Nutraceutical Components of Culinary-Medicinal Shiitake from Various Culture Conditions

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Introduction

Lentinus edodes (Shiitake) is an edible mushroom cultivated and marketed due to its nutritional and medicinal values (1-4). This mushroom is appreciated for its unique fragrant taste; its high dietetic potential is valuable for health and its bioactive molecules explain its interest as medicinal mushroom (5). Shiitake can be grown using various substrates and culture conditions (6). Our work focused on the comparison of nutraceutical compounds (i.e., amino acids and ergosterol) of *L. edodes* fruit bodies cultivated in organic or non-organic (O/NO) growing conditions in the French region of Occitanie (7-9).

Lentinus edodes

Material and methods

Shiitake fruit bodies were cultivated by three mushroom producers (9) in the French region of Occitanie using the strain Mycelia-3782 in various growing conditions (organic: producer B; non-organic: producers A and C).

Sequential extraction (C_6H_{12}, $CHCl_3$, EtOH, H_2O) under sonication was performed on freeze dried fungal materials.

Quantitative evaluation of amino acids was carried out for the ethanolic extracts using HP-TLC (550 nm, scanner CAMAG TLC 3), Mobile phase (BuOH, CH_3COOH, H_2O:3/1/1), Reagent Ninhydrin

Dosage of ergosterol was done using HPLC (CH_3OH, ACN:70/30, 280 nm).

Producer	Extracts	Ergosterol Concentration (mg/mg of extract)	Ergosterol Content (mg/100 g DW)
A	Cyclohexane	0.169 ± 0.012	294.43
	Chloroform	0.095 ± 0.006	
	Ethanol	0.001 ± 0.001	
	Water	< 0.001	
B	Cyclohexane	0.183 ± 0.016	478.21
	Chloroform	**0.15** ± 0.019	
	Ethanol	0.002 ± 0.001	
	Water	< 0.001	
C	Cyclohexane	**0.235** ± 0.016	341.29
	Chloroform	0.093 ± 0.013	
	Ethanol	0.001 ± 0.001	
	Water	< 0.001	

Ethanolic Extracts	Amino Acids Concentration (µg/mg of extract)		
	Alanine	Valine	Isoleucine
Producer A (NO)	**8.21** ± 0.46	3.77 ± 0.28	5.42 ± 0.17
Producer B (O)	**8.53** ± 0.25	3.71 ± 0.15	**7.29** ± 0.97
Producer C (NO)	5.92 ± 0.50	**5.17** ± 0.60	6.19 ± 0.71

Ergosterol, a Provitamin of Vitamin D

- Higher concentration is observed in the most apolar solvent as Shiitake cyclohexane extract of producer C (C>B>A)

- Concentration of ergosterol is from 1.22 (producer B) to 2.5 (producer C) higher in cyclohexane than in Shiitake chloroform extracts

- Shiitake fruit bodies from organic producer B have the highest ergosterol content

Essential and Non Essential Amino Acids

- Alanine (non essential amino acid): higher values for Shiitake fruit bodies from non organic producer A and organic producer B

- Valine (essential amino acid): higher value for Shiitake sporophores from non organic producer C

- Isoleucine (essential amino acid): higher value for Shiitake sporophores from organic producer B

Conclusion

For the both nutraceuticals (ergosterol and amino acids), differences were highlighted between extracts (depending on the nature of the solvents) and between growing conditions (organic versus non-organic culture conditions).

Extracts from organic producer B have the highest levels of isoleucine and alanine, and the lowest content of valine. Shiitake mushrooms of organic producer B contain a significantly higher level of ergosterol.

This work demonstrated that culture conditions *of L. edodes* influence the chemical profile of the harvested fruit bodies for nutraceuticals as ergosterol and amino acids. That could contribute to improve nutrition and human health.

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