Determination of Nutrition facts, Anti-oxidation Activity and Inflammatory reactivity of *Salicornia herbacea L.* by different Solvent Extraction

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Abstract

The purpose of this study was to develop fuctional food using *Salicornia herbacea L.* Nutrition facts, free sugar were analyzed by dried sample and polyphenolic and flavonoid compounds, radical scavenging activity, inflammatory reactivity of the sample were analyzed by 0, 50, 100% prethanol solvent extraction in two location Ganghwa and Kimjea. The Nutrition facts showed 7.2 g/100g of moisture, 27.3 g/100g of Ash, 7.0 g/100g of fat, 1.7 g/100g of protein. The total dietary fiber was the highest fact, showed 56.3 g/100g. The total Mineral content was 5,788 mg/100g in Ganghwa, 9,477mg/100g in Kimjea. Na was high mineral contents in both location. The total free sugar content was 37.7 mg/g in Ganghwa, 10.6 mg/g in Kimjea, glucose and sucrose showed high value. The total polyphenol and flavonoid contents showed high value in 100% prethanol extracted (24.2 µg GAE/ml, 15.45 µg CE/ml), Kimjea was higher than Ganghwa. The DPPH and ABTS radical scavenging activity of 0, 50, 100% prethanol extracted expressed as FSC50 and RC50 values. FSC50 values of DPPH were 0% > 50% > 100%. RC50 values of ABTS were 0% > 50% > 100% The anti-inflammatory effect of the sample showed 100% prethanol extraction has the cytotoxic effects on RAW 264.7 cells.

Introduction

Hamcho, *Salicornia herbacea L.* is one of the well-known halophyte growing in the salt marshes in Korea. It has been used as a vegetable seasonly and a folk medicine to treat a diseases such as constipation, obesity, diabetes, cancer, skin care etc . Hamcho also is reported to a dietary source containing lots of minerals, particularly magnesium, calcium, potassium and dietary fibers and some resherch have indicated that extracts of Hamcho inhibited tyrosinase, thrombosis, oxidant activity too. According to find possibility of Hamco as a functional material, we do nutrient, anti-oxidation, inflammatory analysis using Hamcho which grown in Ganghwa and Kimjea

Materials & Methods

The samples of Hamcho were obtained from Ganghwa and Kimjea, grown in closed sea beach. These samples were dried at 55°C for 48hr. We ground dried sample using mixer. Grounded sample was extracted by 0%, 50%, 100% prethanol for DPPH, ABTS, Total polyphenol and flavonoid contents, cell toxity and anti-inflammatory experiment.

- **Nutrient , Mineral and free sugar** : Follow Korea food public code.
- **DPPH scavenging activity** : Each sample dissolved in ethanol (100 µL) was reacted to 100 µL of DPPH (0.2mM in ethanol) solution. The mixture was kept in a dark place for 30 min. The absorbance was analyzed at 520 nm.
- **ABTS scavenging activity**: Each sample dissolved in water (100 µL) was reacted to 100 µL of ABTS (2.45mM in potassium persulfate solution) solution. The mixture was kept in a dark place for 60 min. The absorbance was analyzed at 734 nm.
- **Total polyphenol** : Each sample dissolved in water (10 µL) was reacted to 200 µL of 2% Na_2CO_3 solution for 3 min and 10 µL of 50% Folin-Ciocalteu's solution for 15min. The absorbance was analyzed at 750 nm.
- **Total flavonoid** : Each sample dissolved in water (25 µL) was reacted to 100 µL of water, 7.5 µL of 5% NaNo2 for 6min, 15 µL of AlCl3•6H2O for 5min and 50 µL of NaOH for 11 min. The absorbance was analyzed at 510 nm.
- **Cell viability**: Each sample (100 µL) was reacted to RAW264.7 cell for 24hr(10,000cell 96 well plate). 100 µL of 10% EZ-cytox solution was added and reacted for 4hr. The absorbance was analyzed at 450 nm.
- **Anti-inflammatory reaction**: Each sample was reacted to TNF-α and IL-6 Kit of ELISA(R&D system).

Result

Table 1. Nutrient composition and mineral contents of dried *Salicornis herbacea L.* in Ganghwa and Saemangeum.

region		Ganghwa	Kimjea
Nutrient	Misture (g/100g)	11.9±0.04	2.6±0.01
	Ash (g/100g)	16.6±0.05	38.1±0.03
	Fat (g/100g)	4.8±0.07	9.3±0.19
	Protein (g/100g)	1.4±0.04	1.9±0.08
	Cabohydrate (g/100g)	65.4±0.08	48.1±0.27
	Total Dietary Fiber (g/100g)	56.3±0.46	28±0.58
Mineral	K (mg/100g)	893±17.95	1316.4±18.57
	P (mg/100g)	91±1.1	190.9±3.24
	Ca (mg/100g)	210.5±1.17	194.7±0.27
	Mg (mg/100g)	324.5±0.92	467.7±7.06
	Na (mg/100g)	3918±81.15	6868±147.22
	Cu (mg/100g)	-	-
	Fe (mg/100g)	21.3±0.05	4.4±0.12
	Mn (mg/100g)	2.2±0.01	3.8±0.03
	Zn (mg/100g)	0.7±0.02	0.7±0.09
	S (mg/100g)	329.4±18.34	434.6±13.07

- Both of sample has high mineral contents such as K, Ca, Mg, S over 200 mg/100g.
- Ganghwa has higher TDF(Total Dietary Fiber) and lower Na than Kimjea.

Table 2. Free sugar from *Salicornis herbacea L.*

free sugar (mg/g)	fructose	glucose	sucrose	maltose	raffinose	stachyose
Ganghwa	-	14.0	10.6	13.1	-	-
Saemangeum	-	-	10.6	-	-	-

Table 3. Charateristics of the 0, 50, 100% prethanol extract of *Salicornis herbacea L.*

		Yield(%)	Total polyphenols (µg garlic[1)]eq/ml)	Totla flavonoids (µg (+)-catechin[2)]eq/ml)
Ganghwa	0% prethanol	9.0	20.3±4.2	5.3±2.4
	50% prethanol	10.1	18±2.7	4.7±1.5
	100% prethanol	6.0	25.1±3	12±1.9
Saemangeum	0% prethanol	49.7	20.4±3.7	7.8±4.5
	50% prethanol	58.3	22.6±4.3	16±3.5
	100% prethanol	27.2	23.4±4.6	18.9±2.1

1) Garlic acid: Positive standard of total polyphenol analysis.
2) (+)-catechin acid: Positive standard of total flavonoid analysis.

- 50% prethanol extraction of Saemangeum has the highest yield 58.3% and 100% prethanol extraction of Ganghwa has the lowest yield 6.0%
- 100% prethanol extraction has high flavonoid (12, 18.9 µg (+)-catechin eq/ml) contents compare to others extraction.

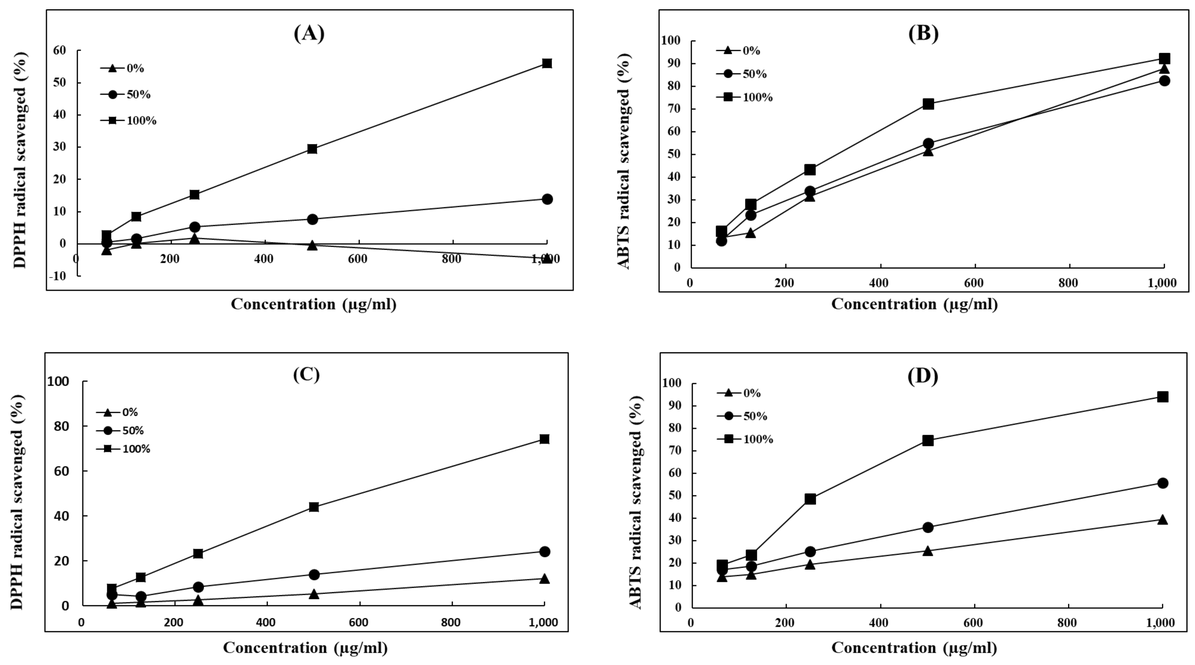

Figure 1. Concentration-dependant scavenging effects form 0, 50, 100% prethanol extract of *Salicornis herbacea L.* on DPPH(A), ABTS(B) in Ganghwa, DPPH(C), ABTS(D) in Saemangeum.

Table 4. The calculated FSC50s and RC50s as radical scavenging activity of the extracts of hamcho harvested in Ganghwa and Saemangeum.

		Radical scavenging activity (µg/ml)	
Chemical/samples		DPPH anion (FSC50[1)])	ABTS cation (RC50[2)])
Ganghwa	0% prethanol	NC[3)]	511.9
	50% prethanol	3567.2	507.7
	100% prethanol	882.0	381.6
Saemangeum	0% prethanol	4264.7	1391.9
	50% prethanol	2175.4	853.8
	100% prethanol	634.1	362.7

1) FSC50: Free radical scavenging concentration of 50% scavenging.
2) RC50: Radical scavenging concentration of 50% scavenging.
3) NC: Not calculated. Different superscripts within a column differ significantly.

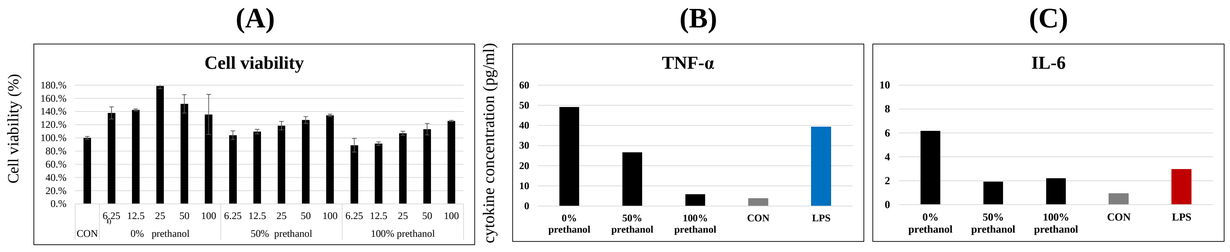

Figure 2. Effects of prethanol extraction form glasswort on cell viability and TNF-α, IL-6 production in RAW264.7 cell. The viability of RAW264.7 cell treated with 6.25-100µg/ml was analyzed for 24hr(A). Effects of each extraction on TNF-α production in LPS-stimulated RAW264.7 cells during 24 hr(B). Effects of each extraction on IL-6 production in LPS-stimulated RAW264.7 cells during 24 hr(C). 1) The concentrations of samples were 6.25-100 ppm

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