Study polysaccharide content and antioxidant properties of *Hericium* fermented cereal beverage

Su-Der Chen[1]*, Yu-Ting Lin[1], Yeong-Hsiang Cheng[2]

[1]Department of Food Science, National Ilan University, [2]Departmentof Animal Science, National Ilan University, I-Lan, Taiwan

Abstract

Hericium sp. is well known as a traditional and valuable mushroom in China. It can produce various bioactive components, such as polysaccharide etc. It can modulate immunity and remarkably cure gastric cancer and gastric ulcer. The objective of this research is to develop the fermented cereal *Hericium erinaces* beverage and to evaluate their antioxidant properties. The higher mycelial content and polysaccharide concentration were at pH 6.0 cereal medium for pre-activated *Hericium* at 25℃, 150 rpm one week. The polysaccharide content in the fermented cereal products after two-day *Hericium* fermentation was rice > adlay > oat > corn > wheat > soybean. Further the antioxidant properties such as scavenging DPPH ability, chelating ability of ferrous ion and reducing power of 5 mg/mL hot water extracts from the freeze-dried *Hericium* fermented products were analyzed. The scavenging DPPH abilities of *Hericium* fermented products were 45~65%. The chelating ferrous ion abilities of *Hericium* fermented products were 50%~90%, except 20% for oat. The reducing powers of *Hericium* fermented products were 0.6~0.9 absorbance at 700 nm. Finally, the viscosity, pH, total solid content, sugar and polysaccharide contents of the commercial rice milks and *Hericium* fermented rice milks were further studied. The pH, total solid, sugar and polysaccharide contents of the rice milks were about 6, 8~16%, 8~12˚Brix and 10~40 mg/mL, respectively.

Introduction

Hericium erinaceus is well known as a traditional Chinese medicine and functional food. This *Hericium erinaceus* contains polysaccharides, which exhibit immunomodulating activity, antitumor effects and antioxidant activity etc. The objectives of this study were (1) to investigate the effects of different cereal media and operation conditions on the production of polysaccharide by *Hericium erinaceus* submerged fermentation in a shake flask, (2) to analyze their antioxidant components and properties, and (3) to develop *Hericium erinaceus* fermentative rice milk.

Materials and methods

Hericium erinaceus (BCRC 36470)

↓

3% soy bean, 2% corn and 5% glucose medium for pre-activation at pH 3, 4, 5,6, 7 → 7 day → Mycelia dry weight / Polysaccharide

↓

3% cereal medium (soybean, oat, wheat, adlay, rice and corn)

↓

- Crude polysaccharide
  - Commercial rice milks
  - Fermented rice milks
  - → Total solid, Protein, pH, Sugar, Color, Viscosity
- Antioxidant properties
  - •Scavenging DPPH free radicals ability
  - • Ferrous ion-chelating ability
  - • Reducing power
  - • Total phenolics
  - • Flavonoid contents

Table 1. The mycelia dry weight and polysaccharide concentration of *H. erinaceus* in different initial pH cereal medium after seven-day cultivation

	Mycelia dry (g)	Polysaccharide (mg/mL)
pH 3	0.55 ± 0.02 c	12.98 ± 1.99 c
pH 4	0.65 ± 0.05 c	13.02 ± 1.17 c
pH 5	0.94 ± 0.10 b	13.96 ± 0.91 bc
pH 6	1.65 ± 0.31 a	17.89 ± 1.04 a
pH 7	1.09 ± 0.10 b	15.56 ± 1.04 ab

Table 2. Polysaccharide, total phenolics and flavonoid contents of two-day *H. erinaceus* fermentative grains

Cereal	Polysaccharide (mg/mL)	Total phenolic (mg/g)	Flavonoids (mg/g)
Soybean	7.06 ± 0.87f	4.71 ± 0.85a	0.63 ± 0.06a
Wheat	11.04 ± 0.25e	2.75 ± 0.47bc	0.25 ± 0.10b
Adlay	16.17 ± 0.32b	2.55 ± 1.03d	0.15 ± 0.09d
Oat	15.28 ± 0.14c	2.30 ± 0.11c	0.25 ± 0.14bc
Rice	26.37 ± 0.87a	2.38 ± 0.60c	0.14 ± 0.07d
Corn	12.97 ± 0.87d	3.60 ± 1.02ab	0.27 ± 0.16cd

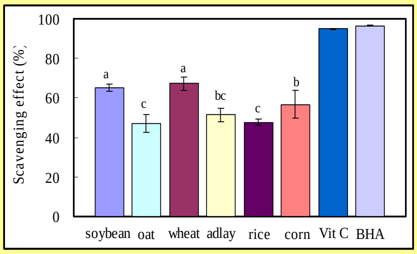

Fig. 1 Scavenging effect of hot water extracts form *H. erinaceus* submerged fermentative products on DPPH radicals

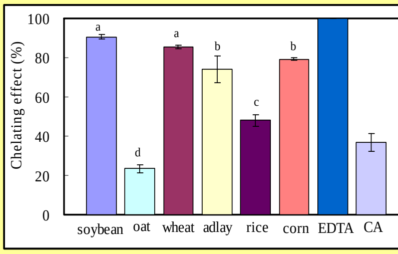

Fig. 2 Chelating effect of hot water extracts form *H. erinaceus* submerged fermentative products on ferrous ions

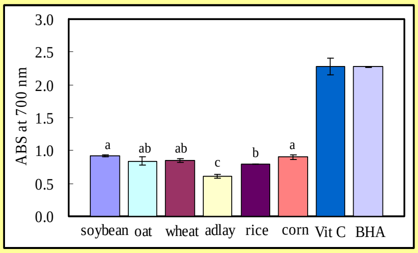

Fig. 3 Reducing power of hot water extracts form *H. erinaceus* submerged fermentative products

Table 3. The chemical analyses of commercial and *H. erinaceus* fermentative rice milks

Sample	Total solid (%)	Protein (%)	pH	Sugar (˚Brix)	Viscosity (cP)	Polysaccharide (mg/mL)
A	14.54 ± 0.004b	9.21 ± 0.61b	6.53 ± 0.03b	10.93 ± 0.12b	3460.28 ± 13.21c	11.24 ± 0.34e
B	11.05 ± 0.004e	12.64 ± 0.39a	6.94 ± 0.03a	9.67 ± 0.12d	798.27 ± 10.06f	21.72 ± 0.32d
C	16.10 ± 0.01a	4.22 ± 0.24c	6.22 ± 0.03c	12.67 ± 0.12a	722.52 ± 4.53g	27.35 ± 1.14cd
D	12.46 ± 0.02c	2.47 ± 0.29d	5.75 ± 0.06f	10.67 ± 0.12c	1282.24 ± 12.29e	32.29 ± 2.33b
5% rice	8.88 ± 0.06g	1.19 ± 0.14e	6.15 ± 0.01d	8.07 ± 0.06e	2588.33 ± 4.16d	30.24 ± 0.77c
7% rice	10.53 ± 0.004f	1.65 ± 0.44e	6.06 ± 0.03e	9.77 ± 0.06d	6089.99 ± 15.81b	45.57 ± 1.78a
9% rice	12.09 ± 0.02d	1.88 ± 0.54e	6.01 ± 0.01e	10.8 ± 0.10bc	13786.80 ± 8.87a	40.33 ± 5.45ab

Results and discussion

The pre-activated *Hericium erinaceus* medium was 3% soy bean, 2% corn and 5% glucose adjusting at different pH of 3~7 and inoculated seven days. The maximum amounts of mycelia and polysaccharide at pH 6 medium by *Hericium erinaceus* two-day liquid fermentation reached 1.65 g and 17.89 mg/mL (Table 1). The polysaccharide content of *Hericium erinaceus* fermentative cereal was rice > adlay > oat > corn > wheat > soybean (Table 2). The scavenging ability on DPPH radicals and chelating ability on ferrous ions of 5 mg/mL water extracts from fermentative soybean and wheat were the highest than other fermentative cereals (Fig. 1&2). Reducing powers of 5 mg/mL water extracts from fermentative cereals were 0.6~1 (Fig. 3). The different rice concentrations (5, 7, 9%) with 5% glucose were fermented by *Hericium erinaceus* to produce the *Hericium* fermentative rice milk. The compositions of four commercial rice milk products and *Hericium erinaceus* fermentative rice milks were analyzed in Table 3.

Conclusions

The higher polysaccharide contents of fermentative cereal media were obtained by *Hericium erinaceus* two-day 25℃, 150rpm shaking flask fermentation. They had the scavenging ability on DPPH radicals, reducing power and chelating ability on ferrous ions antioxidant properties. The *Hericium erinaceus* fermentative rice milks were developed due to their highest polysaccharide content among the fermentative cereals.

(IUFoST 2008) 14th World Congress of Food Science & Technology Oct.19-23 2008 Shanghai.China