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Selenium and Mercury Content of Some Edible Mushrooms

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During the last few years it was discovered that selenium has a protective effect against mercury toxicity (1, 2, 3).

The cause of this remarkable phenomenon is still obscure, but it is an established fact that fish, the food source containing most mercury, is also very rich in selenium. This may, at least, partly explain the tolerance of fish for high levels of mercury (4).

Recently, some papers were published on the mercury accumulating abilities of several species of fungi (5, 6, 7). It was, therefore, considered interesting to check whether the high mercury concentrations in these cryptogams were also accompanied by appreciable selenium levels.

A provisional answer to that question was obtained by determining the selenium contents in 12 samples of edible mushrooms according to a method which was recently developed by the present authors (8). In this procedure the sample, usually 0,5 g, was wet-ashed with nitric acid in a teflon and stainless steel decomposition vessel. After adding 4,5 dichloro-o-phenylenediamine to the digest at pH 1, the resulting dichloropiazselenol complex was extracted into toluene. After a simple cleanup step, the selenium complex was determined by gas chromatography, using an electron capture detector. Selenium standard solutions of suitable concentration, treated by the same procedure, were included with each set of samples. Mercury in the same samples was determined as reported earlier (1). The results of the analyses for both elements are listed in the following table.

Although these data are not sufficient to permit a definitive conclusion, it is worth noting that there is a correlation between the levels of the two elements: high mercury-high selenium and low mercury-low selenium, and in most samples the selenium contents were found to be higher than the concentrations of mercury. However, there are two notable exceptions: in the samples of cultivated A. bisporus the selenium level is significantly lower than the mercury content. Interestingly, the closely related A. arvensis species has much higher concentrations of both selenium and mercury and the former is somewhat higher than the latter.

This difference between mercury and selenium uptake in these two members of the same genus may be explained by assuming that the concentration of the trace elements in the fruit body is probably directly proportional to that already accumulated by the mycelium. In cultivated A. bisporus, the mycelium is rarely

Selenium and mercury content of edible mushrooms
Results expressed in ppm on dry weight

Commercial name	Species	Selenium	Mercury	Remarks
Dried boletus	Boletus edulis	11,8	4,0	
Dried boletus	Boletus edulis	13,0	3,2	Imported
Dried boletus	Boletus edulis	12,6	3,1	from
Dried boletus	Boletus edulis	18,6	4,8	Yougoslavia
Dried boletus	Boletus edulis	13,6	3,3	
Dried boletus	Boletus edulis	9,2	3,2	Gathered in a forest near Vevey (Switzerland)
Champignons de Paris lyophilised	Agaricus bisporus	0,34	0,72	Imported from Taiwan
Champignons de Paris lyophilised	Agaricus bisporus	0,08	0,17	Cultivated in Switzerland
Champignons de Paris lyophilised	Agaricus arvensis	7,8	6,5	Gathered on a lawn in Vevey (Switzerland)
Dried Gyromitres	Gyromitra esculenta	0,035	0,02	
Dried Morels	Morchella conica	0,11	0,07	
Chanterelle mushrooms canned	Cantharellus cibarius	0,14	0,03	Imported from Sweden

very old as it is renewed every 12 weeks to ensure a good yield of mushrooms. The uptake of mercury and selenium is, therefore, rather low. In the case of A. arvensis it could be established that the mycelium of this wildlife species was at least 10 years old (9), so that it had ample time to accumulate high levels of both trace elements.

The rate of accumulation from, and the concentration and availability of mercury and selenium in the substrate or soil should also be considered. The results of a number of soil analyses (samples were mainly of Swiss origin) performed in the authors' laboratory indicate that mercury is generally more abundant than selenium. This means that the rate of accumulation of selenium in a species as, for example, B. edulis far exceeds that of mercury.

For a correct interpretation of the selenium levels in mushrooms as reported in this paper, it should not be forgotten that these are expressed on a dry weight

basis. Calculated on fresh weight, by assuming a water content of 90 percent, B. edulis contains between 0,9 and 1,8 ppm of selenium, a concentration range that is quite comparable to that measured in seafoods such as salmon and shrimp (10).

Zusammenfassung

Untersuchungen an 12 Proben eßbarer Pilze haben gezeigt, daß es zwischen deren Quecksilber- und Seleniumgehalt eine Korrelation gibt. Diese Beobachtung ist interessant, da in jüngsten Veröffentlichungen gezeigt wurde, daß in Anwesenheit von Selenium die Toxizität des Quecksilbers herabgesetzt wird.

Résumé

Des analyses faites sur 12 échantillons de champignons comestibles ont montré qu'il y a une corrélation entre leurs teneurs en mercure et en sélénium. Cette observation est intéressante, parce que certains travaux récents ont montré que, en présence de sélénium la toxicité du mercure est diminuée.

Literature

1. *Ganther, H. E.* et al: Selenium: relation to decreased toxicity of methyl mercury added to diets containing tuna. Science **175**, 1122—1124 (1972).
2. *Ganther, H. E.* and *Sunde, M. L.:* Effect of tuna fish and selenium on the toxicity of methyl mercury — a progress report. J. Food Sci. **39**, 1—5 (1974).
3. *Stillings, B., Lagally, H., Soares, J.* and *Miller, D.:* Effects of cystine and selenium on the toxicological effects of methyl mercury in rats, 9th International Congress on Nutrition, in Mexico City Summaria 206 (1972).
4. *Newberne, P. M.:* Mercury in fish: a literature review. CRC Critical Review in Food Technology, January 1974, 311—335.
5. *Stegnar, P., Kosta, L., Byrne, A. R.* and *Ravnik, V.:* The accumulation of mercury by, and the occurrence of methyl mercury in, some fungi. Chemosphere **2**, 57—63 (1973).
6. *Schelenz, R.* and *Diehl, J. F.:* Quecksilber in Pilzen. Z. Lebensm. Unters. -Forsch. **154**, 160—161 (1974).
7. *Stijve, T.* and *Roschnik, R.:* Mercury and methyl mercury content of different species of fungi. Trav. chim. aliment. hyg. **65**, 209—220 (1974).
8. *Stijve, T.* and *Cardinale, E.:* Gas chromatographic determination of selenium via its dichloro piazselenol derivative — paper submitted for publication.
9. *Stijve, T.:* Unpublished mycological observations.
10. *Arthur, D.:* Selenium content of Canadian foods. Can. Inst. Food Sci. Technol. J. **5**, 165—169 (1972).

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