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

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돌외차(*Gynostemma pentaphyllum* Makino)의 糖에 관한 연구

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요 약

돌외를 채취해서 잎과 줄기로 나누고 각각 실험실에서 차로 제조한 것과 제품으로 시판되고 있는 국산품과 일본산 제품 및 국산품 볶은 것에 대해 총당, 환원당 및 유리당 함량을 측정하고 비교하였다.

제조된 돌외차의 총당과 환원당 함량은 줄기가 잎의 2배 많았으며 한국산 제품과 일본산 제품의 함량은 비슷하였으나 볶은 것은 볶지 않은 한국산보다 총당이 17.2% 감소하였으며, 환원당은 40.9% 감소하였다.

돌외차에 함유된 유리당은 rhamnose, fructose, glucose 및 sucrose등이 확인되었다. 그 비율은 부위에 따라 차이가 많았으나 일반적으로 glucose〉 fructose〉 sucrose〉 rhamnose 순으로 조성되었고 일본산 제품의 rhamnose 함량이 한국산 제품보다 6배 많았으며 볶은 것은 전체적으로 유리당량이 낮았다.

Introduction

According to the Choongyak Large Dictionary,[1] Dolwoe is a safe herb and therefore it has been taken as tea or liquor. It is reported that the clinical effects of the Dolwoe are various, that is, it can prevent or cure liver function disorder, diabetes, hypertention, asthma, insomnia, disease of adults, etc.[2,11]

Park et. al.[3] and Lim et. al.[4] investigated about the saponins of *Gynostemma pentaphyllum*. Park et. al.[5] examined the mineral contents of Dolwoe tea and Lee[6] studied on the constituents of raw *Gynostemma pentaphyllum*.

The objective of this study is to analyze and compare the contents of total sugars, reducing sugars and free sugars in Dolwoe tea.

Materials and Methods

Sample Preparation

The dried Dolwoe-leaf tea and the Dolwoe-stem tea were made by the method of Park et. al.[5] The Korean product and the Japanese one of mixed leaf and stem of Dowoe were purchased from the market and used for the investigation. As for the Korean product, half of the sample was roasted slightly, sealed and then stored in a cool place.

Chemical Component Analysis

Total sugars and reducing sugars were determined by the phenol-sulfuric acid method of Dubois et. al.[7] and the DNS method,[8] respectively. For the analysis of free sugars, 3g samples of the prepared Dolwoe tea (leaf and stem) and marketed products were made and then prepared as shown in Fig. 1.

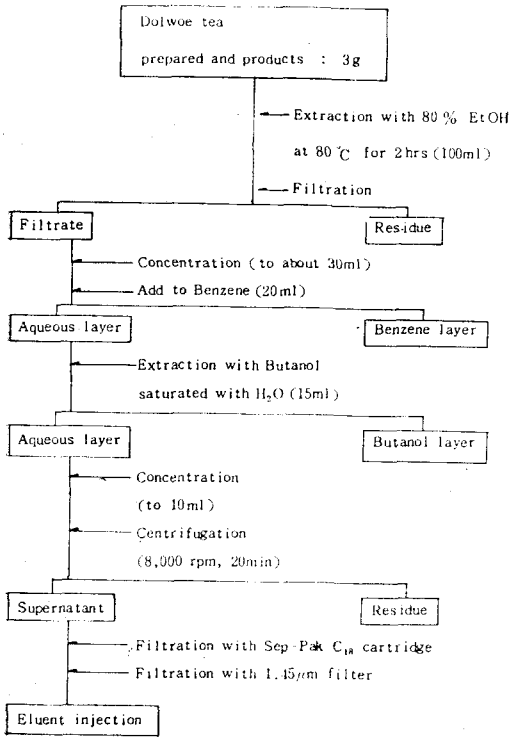

Fig. 1. Flow chart of preparation of free sugars in Dolwoe tea

The standard solution, from a mixture of 1mg/mℓ solution containing rhamnose, maltotriose and raffinos with a 5mg/mℓ solution containing fructose, glucose, sucrose and maltose, was determined by analytical high-pressure liquid chromatograph (model HPLC/ALL-244, Waters Associates, Inc., U.S.A) equipped with a differential refractive index detector (R-401) and a carbohydrate analysis column. A mobile phase of acetonitrile water in the ratio of 80: 20 was used for separation of sugars. The flow rate was 2.0mℓ/min. and 10 μl of sample was injected. Areas of the peaks of the samples were calculated and expressed relative to the areas with standard solutions.

Result and Discussion

Total Sugar and Reducing Sugar

The contents of total sugar and reducing sugar in Dolwoe tea are shown in Table 1. The contents of total sugar and reducing sugar in prepared Dolwoe stem tea were 2 times as high as those of leaf tea. These values in prepared Dolwoe leaf tea coincided with the data of Lee[9] reporting that the contents of total sugar and reducing sugar of green tea were 53mg/g and 27.2mg/g, respectively. The sugar content of Korean Dolwoe products was similar to that of the Japanese, but the total sugar and reducing sugar contents of the Korean-roasted sample were decreased to 17.2% and 40.9%, respectively. The decrease in reducing sugar suggested that it could be involved in the roasting process. This result coincided with the report of Kubota et. al.[10] They observed the changes in the contents of free amino acids and reducing sugars during roasting of green tea in order to study the aroma precursors of roasted green tea. Large decreases in the contents of free amino acids and reducing sugars were observed. (Table 1)

Table 1. Content of sugars in Dolwoe tea

(dry basis, *mg/g*)

Samples / Components	Prepared		Products		
	Leaf	Stem	Korean	Japanese	Korean-roasted
Total sugar	52.60	109.59	61.39	63.26	50.85
Reducing sugar	26.67	48.04	51.15	56.44	30.22

Table 2. Content of free sugars in Dolwoe tea

(dry basis, *mg/g*)

Samples / Components	Prepared		Products		
	Leaf	Stem	Korean	Janpanese	Korean-roasted
Rhamnose	0.35	0.34	0.42	2.49	0.26(38.1)*
Fructose	5.79	12.27	8.80	12.72	3.79(56.9)
Glucose	16.98	22.93	15.51	36.69	6.30(59.4)
Sucrose	5.75	3.69	0.29	0.35	0.05(82.8)

* Numbers in parentheses indicate percentages of loss for Korean product

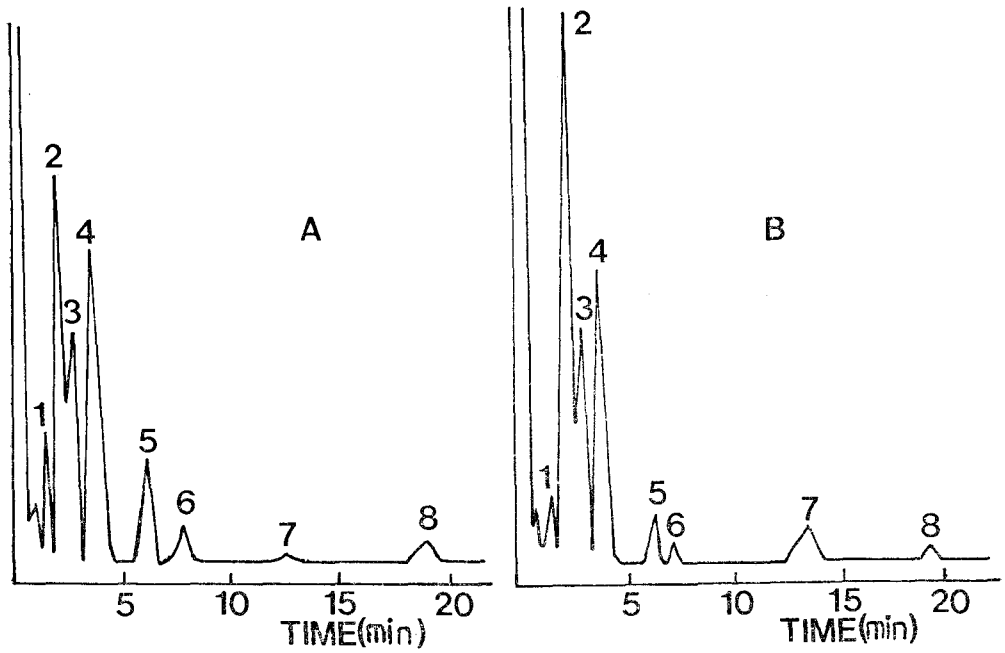

Fig. 2. HPLC chromatogram of free sugars in prepared Dolwoe tea

A; Leaf, B; Stem

1. Rhamnose 2. Unknown 3. Fructose 4. Glucose
5. Sucrose 6. Unknown 7. Unknown 8. Stachyose

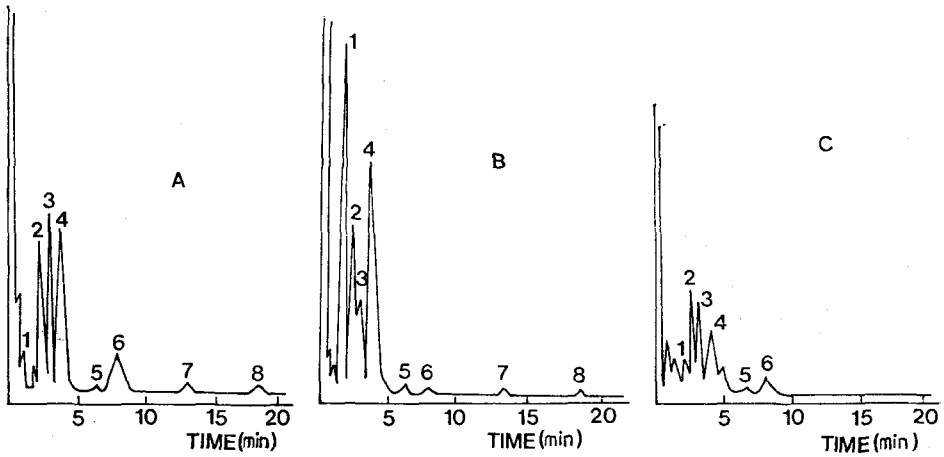

Fig. 3. HPLC chromatogram of free sugars in processed Dolwoe tea
A; Korean product, B; Japanese product C; Korean product-roasted
1. Rhamnose 2. Unknown 3. Fructose 4. Glucose
5. Sucrose 6. Unknown 7. Unknown 8. Stachyose

Free Sugars

Fig. 2 and 3 show that the HPLC chromatogram of free sugars of prepared Dolwoe tea (leaf and stem) and marketed products. The contents of free sugars of the sample were shown in Table 2.

It was confirmed that the free sugar components of Dolwoe tea are rhamnose, fructose, glucose and sucrose. But no raffinose was identified in green tea. It is remarkable that rhamnose was identified in Dolwoe tea. Glycosides, that is, combined with the gypenosides of Dolwoe are glucose, rhamnose, arabinose and xylose.[11] It can be assumed that rhamnose is broken down during the sample preparation. There is a report that rhamnose was identified in free sugars of red Ginseng by Choi et. al.[12] They explained that the glucose-rhamnose linkage is broken in a liquid solution, too.

Comparing the free sugar contents in prepared Dolwoe tea, glucose was the highest followed by fructose, sucrose and rhamnose. On the other hand, in marketed Dolwoe tea, glucose was the highest substance followed by fructose, rhamnose and sucrose.

The content of both rhamnose and total free sugar in the Japanese product were 6 times and 2 times, respectively as much as that of the Korean one. The free sugar content of the Korean-roasted sample was considerably low. The percentages of loss for the Korean product ranged from 38% to 83% and the rate of decrease of sucrose, fructose and glucose were remakable. This loss thought to be caused by the Maillard reaction between sugar and amino acid, which induced flavor such as aldehyde[13] and other intermediate products.

It was supposed that many unidentified unknown peaks might belong to arabinose and xylose. Peak number 8, an unknown peak, coincides with the stachyose identified by Lee[6] Also, an unknown peak which stood close to the peak of fructose may be xylitol which has the same location according to Lee's expeiment. More research in this area is necessary.

Abstract

The sugar contents of Dolwoe, which were prepared in the laboratory and marketed Ko-

rean products of Dolwoe, Japanese product of Dolwoe and Korean-roasted products of Dolwoe were analyzed and compared.

The contents of total sugar and reducing sugar of stem in prepared Dolwoe tea were 2 times higher than those of leaf. The sugar content of Korean product was similar to that of Japanese, but the contents of total sugar and reducing sugar in Korean-roasted sample decreased to 17.2% and 40.9%, respectively.

It was confirmed that free sugar in Dolwoe tea was composed of rhamnose, fructose, glucose and sucrose. The ratio of free sugar content was quite different between Dolwoe-leaf tea and Dolwoe-stem tea. Comparing the free sugar content in prepared Dolwoe tea, glucose was the highest followed by fructose, sucrose and rhamnose. On the other hand, in marketed Dolwoe tea, glucose was the highest substance and followed by fructose, rhamnose and sucrose. It was found that rhamnose content in Japanese product was approximately 6 times more than that of Korean.

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