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# Study on the Nutrient Composition of Hydroponic Water Dropwort

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Abstract

**This study was conducted to investigate the nutrient composition of hydroponic water dropwort and the effect of blanching condition on ascorbic acid content. Nutrient composition of hydroponic water dropwort of mid harvest on the 30th day was measured in three portions of leaves, petioles and stems, and was compared with that of late harvest on the 40th day. Hydroponic water dropwort was obtained from the Department of Horticultural Science, Seoul National University. The results were as follows. The nutrients content of leaves were significantly higher in ash and ascorbic acid and lower in moisture, crude fat and crude fiber than those of stems and petioles. There was no significant difference in total vitamin A and thiamin contents between three portions. Ascorbic acid content of leaves harvested on the 30th day was the highest, 57mg/100g, and decreased to 18mg/100g in the leaves harvested on the 40th day. Marked increase in crude fiber and vitamin A content of leaves was observed in late harvest may be due to the maturation. The results of nutrient composition analysis suggest that the leaves of hydroponic water dropwort is important in ascorbic acid and ash. It is recommended that shorter blanching time and addition of 0.5% NaCl to the blanching water are better for higher ascorbic acid retention of hydroponic water dropwort. In conclusion, as hydroponic water dropwort has high content in ash, calcium, vitamin and free sugar with alkalinity, leaves as well as stems and petioles can be recommended as a vegetable of high nutritional quality.**

**Key words** : hydroponic water dropwort, nutrient composition

## INTRODUCTION

Water dropwort is one of the more commonly used vegetables for human nutrition. Being a source of minerals, vitamins and dietary fiber (1-3) and of volatile components (4), it is generally regarded as a health food item. It has been reported (5) that the large amount of the extracts (750mg/kg) administered groups exhibited more rapid recovery of liver cell enlargement, edema, necrosis in carbon-tertrachloride treated rabbits. Traditionally, the stems of vegetables are used in food preparations like kimchi, a fermented vegetable preservation and various cooked vegetable dishes. Despite the frequent use of it, very little information on the nutrient composition of water dropwort can be found in the literature. Most work has been concerned with the development of hydronic system (6,7). However, it might not correspond with the consumers' wish for high nutritional quality. With the current recommendations of increasing vegetable consumption, information on the nutritional value of green leafy vegetables becomes even more important. The purpose of this study was to investigate the proximate composition and some minor constituents like minerals and vitamins of two hydroponic water dropwort samples as influenced by time of harvest and the effect of blanching condition on its ascorbic acid content.

## MATERIALS AND METHODS

### Samples

Samples of hydroponic water dropwort obtained from the Department of Horticultural Science, Seoul National University in Suwon, Korea were cultivated under defined water culture condition (6,7) on the 30th day for mid harvest and the 40th day for late harvest. The samples were thoroughly cleaned to remove the impurities with distilled water. Nutrient compositon of hydroponic water dropwort was measured in three portions of leaves, petioles and stems.

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### Analytical methods

Moisture content was determined by oven-drying at 103° C. Crude protein (6.25 × N), fat and fiber and total ash and alkalinity (ml/1N NaOH) were determined according to the standard methods of A.O.A.C .(8). Carbohydrate content was obtained by subtracting the sum of protein, fat, ash and moisture from 100. The concentrations of calcium, phosphorus, iron, potassium, sodium and magnesium were determined using a flame atomic absorption spectrophotometer (GBC 903 single beam). The samples ashed in the muffle furnace. Sample preparations for vitamin analyses were performed by Morris's method (9). Free sugar composition was determined using HPLC described by Wilson *et al.* (10).

### Statistical analysis

Comparison of means was done for three portions leaves, petioles and stems of hydronic water dropwort harvested on the 30th day and the results were analysed by one-way analysis of variance and the significance of differences among the portions of samples were determined using Duncan's multiple range test.

## RESULTS AND DISCUSSION

The proximate analysis and vitamin compositions of hydroponic water dropwort harvested on the 30th day are presented in Table 1. There were significant differences between three portions in their nutrient composition. The nutrient content in leaves of hydroponic water dropwort was significantly higher in ash and ascorbic acid and was lower in moisture, crude fat and fiber than those of stems and petioles. Especially, ascorbic acid content in leaves was 57±0.05mg/100g. There was no significant difference in total vitamin A and thiamin content between three portions.

The contents of minerals are given in Table 2. Potassium is the predominant element in the vegetable followed by phosphorus and calcium. In general, plants have higher content of potassium than of sodium. Sodium content was the lowest in hydroponic water dropwort.

The nutrient composition of hydroponic water dropwort harvested on the 40th day is given in Table 3. These results are in good agreement with the values reported by Kwon *et al.* (1) and Food Composition Table by RNI-RDA(2). The contents (per 100g) of protein (3.6g), crude fiber (3.1g), ash (1.58g), calcium (185mg), phosphorus (83mg), thiamin (0.53mg), riboflavin (0.13mg), niacin (2.0mg) and ascorbic acid (18mg) in leaves of late harvested hydronic water dropwort were comparatively higher than those of

**Table 1. Proximate and vitamin composition of hydroponic water dropwort harvested on the 30th day**

(per 100g EP)

| | Leaves | Petioles | Stems |
|---|---|---|---|
| Moisture (g) | 88±0.4[b] | 94±0.2[a] | 93±0.6[a] |
| Crude fat (g) | 0.45±0.09[b] | 0.52±0.05[b] | 0.90±0.15[a] |
| Crude fiber (g) | 0.57±0.02[b] | 0.84±0.01[a] | 0.91±0.04[a] |
| Ash (g) | 1.69±0.02[a] | 1.20±0.01[b] | 1.29±0.03[b] |
| Vitamin A (R.E.) | 220±57[NS] | 234±27 | 219±58 |
| Niacin (mg) | 0.37±0.02[b] | 0.40±0.07[b] | 0.7±0.05[a] |
| Ascorbic acid (mg) | 57±0.05[a] | 31±1.95[c] | 38±0.01[b] |

Values are mean±SE, [NS]Not significant

[a-c]Superscripts with different alphabets in rows are significantly different at $p<0.01$ by DUNCAN'S multiple range test

R.E : Estimated retinol equivalence : weighted for proportion of β-carotene and other-carotene in green leafy vegetables, ie., (total vitamin A, IU×0.75)×1/10+(total vitamin A, IU×0.25)×1/20

**Table 2. Contents of minerals in hydroponic water dropwort harvested on the 30th day**

| | mg per 100g EP |
|---|---|
| Calcium | 62 |
| Phosphorus | 66 |
| Iron | 4.7 |
| Potassium | 615 |
| Sodium | 0.07 |
| Magnesium | 0.22 |

**Table 3. Nutrient composition of hydroponic water dropwort harvested on the 40th day** (per 100g EP)

| | Leaves | Petioles and stems |
|---|---|---|
| Moisture (g) | 91.46 | 94.04 |
| Cude protein (g) | 3.6 | 1.6 |
| Crude fat (g) | 0.1 | 0.1 |
| Carbohydrates | | |
| Non-fibrous (g) | 3.26 | 3.05 |
| Crude fiber (g) | 3.1 | 2.1 |
| Ash (g) | 1.58 | 1.21 |
| Calcium (mg) | 185 | 62 |
| Phosphorus (mg) | 83 | 58 |
| Iron (mg) | 1.0 | 0.3 |
| Vitamin A (R.E.) | 1220 | 103 |
| Thiamin (mg) | 0.53 | 0.17 |
| Riboflavin (mg) | 0.13 | 0.08 |
| Niacin (mg) | 2.0 | 1.8 |
| Ascorbic acid (mg) | 18.0 | 6.4 |

**Table 4. Effects of blanching on ascorbic acid retention of hydroponic water dropwort harvested on the 30th day**

(% retention)

| Blanching time (min) | $H_2O$ : Vegetable ratio | | |
|---|---|---|---|
| | 3 times | 4 times | 5 times |
| 1 | $81 \pm 1.7^{A a}$ | $67 \pm 0.5^{B a}$ | $75 \pm 2.6^{A a}$ |
| 2 | $52 \pm 7.2^{NS b}$ | $52 \pm 4.9^{b}$ | $64 \pm 10.1^{a}$ |
| 4 | $26 \pm 4.0^{NS c}$ | $22 \pm 3.4^{c}$ | $20 \pm 1.6^{b}$ |

Values are mean ± SE, [NS]Not significant

[A,B]Superscripts with different large alphabets in rows are significantly different at $p<0.01$ by DUNCAN's multiple range test

[a-c]Superscripts with different small alphabets in rows are significantly different at $p<0.01$ by DUNCAN's multiple range test

**Table 5. Effect of salt on ascorbic acid retention of hydroponic water dropwort harvested on the 30th day**

(% retention)

| NaCl(%)[1] | Ascorbic acid |
|---|---|
| 0 | $52 \pm 7.2^{b}$ |
| 0.5 | $67 \pm 1.8^{a}$ |
| 1 | $40 \pm 2.6^{bc}$ |

[1]Blanching 2min. in $H_2O$ : vegetable ratio 3

Values are mean ± SE

[a-c]Superscripts with different alphabets in rows are significantly different at $p<0.01$ by DUNCAN's multiple range test

the results reported elsewhere (1,2). Moisture content and total ash values of hydroponic water dropwort on the 40th day were in a good agreement with the values (11) on the 30th day as presented in Table 1. However, a difference was found in crude fiber. The higher values of crude fiber in leaves and petioles on the 40th day (3.1g and 2.1g per 100g EP, respectively) against those on the 30th day (0.57 and 0.84 per 100g EP, respectively) may be due to the difference between time of harvest. Differences between time of harvest in the content of vitamin A and ascorbic acid were also observed. Six times higher values in vitamin A content of leaves and lower value in ascorbic acid in samples of late harvest compared with mid harvest may be caused by maturation.

Blanching time as well as addition of NaCl had significant effects on ascorbic acid retention of hydroponic water dropwort (Table 4 and 5). It is recommended that shorter blanching time and addition of 0.5% NaCl to the blanching water are better for the higher ascorbic acid retention of hydroponic water dropwort. As hydroponic water dropwort has high content in ash, calcium, vitamins and free sugar with it's alkalinity (Table 6), leaves as well as stems and petioles of fresh hydroponic water dropwort can be recommended as a vegetable of high nutritional quality.

**Table 6. Free sugar composition and alkalinity of hydroponic water dropwort harvested on the 30th day**

| | Leaves | Petioles | Stems |
|---|---|---|---|
| Fructose (mg) | $107 \pm 17^{c}$ | $518 \pm 11^{b}$ | $745 \pm 28^{a}$ |
| Glucose (mg) | $162 \pm 31^{c}$ | $454 \pm 33^{b}$ | $666 \pm 41^{a}$ |
| Sucrose (mg) | $618 \pm 60^{b}$ | $238 \pm 11^{b}$ | $637 \pm 42^{a}$ |
| Alkalinity | $12.2 \pm 0.6^{a}$ | $11.9 \pm 0.2^{a}$ | $8.7 \pm 0.5^{b}$ |

Values are mean ± SE

[a-c]Superscripts with different alphabets in rows are significantly different at $p<0.01$ by DUNCAN's multiple range test

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# 수경미나리의 영양성분 분석에 관한 연구

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## 요 약

수경미나리의 가식부위별 식용가치를 검토하고자 영양성분과 유리당 함량 및 알칼리도를 분석하였고, 데치기의 조건이 아스코르브산 보유율에 미치는 효과를 실험한 결과는 다음과 같다. 잎의 회분과 아스코르브산 함량은 엽경이나 줄기 보다 높았고 수분, 조지방 및 조섬유의 함량은 낮았다. 30일에 수확한 수경미나리의 비타민 A와 티아민 함량은 가식 부위 사이에서 유의성 있는 차이를 보이지 않았다. 30일에 수확한 수경미나리의 잎에는 아스코르브산 함량이 특히 높아서 57mg/100g이었다. 40일에 수확한 수경미나리의 성분은 30일의 것과 비슷했으나 조섬유 함량은 증가되었고, 잎의 아스코르브산 함량은 18mg으로 저하되었으나 비타민 A 함량은 6배로 증가되었다. 이러한 영양성분 함량의 변화는 숙성에 기인하는 것으로 사료된다. 이상의 결과는 수경미나리의 영양성분 중 회분과 아스코르브산 공급원으로서의 중요성을 시사한다. 수경미나리의 아스코르브산 보유율을 높였던 데치기 조건은 단시간 가열과 0.5% 식염 첨가였다. 수경미나리는 회분, 칼슘, 비타민 및 유리당의 급원으로서 또한 알칼리성 식품으로서, 엽경과 줄기 뿐만 아니라 잎을 생식할 수 있는 식용 및 영양적 가치를 확인할 수 있었다.