ACTA AGROBOTANICA
vol. 39, z. 1 — 1986
111–121

Nutritional values of different strains of mushrooms (*Agaricus bisporus*)

JÓZEF BĄKOWSKI, RYSZARD KOSSON and MARCIN HORBOWICZ

Research Institute of Vegetable Crops, Department of Processing and Freezing, 22 Lipca 1/3, 96-100 Skierniewice, Poland

(Received: November 7, 1984)

Abstract

The nutritional values and chemical composition of different strains of the mushroom (*Agaricus bisporus*) were studied. The study covered four strains cultivated in Poland: OCNOS-1, Somycel-11, Somycel-92, and Somycel-653. The samples were analyzed for dry matter, vitamin C, nitrates, nitrites, total nitrogen and crude protein (N×4.38), amino acid composition, soluble carbohydrates composition, and minerals content. Besides, whiteness values were determined by Hunter's method. All determinations were made on two of fruit-bodies of two sizes: 25–40 mm in pileus diameter (small) and 40–50 mm in pileus diameter (large). A significantly higher dry matter content was found in strain 1 in comparison with strain 92. The lowest value of total nitrogen was detected for strain 92 and the highest for strain 653. From among the four analyzed strains, strain 92 contained the highest amount of essential amino acids. Trehalose content was significantly lower in strain 11 in comparison with other strains both in small and large fruit-body.

INTRODUCTION

Information on mushroom composition is important from the point of view of nutritional values. To find the possible differences between strains of mushrooms (*Agaricus bisporus*) many investigators have been working and reporting their results. The mushroom generally contains between 88% and 91% moisture (Szymczak, 1972; Kurtzman, 1975; Crisan and Sands, 1978). Among many factors, dry matter of mushrooms is also affected by the type of strain. Gapiński and Glebionek (1978) comparing the dry matter content of fruit-bodies from different spawn varieties found, that the mushrooms from Somycel spawn S 53 (8.1%) exhibited highest dry matter content and from the local spawn B_2 (7.2%) the lowest.

Protein is the most critical component contributing to the nutritional value of food. The crude protein content of most foods is calculated from the nitrogen content using the conversion factor N×6.25. However, for the mushrooms, the Food and Agriculture Organization (1970, 1972) adopted the conversion factor N×4.38.

The main reason for this is the relatively high content in mushrooms of indigestible nitrogen substance — chitin. In the cell walls of *Agaricus bisporus* content of chitin ranges from 5.5 to 11.7% of dry matter (Więckowska, 1968; Młodecki et al., 1969; Hammond, 1979). Analyses of fresh *Agaricus bisporus* strains alone indicate a range of 24–34.8% of crude protein, based on dry weight (Crisan and Sands, 1978). Maggioni et al. (1968) found that specimens of *Agaricus bisporus* produced from Hauser spawn contained 27% crude protein, while those from Somycel 87 spawn contained 27–35%.

It is well documented that mushrooms contain all of the essential amino acids as well as most commonly occurring nonessential amino acids and amides. Of the total amino acids content 25–40% consists of essential amino acids (Maggioni and Renosto, 1970; Le Roux and Danglot, 1972; Crisan and Sands, 1978).

Several investigators have reported the levels of soluble carbohydrates in the sporophore of *Agaricus bisporus* (Hughes et al., 1958; Rast, 1965; Holtz, 1971). Mannitol occurs in large quantities, while trehalose, the other major soluble carbohydrate is present at lower levels. According to the investigations of Hammond and Nichols (1976) mannitol accumulated in the sporophore of *Agaricus bisporus* during growth rises from approximately 30 to 50% of dry weight, and trehalose falls from 5% to 1–2% of dry weight.

The mineral elements content of *Agaricus bisporus* is undoubtedly affected by the composition of the growth substrate. This is probably the reason why values of the mineral composition of *Agaricus bisporus* presented by various investigators are often different (Randoin and Billaud, 1956; Schall, 1962; Crisan and Sands, 1978; Gapiński and Glebionek, 1978). *Agaricus bisporus* has an especially high content of phosphorus, sodium and potassium.

MATERIALS AND METHODS

Description of strains and method of their cultivation

Strain OCNOS-1. Mushrooms of this strain are snow-white with medium sized fruit-body. The pilei are semicircular 5–6 cm in diameter. They are smooth without scales. The stipes are about 2 cm long and 1.5 cm in diameter slightly enlarged at the base. This strain is characterized by high stability of fruiting, giving fine mushrooms. The first flush can be obtained after three weeks. This strain fruits uniformly during three months. Flushes are obtained at ten-day intervals. During the first two months about 70% of the total yield are obtained.

Strain Somycel 653. The mushrooms of this strain are snow-white with middle-sized fruit-body and a tendency to form small fruit-bodies. The pileus is semicircular, smooth with a very delicate epidermis. Diameter of the pileus 5–5.5 cm; stipes are straight, cylindrical, comparatively thin, 2 cm long and 1.5 cm in diameter.

The mycelium of this strain is very vital and fruitful. This strain is called "Queen of mushrooms"; very well adapted to intensive growing (a few cycles in the year). During 7–8 weeks almost the total yield can be collected. Flushes are very intensive.

Strain Somycel 11. Mushrooms are white with smooths epidermis. This strain forms thick-fruit-bodies. Strong scales are developed when air circulation is strong. Pileus diameter 6–6.5 cm. Stipe is straight about 1 to 1.5 cm long slightly enlarged at the base. Mycelium of this strain gives very heavy fruit-bodies with high dry matter content, very suitable for dehydration. High yields with very intensive flushes are usually obtained.

Strain Somycel 92. Mushrooms are white thick-fruit-bodies with fleshy round pileus. Diameter 2.5 to 8 cm. Pileus is covered with a few scales depending on the growing conditions. Stipes are short, strong, slightly thicker at the base. Mushrooms are heavy and of very good quality, yields are high and flushes very intensive.

All the strains were cultivated on synthetic compost prepared on the basic of of rye straw, broiler chicken manure and gypsum. The sporophores of the mushrooms were divided into two classes:

I. Approximate diameter of pileus 25–40 mm (small).

II. Aproximate diameter of pileus 40–45 mm (large).

Analytical methods

The following determinations were done: dry matter, vitamin C, nitrates and nitrites, total nitrogen and crude protein (N×4.38), amino acid determination and objective colour determination. A description of this method was published by Bąkowski and Kosson (1985). In addition the content of soluble carbohydrates and mineral composition were analyzed. Extraction of carbohydrates and TMS ethers preparation were run according to the method of Kline et al. (1970) with some modifications. A Pye Unicam 204 gas chromatograph equipped with a flame ionization detector and glass column (1.5 m×3 mm) packed with 3% SE-30 of 60/80 mesh Gas Chrom Q was used for quantitative determinations of carbohydrates as TMS ethers. Gas chromatography operating conditions were as follows: injector temperature — +250°C, detector oven temperature — +300°C, carrier gas — argon at flow rate 60 cm^3/min. The column was operated at +150°C for 2 min., then a programmed increase of temperature at 8°C/min. to +300°C. Peak areas were measured with a DP-101 Computing Integrator.

Mineral composition of mushroom tissue with the exception of phosphorus, sulfur and boron was determined by atomic absorption spectrophotometry after digestion of dried ground material with concentrated nitric acid by warming on hot plate.

Phosphorus was determined colorimetrically (Nowosielski, 1974), sulfur and boron — according to the methods described in The Chemical Analysis of Plant Tissue (Cornell University, Ithaca, New York, 1966).

Confidence limit values of all results were evaluated using the Dean and Dixon (1951) test.

RESULTS AND DISCUSSION

The only significant difference in dry matter content was remarked between strain 1 and strain 92 for large fruit-bodies (Table 1). Vitamin C was significantly higher in strains 1 and 653 as compared with that in strains 11 and 92 (Table 1). The level of vitamin C is comparatively low ranging from 4.5 to 7.3 mg/100 g f.wt. (Table 1). The nitrate content is rather low and no differences between strains were observed (Table 1). Nitrites level is also low but noticeable, although differences between strains are not clearly visible because of high variations among samples (Table 1).

The tested strains belong to the white group of mushrooms therefore differences in whiteness were not detected.

The content of total nitrogen and crude protein is significantly lowest in strain 92 (Table 2). Total nitrogen for strain 92 is about 4.5% (expressed on dry weight basis) while for strain 653 it is about 7%.

The content of individual amino acids are differentiated and depend on the strain (Table 3). Total essential amino acids content varied from 25.7 g/16 g N for strain 653 to 32.6 g/16 g N for strain 92. The same observations can be achieved for total amino acids, where for strain 92 the highest value was also noted amounting to 78.8 g/16 g N, while the lowest value 64.7 g/16 g N was obtained for strain 653. Of the four analyzed strains the amino acids composition of two of them — strain 92 and strain 653 is very interesting because of the differentiated content of individual amino acids. Strain 92 contained the highest amount of histidine, valine, isoleucine, leucine, tyrosine, phenylalanine and a considerable amount of serine, glutamic acid, glycine, alanine and methionine. Strain 653 exhibited the lowest values of glycine, alanine, methionine, isoleucine, leucine and small amount of tyrosine. The values for individual amino acids for the two remaining strains 1 and 11 varied irregularly.

The above mentioned results could be explained by the frequent occurrence of non-protein nitrogenous compounds like chitin or urea influencing the total nitrogen content. Since the results in Table 3 are expressed in grams per 16 grams of nitrogen, lower levels of these non-protein compounds give higher values for individual amino acids. However, we did not analyse the non-protein nitrogenous compounds, but it is known from the literature that this kind of compounds are present in *Agaricus bisporus* in considerable amounts. (Altamura et al., 1967; Więckowska, 1968; Młodecki et al., 1969; Hammond, 1979).

Table 1

Contents of dry matter, vitamin C, nitrates, nitrites and values of whiteness in different strains of the mushroom (*Agaricus bisporus*)

Strain	Approx. diameter of the pileus mm	Dry matter* %	Vitamin C* (mg/100 g fresh weight)	Nitrates* (mg/100 g fresh weight)	Nitrites* (mg/100 g fresh weight)	Whiteness** values (Hunter L)
653	25–40	8.1±0.52	6.34±0.61	2.83±0.53	0.113±0.013	85.5±5.3
	40–50	7.9±1.07	7.28±0.61	2.82±0.70	0.094±0.027	88.0±3.5
1	25–40	9.0±1.31	6.18±0.0	2.26±0.36	0.048±0.014	85.0±3.4
	40–50	9.3±0.66	6.81±0.62	2.56±0.25	0.051±0.027	85.5±4.1
11	25–40	8.2±2.09	4.97±0.42	3.31±0.62	0.041±0.029	81.5±3.1
	40–50	7.9±1.30	4.49±0.44	2.86±0.25	0.043±0.007	79.7±6.0
92	25–40	7.5±0.85	5.29±0.22	4.13±1.70	0.063±0.044	83.6±9.1
	40–50	7.4±0.77	4.83±0.00	3.76±1.86	0.068±0.055	85.0±8.5

* Averages from three independent replicates ± confidence limits at p = 0.95, evaluated according to the Dean and Dixon test.

** Averages from 20 mushrooms ± confidence limits at p = 0.95, evaluated according to the Dean and Dixon test.

Table 2

Contents of the total nitrogen and crude protein (expressed on the dry weight basis) in four strains of the mushroom (*Agaricus bisporus*)*

Stage of sporophore development	Strain 653		Strain 1		Strain 11		Strain 92	
	total N %	crude protein N×4.38 %	total N %	crude protein N×4.38 %	total N %	crude protein N×4.38 %	total N %	crude protein N×4.38 %
Approx. diameter of pileus 25–40 mm	7.16±0.39	31.36±1.71	6.78±0.35	29.69±1.53	6.60±0.46	28.91±2.01	4.63±0.16	20.28±0.70
Approx. diameter of pileus 40–50 mm	6.81±0.30	29.83±1.31	6.81±0.23	29.83±1.01	6.17±0.30	27.02±1.31	4.44±0.22	19.45±0.96

* Averages from three independent replicates ± confidence limits at p = 0.95, evaluated according to the Dean and Dixon test.

Table 3

Amino acid composition (in grams per 16 grams of nitrogen) in different strains of the mushroom (*Agaricus bisporus*)*

Amino acid	Strain 653		Strain 1		Strain 11		Strain 92	
	g/16 g N							
	approximate diameter of the pileus							
	25–40 mm	40–50 mm	25–40 mm	40–50 mm	25–40 mm	40–50 mm	25–40 mm	40–50 mm
Lysine**	6.08±0.67	5.75±0.39	5.24±0.25	4.96±0.62	5.84±0.05	6.90±0.22	5.08±0.16	5.73±0.31
Histidine**	1.76±0.20	1.39±0.17	1.65±0.14	1.65±0.13	1.58±0.14	1.88±0.17	1.88±0.01	2.18±0.09
Arginine**	3.57±0.74	3.22±0.09	3.80±0.29	3.87±0.26	3.82±0.39	4.11±0.29	4.36±0.55	4.69±0.26
Aspartic acid	7.92±0.26	6.22±0.20	7.60±0.51	6.98±0.66	6.39±0.85	8.64±0.42	7.45±0.41	8.08±0.12
Threonine**	2.89±0.20	2.59±0.14	3.69±0.44	3.04±0.39	3.02±0.38	3.40±0.14	4.24±0.02	4.23±0.15
Serine	2.87±0.28	2.51±0.10	3.39±0.39	3.14±0.32	3.09±0.36	3.65±0.31	4.27±0.27	3.56±0.16
Glutamic acid	13.80±0.80	12.87±1.35	18.17±2.30	15.29±1.88	14.81±1.10	17.72±0.76	18.01±1.30	15.09±0.54
Proline	5.61±0.43	5.10±0.13	6.11±0.88	6.97±0.67	4.04±0.44	4.61±0.39	4.99±0.26	4.63±0.13
Glycine	3.11±0.22	2.85±0.11	3.77±0.30	3.62±0.53	3.38±0.30	3.81±0.13	3.72±0.12	3.72±0.34
Alanine	4.58±0.10	3.91±0.21	5.28±0.19	4.87±0.38	4.77±0.29	5.47±0.38	5.12±0.39	4.84±0.31
Valine**	3.56±0.28	3.12±0.36	3.51±0.22	3.53±0.17	3.40±0.16	3.72±0.21	4.05±0.28	4.27±0.14
Methionine**	0.90±0.10	0.77±0.01	1.18±0.10	1.10±0.09	1.08±0.09	1.16±0.16	1.10±0.05	1.22±0.05
Isoleucine**	2.53±0.07	1.99±0.28	2.68±0.06	2.60±0.15	2.57±0.12	2.97±0.10	3.61±0.06	3.31±0.16
Leucine**	4.05±0.14	3.96±0.73	4.57±0.18	4.48±0.20	4.70±0.36	5.02±0.28	5.79±0.11	5.56±0.12
Tyrosine**	2.16±0.11	2.13±0.06	2.64±0.46	2.13±0.30	2.06±0.19	2.38±0.13	3.00±0.04	2.70±0.08
Phenyloalanine**	3.23±0.22	2.47±0.31	2.72±0.21	3.05±0.19	2.67±0.18	2.81±0.26	3.84±0.07	3.36±0.22
Total essential amino acids**	27.16	24.17	27.88	26.54	26.92	30.24	32.59	32.56
Total amino acid	68.62	60.85	76.00	71.28	67.20	78.25	80.51	77.17

* Averages from three independent replicates ± confidence limits at $p = 0.95$, evaluated according to the Dean and Dixon test.

** Essential amino acids.

Mannitol content varied from 1.77 (strain 11) to 2.23 g/100 g f.wt. (strain 92), but the differences are not statistically significant because of wide variation especially in strain 92 (Fig. 1). Trehalose content is significantly lower in strain 11 as compared with all the remaining strains, both for small fruit-bodies and for large ones (Fig. 2). Trehalose content in strain 653 is more than threefold higher in comparison with strain 11, being respectively (averages for both sizes mushroom) 173.1 and 49.7 mg/100 g f.wt. As seen in Figure 2, two strains, 92 and 11, contain higher amounts of glucose than the remaining ones, 653 and 1, however, the results are not always statistically significant because of wide variations among samples. When comparing trehalose and glucose contents in strains 653 and 11, an interesting trend can be observed. In each case a higher amount of trehalose is connected with a lower amount of glucose and conversely. This phenomenon could be due to different trehalose breakdown in the investigated strains. A similar mechanism was observed in *Agaricus bisporus* by Hammond and Nichols (1977).

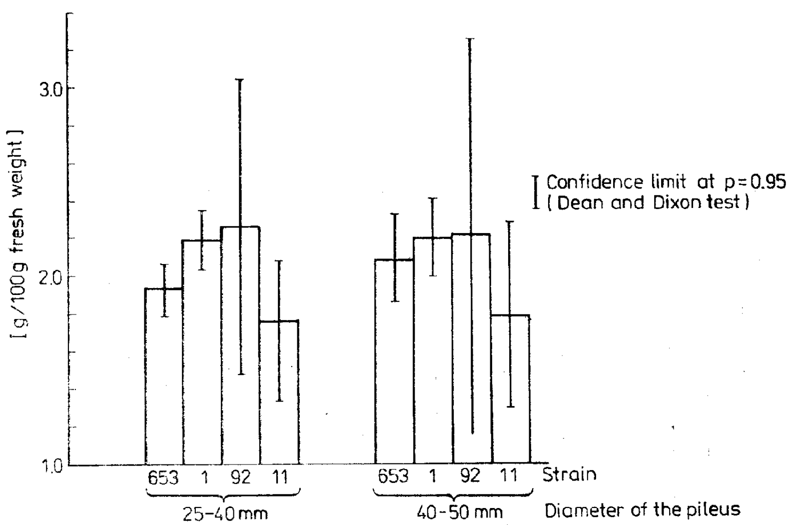

Fig. 1. Content of mannitol in different strains of the mushroom (*Agaricus bisporus*)

The effect of strains was noted in this experiment. Some differences were statistically proved for potassium, calcium, magnesium and iron between strains 92 and the remaining ones. Strain 92 contained the highest amounts of the above mentioned elements. Strain 653 was characterized by the lowest quantity of calcium, magnesium and boron. No differences were observed in the amounts of phosphorus and cobalt between the tested strains (Table 4). Literature data concerning the mineral composition of mushrooms are highly variable (Randoin and Billaud, 1956; Schall, 1962; Crisan and Sands, 1978; Gapiński and Glebionek, 1978). It seems to us that the values of minerals presented by different authors should not be interpreted in absolute figures, but rather as indicative of the order of magnitude to be expected.

Table

Contents of macro- and microelements (expressed on a fresh weight

Strain	Approximate diameter of the pileus mm	K (mg/100g)	P (mg/100g)	Ca (mg/100g)	Mg (mg/100g)
653	25–40	247.7±22.6	47.1±9.6	1.78±0.54	8.03±0.64
	40–50	255.3±24.2	51.4±15.9	1.97±0.54	8.08±0.82
1	25–40	173.4±31.5	56.4±18.1	1.86±0.84	8.09±1.48
	40–50	234.4±22.0	52.3±7.8	2.52±0.76	8.28±0.71
11	25–40	200.5±28.3	71.3±15.1	2.11±0.29	8.21±2.57
	40–50	211.6±34.2	60.9±11.1	3.53±0.99	8.09±0.99
92	25–40	309.8±27.6	53.5±14.9	2.86±0.33	10.34±1.26
	40–50	361.1±27.3	54.4±15.5	3.95±0.60	10.33±0.39

* Averages from three independent replicates ± confidence limits at p = 0.95, evaluated according to the Dean

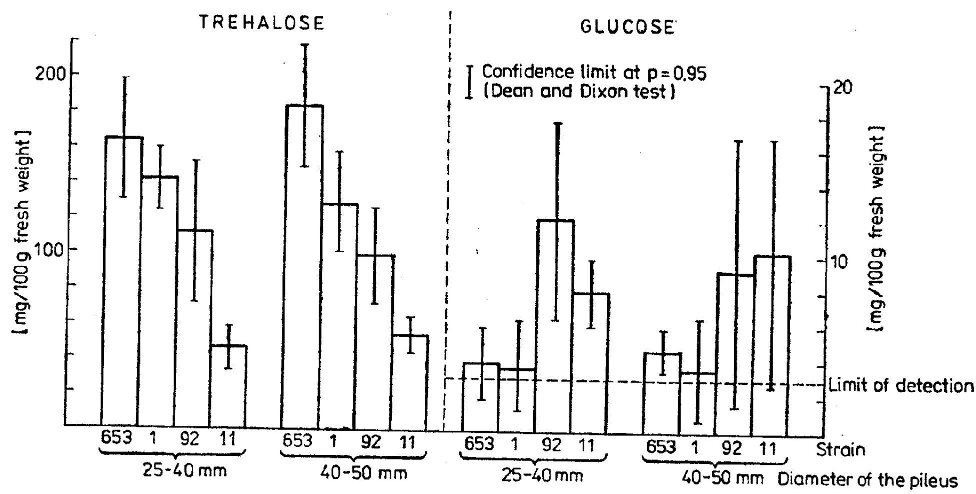

Fig. 2. Contents of trehalose and glucose in different strains of the mushroom (*Agaricus bisporus*)

CONCLUSION

1. A significantly higher dry matter content was found in strain 1 in comparison with strain 92.

2. The lowest value of total nitrogen and crude protein was detected for strain 92 and the highest for strain 653.

3. Vitamin C content was significantly higher in strain 1 and 653 in comparison with strains 11 and 92. The level of vitamin C is comparatively low, ranging from 4.5 to 7.3 mg/100 g f.wt.

4

basis in different strains of the mushroom (*Agaricus bisporus*)*

S (mg/100g)	Cu (mg/100g)	Zn (mg/100g)	Fe (mg/100g)	Mn (μg/100g)	Co (μg/100g)	B (μg/100g)
28.1±2.3	0.40±0.026	0.46±0.104	0.21±0.039	50.0±15.6	21.0±6.5	44.4±11.8
25.0±4.9	0.39±0.052	0.51±0.065	0.20±0.026	40.2±14.3	19.8±11.1	50.9±9.2
29.2±1.6	0.44±0.091	0.50±0.039	0.20±0.065	64.1±2.6	26.4±10.1	67.3±7.7
28.5±3.2	0.43±0.039	0.53±0.057	0.23±0.065	59.4±11.7	23.8±10.2	93.9±21.2
24.5±3.2	0.33±0.13	0.46±0.143	0.22±0.078	56.5±7.8	21.3±4.1	83.4±15.9
21.7±1.8	0.34±0.026	0.48±0.104	0.22±0.052	55.2±3.9	20.2±6.3	60.8±11.0
20.3±2.3	0.30±0.065	0.38±0.052	0.35±0.052	70.1±3.9	23.9±4.7	91.1±10.3
19.3±1.4	0.30±0.052	0.37±0.104	0.37±0.091	50.0±22.1	24.6±5.9	73.5±6.5

and Dixon test.

4. The nitrate content is rather low and no differences between strains were observed. So is the nitrites level, but noticeable and the differences between strains are not clearly visible because of high variations among samples.

5. Of the four analyzed strains, strain 92 contained the highest amount of histidine, valine, isoleucine, tyrosine, phenylalanine, and considerable amounts of serine, glutamic acid, glycine, alanine, methionine; strain 653 exhibited the lowest value of glycine, alanine, methionine and isoleucine.

6. Trehalose content is significantly lower in strain 11 in comparison with all the remaining ones for small and large fruit-bodies. Trehalose content in strain 653 is more than threefold higher in comparison with strain 11.

7. Strain 92 contained higher amounts of potassium, calcium, magnesium and iron, while strain 653 was characterized by the lowest quantity of calcium, magnesium and boron.

Acknowledgments

This work was supported by funds made available from the Maria Skłodowska-Curie Fund (Grant No PL-ARS-95 (P-103)) established by contributions of the United States and the Polish Government.

REFERENCES

Altamura M. R., Robbins F. M., Androetti R. E., Long L., Jr., Hasselstrom I. 1967. Mushroom ninhydrin — positive compounds. Amino acids, related compounds and other nitrogenous substances found in cultivated mushroom, *Agaricus campestris*. J. Agric. Food Chem. 15: 1040–1043.

Bąkowski J., Kosson R., 1985. Nutritional values and amino acids composition of the mushroom (*Agaricus bisporus*) at different stages of its development. Acta Agrobot. 38, 2: 00–000.

Crisan E. V., Sands A., 1978. Nutritional value. [In:] The biology and cultivation of edible mushrooms. part 6 edt. by S. T. Chang and W. A. Hayes, Academic Press Inc. pp. 137–168.

Dean R. B., Dixon W. J., 1951. [In:] Laboratory manual for food and processors. AVI Publishing Comp. Inc., Westport, Connecticut. 1968, 2, p. 28.

Food and Agriculture Organization, 1970. Amino acid content of foods and biological data on proteins. Nutr. Stud., No. 24. Food Policy and Food Sci. Serv. Nutr. Div., Food Agric. Organ. U. N., Rome.

Food and Agriculture Organization, 1972. Food composition table for use in East Asia. Food Policy and Nutr. Div. Food Agric. Organ. U. N., Rome.

Gapiński M., Glebionek Z., 1978. Porównanie plonowania kilku odmian grzybni pieczarek o owocnikach białych. Rocz. Akad. Rol. Poznań 98: 61–70.

Hammond J. B. W., Nichols R., 1976. Carbohydrate metabolism in *Agaricus bisporus* (Lange) Sing.: Changes in soluble carbohydrates during growth of mycelium and sporophore. J. Gen. Microbiol. 93: 309–320.

Hammond J. B. W., Nichols R., 1977. Carbohydrate metabolism in *Agaricus bisporus* (Lange) Sing.: Metabolism of ^{14}C labelled sugars by sporophores and mycelium. New Phytol. 79: 315–325.

Hammond J. B. W., 1979. Changes in composition of harvested mushrooms (*Agaricus bisporus*). Phytochemistry 18: 415–418.

Holtz R. B., 1971. Qualitative and quantitative analyses of free neutral carbohydrates in mushroom tissue by gas-liquid chromatography and mass spectrometry. J. Agric. Food Chem. 19: 1272–1273.

Hughes D. H., Lynch D. L., Somers G. F., 1958. Chromatographic identification of the amino acids and carbohydrates in the cultivated mushroom *Agaricus campestris* L. ex. Fries. J. Agric. Food Chem. 6: 850–853.

Kline D. A., Fernandez-Flores E., Johnson A. R., 1970. Quantitative determination of sugars in fruits by GLC separation of TMS derivatives. J. AOAC. 53: 1198–1202.

Kurtzman R. H., 1975. Mushroom as source of food protein. [In:] Protein nutritional quality of foods and feeds., part 2. M. Friedman edt., M. Dekker Inc., New York, 305–317.

Le Roux D., Danglot Y., 1972. Composition chimique et valuer alimentaire du champignon cultive (*Agaricus bisporus*) en function des conditions de stockage. Mushroom Sci. 8: 471–474.

Maggioni A., Passera C., Renosto F., Benetti W., 1968. Composition of cultivated mushrooms (*Agaricus bisporus*) during the growing cycle as affected by the nitrogen source introduced in composting. J. Agric. Food Chem. 16: 517–519.

Maggioni A., Renosto F., 1970. Variazioni delle compozizione del fungo coltivato (*Agaricus bisporus*) nei processi d'inscatolamento e di conservazione in salamoia. Ind. Conserve 45: 311–314.

Młodecki H., Więckowska E., Chądzyńska H., 1969. Oznaczanie chityny w grzybach za pomocą ilościowego ujęcia glukozoaminy w hydrolizatach. Mikologia Stosowana 2: 89–94.

Nowosielski O., 1974. Metody oznaczania potrzeb nawożenia. PWRiL, W-wa.

Randoin C., Billaud S., 1956. Composition chimique et valeur nutritive du champignon de couche. Mushroom Sci. III, 59.

Rast D., 1965. Zur stoffwechselphysiologischen Bedeutung von Mannit und Trehalose in *Agaricus bisporus*. Planta 64: 81–93.

Schall H., 1962. Nahrungsmitteltabelle (18 Aufl.), Leipzig.

Szymczak J., 1972. Zmiany składu chemicznego w czasie rozwoju owocników pieczarki *Agaricus bisporus* (Lange). Bromat. Chem. Toksyk. 5: 5–8.

Więckowska E., 1968. Oznaczanie chityny w grzybach. Mikologia Stosowana 1: 65–71.

Wartość odżywcza różnych ras pieczarek (*Agaricus bisporus*)

Streszczenie

Przeprowadzone zostały badania wartości odżywczych i składników chemicznych różnych ras pieczarek (*Agaricus bisporus*). Badano cztery rasy pieczarek uprawianych w Polsce: OCNOS-1, Somycel 11, Somycel 92 i Somycel 653. Przeprowadzono analizy suchej masy, witaminy C, azotanów i azotynów, azotu organicznego i białka surowego (N×4.38), składu aminokwasowego, węglowodanów rozpuszczalnych i składu mineralnego. Wykonano oznaczenie białości używając aparatu Huntera. Wszystkie oznaczenia przeprowadzono na owocnikach o dwóch wielkościach: 25–40 mm (małe) i 40–50 mm (duże). Istotnie większą zawartość suchej masy zaobserwowano u rasy OCNOS-1 w porównaniu z rasą Somycel 92. Najmniejszą zawartością azotu i białka charakteryzowała się rasa Somycel 92, a największą rasa Somycel 653. W pieczarkach rasy OCNOS-1 i Somycel 653 stwierdzono więcej witaminy C w porównaniu do ras Somycel 11 i Somycel 92. Nie stwierdzono różnic w zawartości azotanów pomiędzy rasami grzybów. Poziom zawartości azotynów w pieczarkach jest bardzo niski, a różnice międzyrasowe niezbyt wyraźne z powodu dużej zmienności w wynikach dla poszczególnych próbek. Spośród czterech analizowanych ras, rasa Somycel 92 zawierała największe ilości aminokwasów egzogennych. Zawartość trehalozy była istotnie mniejsza u rasy Somycel 11 w stosunku do pozostałych badanych ras, tak w przypadku małych jak i dużych owocników.