.6	13.0
	Korean-roasted	7.5	59.1	15.8	4.9	12.7

Table 3. Content of minerals of Dolwoe tea (dry basis, *mg*/100*g*)

Samples \ Elements		K	Na	Mg	Mn	Fe	Ca	Cu
Prepared	leaf	3,219	29	1,404	8	21	1,746	1.2
	stem	4,849	66	641	4	20	464	0.4
Products	Korean	4,473	32	679	10	48	1,253	2.0
	Japanese	3,420	34	849	17	38	1,159	0.8
	Korean-roasted	4,111	63	846	12	54	759	1.5

small quantities.

The content of ash in prepared Dolwoe tea was approximately 13%, K had the highest content(22.8%) in the ash of leaf tea followed by Ca(12.4%) and Mg(10.0%). Other mineral content was in trace amount. In the case of stem tea, K had the highest content(33.4%) followed by Mg(4.4%) and Ca(3.2%). In the ash of products, K had the highest content (24.8~34.9%) followed by Ca(5.5~9.8%) and Mg(5.3~6.2%). Simoda[18] reported that the content of K, Mg, Ca, Fe, Mn and Zn was 1,548*mg*, 440*mg*, 499*mg*, 116.7*mg*, 88*mg* and 2.6*mg*, respectively in 100*g* of steamed green leaf tea. In Dolwoe tea, the content of K, Mg and Ca was higher than in green tea. However, Fe and Mn were lower. These differences suggest a difference in the kinds of tea, i,e. green tea was made from tea leaves, while Dolwoe tea was made from tea leaves and stems after drying totally.

The mineral content of Mg, Mn, Ca and Cu was higher in Dolwoe leaf tea and that of K, Na, and Fe was higher in stem tea.

The content of minerals of Dolwoe tea extraction is shown in Table 4.

All the samples were extracted for 5 minutes as ratio of 1,000*ml* boiling water to 4*g* Dolwoe tea(250:1, v/w). Comparing the rate of extraction of minerals in both Dolwoe tea prepared in the laboratory and products, K was the most extracted element at the rate of 83.2~96.3%

Table 4. Content of minerals in extract of Dolwoe tea (dry basis, *mg*/100*g*)

Samples \ Elements		K	Na	Mg	Mn	Fe	Ca	Cu
Prepared	Extract*	3,356	5	636	trace	trace	255	trace
	(%)**[a]	83.2	10.0	62.2	—	—	23.1	—
Korean	Extract	4,060	2	304	trace	trace	450	trace
	(%)**	90.8	6.3	44.8	—	—	35.9	—
Japanese	Extract	3,288	3	419	trace	trace	450	trace
	(%)**	96.1	8.8	49.4	—	—	38.8	—
Korean-roasted	Extract	3,957	35	467	trace	trace	489	trace
	(%)**	96.3	55.6	55.2	—	—	64.4	—

*Mixture of stem and leaf of Dolwoe tea(50:50)

**Rate of extraction

[a]Versus the mean value of leaf and stem from table 3

followed by Mg at 44.8~62.2%, Ca at 23.1~64.4% and Na at 6.3~55.6%. However, Mn, Fe and Cu were extracted in trace amounts. Kim. et. al.[19] reported that the infusion amount of minerals in green tea was higher when the extraction temperature was higher and the extraction time longer. Takeo[17] reported that the infusion amount of Ca at the first and second times was 83% of the total infusion amount: It can be concluded that the infusion amount of minerals in tea is affected by the extraction method.

References

1. Song, J.T.: Resource Plants in Korean, p.1002, Mido Publishing, Co., Seoul(1983)
2. Anonymous: Manchurian Flora, Taiwan Daily Newspaper Co., 6, 194(1932)
3. Park, M.K.: Korean Dicotyledon Flora (Herb), p.152, Jungeum Publishing Co. (1974)
4. Chung, K.S.: Medical Plants, Hewsletter of Research and Guidance, *Office of Rural Development, Korea*, **4**(2), 32~35.(1985)
5. Lee, C.B.: Illustrated flora of Korean, p.719, Hyangmoon Publishing Co.(1980)
6. Takemoto, T.: Yakugaku Zasshi, 103(2), 173~185.(1983)
7. Park, H. and Lee, M.K.: *Korean J. Ginseng Sci.*, **8**, 2(1984)
8. Lim, U.K. and Kim, H.J.: *Korean J. Crop Sci.*, **31**, 2(1986)
9. Anan, T., H. Takayanagi and K. Ikegaya: *Nippon Shokuhin Kogyo Gakkaish*, **32**(1), 43(1985)
10. Japanese Research Institute of Tea: *Analytical Method of Tea*, **6**, 167(1970)
11. A.O.A.C.: Official Method of Analysis, 14th ed., Association of Official Analytical Chemists, Washington, D.C.(1984)
12. Dubois, M., K.A. Gilles, J.K. Hamilton, P.A. Rebers and F. Smith: *Anal. Chem.* **28**(1956)
13. Miller, G.L.: *Anal. Chem.* **31**(3),(1959)
14. Chung, D.H, and Chang, H.K.: New Methods in Food Analysis, p.141, Samjoongdang Publishing Co., Seoul (1982)
15. Kim, C.M., Choi, J.H. and Oh, S.K.: *J. Korean Soc. Food Nutr.* **12**(2) (1983)
16. Chung, Y.M.: M.S. Thesis, Chonnam National University (1986)
17. Takeo, T.: *Nippon Shokuhin Kogyo Gakkaishi*, **27**(9), 445(1980)
18. Simoda, A.: Chemistry of Food Preparation, p.84, Chochang Publishing Co., Tokyo (1983)
19. Kim, Y.H. and Koh, J.B.: *J. Korean Soc. Food Nutr.* **14**(3),(1985)