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CHEMICAL COMPOSITION AND NUTRITIONAL POTENTIAL OF SOME MUSHROOM VARIETIES CULTIVATED IN EGYPT

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ABSTRACT

The proximate composition and nutritional quality of two mushroom varieties cultivated in Egypt (*Agaricus bisporus* and *pleurotus ostreatus*) were investigated using standard analytical techniques. The samples of mushroom contained 26.05% and 33.85%, crude protein in the dried *P. ostreatus* and *A. bisspours* respectively. Crude fat content in mushroom varieties (*P. ostreatus and A. bisporus*) were almost the same (P > 0.05) and had value of 2.79% and 2.41%, respectively. Also, other proximate composition values were in the following ranges: moisture content 9.65% – 11.81%, ash 5.86% – 7.97%, crude fibre 8.25 – 13.21% and carbohydrate (by difference) 57.05% – 42.56%. for (*P.ostreatus* and *A.bisporus*) respectively. Protein in both of dried mushroom varieties (*P. ostreatus* and *A. bisporus*) were slightly lower than FAO/WHO (1973) in total essential amino acids., the total essential amino acids values of dried mushroom (*P.ostreatus* and *A.bisporus*) were 39.25 and 44.95 gm / 16 gm N, respectively. The results show that histidine scored the highest chemical protein score of 140.38 and 136.15 for dried mushroom varieties Also, dried mushroom varieties *Agaricus bisporus* and *Pleurotus ostreatus* oils had higher amounts of unsaturated fatty acids. Total phenols and antioxidant activity in dried *Agaricus bisporus* were significantly (P < 0.05) higher than that in *Pleurotus ostreatus*. The results showed that these nutrient rich mushroom flours under investigation may prove useful in the formulation of different food products such as, retention of flavour and palatability.

INTRODUCTION

Mushroom is a general term used mainly for the fruiting body of macrofungi (Ascomycota and Basidiomycota) and represents only a short reproductive stage in their life cycle (Das, 2010). Mushroom can be epigeous or hypogeous, large enough to be seen with the naked eyes and can be picked by hand (Chang and Miles, 1992). From the taxonomic point of view, mainly basidiomycetes but also some species of ascomycetes are mushroom forming fungi. Total mushrooms on the earth are estimated to be 140,000 species in which 10% (14,000 approximately) are known. Assuming that the proportion of useful mushrooms among the undiscovered and unexamined mushrooms will be only 5% implies that there are 7,000 yet undiscovered species, which if discovered will be provided with the possible benefit to mankind (Hawksworth, 2001).

Mushrooms have a long association with humankind and provide profound biological and economical impact. From ancient times, wild mushrooms have been consumed by man with delicacy probably, for their taste and pleasing flavor (Das, 2010). They have rich nutritional value with high content of proteins, vitamins, minerals, fibers, trace elements and low/no

calories and cholesterol (Agahar- Murugkar and Subbulakshmi, 2005; Wani *et al.,* 2010). Many of them have been used in folk medicine for thousands of years. Some of them are nutraceuticals (natural food having potential value in maintaining good health and boosting immune system of the human body) while others can produce potent nutriceuticals (compounds that have medicinal and nutritional attributes and are consumed as medicines in the form of capsules or tablets but not as food) (Elmastas *et al.,* 2007; Ribeiro *et al.,* 2007). Mushrooms are known to be rich sources of various bioactive substances like antibacterial, antifungal, antiviral, antiparasitic, antioxidant, antiinflammatory, antiproli-ferative, anticancer, antitumour, cytotoxic, anti-HIV, hypo-cholesterolemic, antidiabetic, anticoagulant, hepato-protective compounds, among others (Ajith and Janardhanan, 2007). Out of approximately 14,000 known species, 2,000 are safe for human consumption and about 650 of these possess medicinal properties (Rai *et al.,* 2005). In developing countries like India with rich biodiversity, mushrooms are a boon for progress in the field of food, medicine and unemployment because of several nutriceuticals and medicinal mushrooms that have been found to be useful towards human health development as food, medicine, minerals and drugs among others (Rai *et al.,* 2005 and Wani *et al.,* 2010). The present investigation was carried out to determine the proximate composition and nutritional potential of two mushroom varieties, characterizing of the oil fraction and total polyphenols and antioxidants properties of

MATERIALS AND METHODS

Materials:

Mushroom samples of the two different edible mushrooms species were used. *Agaricus bisporus* and *pleurotus ostreatus* were obtained from Food Technology Research Institute, Agricultural Research Center, Giza, Egypt.

Methods:

Preparation of mushroom:

The two mushroom varieties were cultivated adopting the ‘‘layer spawning’’ method. Freshly-harvested, whole mushroom were dried in the shade 3 days and then finely powdered.

Water mushroom extract

The aqueous extract of dried mushroom was prepared using (500g) of Powdered material, then extracted with distilled water (10 L) by stirring it in a 45°C water bath for 8 h. The extract was filtrated, extracted by the same procedure with distilled water again (5 L). The filtrates were evaporated till dryness by electric oven in a 40°C.

Ethanol mushroom extract

Two hundred grams of the powder were extracted with 2000 ml of 60% ethanol using Soxhlet apparatus. The residue was filtered and concentrated to a dry mass by vacuum distillation; the filtrate thus obtained was used as mushroom extract.

Analytical methods:

Cross Chemical Composition: A.O.A.C. 2005 methods were used to determine moisture, protein, fat, crude fiber , ash, total carbohydrate content

were calculated by difference, and mineral contents by digesting ash with 3 ml of HCl and made up to the mark in a 100 cm3 standard flask with 0.36 ml HCl before the mineral elements were determined by atomic absorption spectrophotometer (PYE Unicom, UK, Model SP9).

Amino Acid Determination: Amino acid of mushroom varieties was carried out in National Research Center, Giza, Egypt, as follows: samples were subjected to acid hydrolysis using 6N Hcl. The hydrolyzate was recovered by removing the acid by evaporation in a rotary evaporator. Amino acids were performed in hydrolyzate using amino acid analyzer, LC 3000 amino acid analyzer, High performance system, a product of LC Biochrom EPPDROP. Germany, **A.O.A.C. 2005.**

Fatty Acid Determination: Fatty acid composition was analyzed on the gas liquid chromatography (GLC). The oil was etherified before GLC analysis using the method described by Stahle 1967. The methyl esters of fatty acids were prepared using benzene: methanol: concentrated sulfuric acid 86: 10: 4 and the methylation process were carried out for one hour at 80-90°C. A pye Unicom PU 4550 equipped with dual flame ionization detector was used. The fractionation of fatty acid methyl esters was conducted using a coiled glass column (1.5 mm X 4 mm) packed with diatomic (100-120 mesh) and coated with 10 % polyethylene glycol . The oven temperature was programmed at 8°C / min. from 70°C to 190°C then isothermally at 190°C for 10 min. With nitrogen at 30ml / min. as a carrier gas, the flow rates for hydrogen and air were 30 ml/ min. and 320 ml / min. respectively. Detector and injector temperature were 300°C and 250°C, respectively. The chromatogram of the authentic fatty acids was used to characterize the unknown fatty acids according to their retention times. Present normalization of each fatty acid was calculated by the normalization with response factor method using the PU 4810 competing integration. The fatty acid composition was expressed as percentage of total fatty acid .

Determination of total phenolic

The total phenolic content was estimated using the Folin– Ciocalteu's reagent (Obanda and Owuor, 1997 and Singletion and Rossi, 1965). A calibration curve of gallic acid (range from 5 mg/ml to 30 mg/ml) was prepared and the results, determined gallic acid standard calibration curve, were expressed as milligram of gallic acid equivalents per gram of the extract. In this method, 1 mg of GLEt dissolved in 5 ml of 80% methanol (200 µg/ml) (to obtain absorbance in the range of the prepared calibration curve) was mixed with 1 ml of 3-fold-diluted Folin-Ciocalteu's phenol reagent. Two milliliter of 35% sodium carbonate solution is added to the mixture, shaken thoroughly and diluted to 6 ml by adding 2 ml of deionised water. The mixture is allowed to stand for 30 min and blue colour formed is measured at 700 nm using 6705 u.v.vis. a spectrophotometer (genwey). If turbidity appears, centrifuge it and read the supernatant.

Antiradical activity against DPPH:

The antioxidant activity of the plant extract and standard was assessed on the basis of the radical scavenging effect of the stable DPPH (2,2-Diphenyl-1-Pikryl-Hydrazyl) radical (Cuendet *et al.,* 1997). The GLEt extract range from 50, 100, 150, and 200 µg/ ml in 80% of methanol or

standard ascorbic acid (range from 0.063 to 0.5 mM i.e. 11–88 µg/ml) was added 1 ml of DPPH radical in methanol solution (0.25 mM). After a 20 min incubation period at room temperature in dark, the absorbance was read at 517 nm. The extract concentration providing 50% inhibition (IC50) was calculated from the plot of inhibition (%) against extract concentration (Yen and Duh, 1994). Tests were carried out in triplicate; ascorbic acid standard was used for comparison.

Statistical analysis

The results recorded as the mean ± SD of seven replicates. The experimental data were subjected to an analysis of variance (ANOVA) for a completely randomized design using the Statistical Analysis System **(SAS, 2000).** Duncan's (1995) multiple range tests were used to determine the differences among means at the level of 5%.

RESULTS AND DISCUSSION

Chemical composition of dried mushroom varieties:

Data in Table (1) show the proximate composition of mushroom varieties (*Pleurotus ostreatus* and *Agaricus bisporus*). Dried *Agaricus bisspours* had significantly ($P < 0.05$) higher protein content than *Pleurotus ostreatus*. The protein content of dried *P. ostreatus* and *A. bisspours* was 26.05%, and 33.85% , respectively. This finding may focus the interest of utilizing dried mushroom varieties as a high protein source in some food formulation. Generally, these results were slightly higher than those reported by Sanmee *et al.,* (2003) for *Pleurotus ostreatus* (24.2 %) and lower than those reported by Vetter and Rimoczi (1993) for *Pleurotus ostreatus* (36.4%). However, the obtained results agree well with those reported by Longvah and Deosthale (1998) who reported that protein content of *L. edodes* (26%) and Bauer-Petrovska, 2001 who determined the mean crude protein content of 32.6% in dry matter of 47 species of edible mushrooms. Protein contents of mushrooms were reported to vary according various factors such as mushroom strain/type, composition of growth media, and time of harvest, management techniques, handling conditions, and the preparation of the substrates (Manzi et al., 2001). Lipids content of dried mushroom varieties (*P. ostreatus* and *A. bisporus*) was almost the same ($P > 0.05$) and had value 2.79 and 2.41%. These data agree with Bano and Rajarathanam, 1982 they found the crude fat content in the range of 1.08 to 9.4% with an average of 2.85% has been reported in *Pleurotus* species. Also, according to proximate composition of four wild mushrooms studied by Manjunathan *et al.* (2011), the fat contents was very less ranged from 0.74% to 2.25%.

Total carbohydrate in *Pleurotus* were significantly ($P < 0.05$) higher than that in *Agaricus*. *Pleurotus* contained 57.05, meanwhile, total carbohydrates contents of *Agaricus* was 42.56%. Generally, the obtained values in this study were slightly lower than that reported by Singdevsachan *et al.* 2013 he found highest total carbohydrates in mushroom varieties ranged between 64.95 to 68.24%. But our results agree well with those reported by Kumar *et al* (2013) reported the carbohydrate contents of 15 selected mushrooms from India ranged between 32.43 to 52.07%.

Agaricus bisporus had significantly (P < 0.05) higher ash and fiber content than *Pleurotus ostreatus*. The values of fiber and ash content were 13.21% and 7.97% for *Agaricus*, and 8.25% and 5.86% for *Pleurotus*., respectively. Generally, these values agree well with those reported by Bernaś and Jaworska, 2010.

Table (1) Chemical composition of dried mushroom varieties.

Components	Mushroom varieties		LSD
	Pleurotus ostreatus	***Agaricus bisporus***	
Protein %	26.05±2.02[b]	33.85±2.25[a]	2.73
Fat %	2.79±0.58[a]	2.41±0.34[a]	0.46
*Total Carbohydrate %	57.05±4.54[a]	42.56±4.21[b]	4.29
Fiber %	8.25±1.47[b]	13.21±1.31[a]	1.39
Ash %	5.86±0.72[b]	7.97±0.66[a]	0.67
Moisture content %	9.65±0.85[b]	11.81±0.97[a]	0.88

Means in the same raw with different letters are significantly difference (P < 0.05).
Means + standard deviation of means of three determinations.
LSD = Least significant differences.
***Total Carbohydrate by difference**

Minerals composition of dried mushroom varieties:

Elemental composition of mushroom varieties (*Pleurotus ostreatus* and *Agaricus bisporus*) is shown in Table (2). Significant (P < 0.05) differences were observed between *Pleurotus ostreatus* and *Agaricus bisporus* in their minerals content. *P. ostreatus* had significant higher content of sodium, phosphorus, Magnesium and Calsium than *A. bisporus*. Meanwhile, *A. bisporus* had higher content of potassium (3869.4 mg/100gm) than *Pleurotus* (3135.6 mg/gm) variety as the major inorganic constituents of the ash in all studied samples. These data agree with Manjunathan and Kaviyarasan (2011) they reported that the potassium concentration in the cultivated mushroom (90.8%) of mineral composition. Therefore, dried mushroom could be used as supplementation for cereal flour to improve its content from Ca and K.

Table (2). Mineral contents of some dried mushroom varieties on dray weight basis.

Components	Mushroom varieties	
	Pleurotus ostreatus	***Agaricus bisporus***
Macro-elements (mg/100 g)		
Sodium	46.2[a]	31.6[b]
Phosphorus	753.8[a]	468.5[b]
Potassium	3135.6[b]	3869.4[a]
Magnesium	148.1[a]	117.8[b]
Calcium	267.3[a]	226.5[b]
Micro-elements (mg/100 g)		
Manganese	1.2[b]	5.3[a]
Zinc	14.6[b]	36.3[a]
Iron	41.3[b]	56.5[a]
Selenium	8.7[b]	12.4[a]

Means in the same raw with different letters are significantly difference (P < 0.05).

Among the trace elements the values found in mushroom varieties are alike and within the limits advised for nutrition. *However, P. ostreatus* had significant higher content of all macro-elements (except potassium) than *A. bisporus*. The variety of *Agaricus* had significant higher content of all micro-elements. Iron in all samples was in a high level and ranged from 41.3 to 56.5 mg / 100 gm. This data agree well with those reported by Manjunathan *et al.* (2011) they found that the level of iron varied from *A. polytricha* with 16.3 mg/g to *M. rhodocus* with 85.6 mg/g. The content of selenium (mg/100g), ranged from negligible levels in *P. ostreatus* (8.7) to very high levels in *A. bisporus* (12.4).

Amino acids of dried mushroom varieties:

The results of the amino acids content of dried mushroom are presented in Table (3). Slight differences were observed between dried mushroom varieties *Pleurotus ostreatus* and *Agaricus bisporus* in their amino acids (except Leucine, Iso leucine and Cysteine+Methionine) composition. Both proteins of dried mushroom varieties (*Pleurotus ostreatus* and *Agaricus bisporus*) were slightly lower than FAO/WHO (1973) in total essential amino acids. The total essential amino acids values of dried mushroom varieties *Pleurotus ostreatus* and *Agaricus bisporus* were 39.25 and 44.95 gm / 16 gm N, respectively. These results were nearly from the results reported by Gupta and Sing (1991), they reported that the total essential amino acids of *P. pistillaris* was level 41.4% essential amino acids in. However, Longvah and Deosthale (1998) also analyzed the amino acid content of two edible wild mushrooms (*Schizophyllum commune* and *L. edodes*) from northeast India and reported that 34% and 39% essential amino acids are present in *S. commune* and *L. edodes* respectively. Dried mushroom varieties *Pleurotus ostreatus* and *Agaricus bisporus* have slightly higher values than FAO/WHO (1973) in Tyrosine and phenylalanine amino acid. Kalaĉ 2009, reported that the Wild mushrooms were formerly called 'meat of poverty' in central Europe.

Table (3). Amino acid composition of dried mushroom varieties.

Amino acids	Mushroom varieties		FAO/WHO 1989
	Pleurotus ostreatus	*Agaricus bisporus*	
Histidine	3.54	3.65	2.60
Isoleucine	3.67	4.86	4.60
Leucine	5.83	8.24	9.30
Lysine	5.18	5.39	6.60
Cysteine+Methionine	2.39	3.57	4.20
Tyrosine+phenylalanine	8.36	8.51	7.10
Threonine	3.62	3.95	4.30
Tryptophan	1.82	1.86	1.70
Valine	4.84	4.92	5.50
Total essentially amino acids	39.25	44.95	46.00
Arginine	5.31	6.02	
Aspartic	11.38	9.98	
Glutamic	16.08	14.23	
Serine	7.98	6.32	
Porline	6.46	5.69	
Glycine	5.16	4.25	
Alanine	8.38	8.96	
Total Non-essential amino acids	60.75	55.05	

The most non essential amino acids in both species were aspartic and glutamic, while the least abundant were glycine , arginine and proline. In *P. ostreatus* these amino acids comprised 11.38%, 16.08%, 5.16% and 6.46% respectively of total amino acids, while in *A. bisporus* the corresponding figures were 9.89%, 14.23%, 4.25% and 5.69%. Guo *et al.* (2007) found that in dried *Pleurotus* mushrooms aspartic acid was the most abundant non-essential amino acid, comprising 19% of total amino acids. Also, Mattila, *et al.,* 2002 reported that the *Pleurotus ostreatus* is contain higher concentrations of aspartic acid than other edible mushrooms, such as *Agaricus bisporus* (brown), *A. bisporus* (white) and Lentinus edodes.

Chemical score of Amino acids of dried mushroom varieties:

The results of the chemical score amino acids of dried mushroom varieties are presented in Table (4). The results shown that histidine scored the highest chemical protein score of 140.38 and 136.15 for dried mushroom varieties *Agaricus bisporus* and *Pleurotus ostreatus* based on the FAO/WHO/UNU (2007) reference. The data also indicated relatively high chemical protein scores of *Agaricus bisporus* and *Pleurotus ostreatus* 119.86 and 117.75 for phenylalanine+tyrosine, and 109.41 and 107.06 for tryptophan, respectively. The data also indicated relatively high chemical protein scores of *Agaricus bisporus* 105.65 for isoleucine. In contrast, cysteine+methionine, leucine, lysine and threonine showed relatively low chemical protein scores for both *Agaricus bisporus* and *Pleurotus ostreatus*.

The first limiting amino acid was total sulfur amino acids (Cysteine+Methionine) for *Pleurotus ostreatus* and lysine for *Agaricus bisporus* with values 56.91and 81.67, respectively. While the second limiting amino acid was leucine for *Pleurotus* and total sulfur amino acids for *Agaricus bisporus* with values 62.69 and 85.00, respectively. Bernaś, and Jaworska 2010 reported that the Comparison with the FAO/WHO (1991) and FAO/WHO/UNU (2007) reference protein patterns for adults and the FAO/WHO (1991) pattern for pre-school children, no limiting amino acids were found in either species. Also, (Belitz and Grosch, 1999) found that the composition of mushroom proteins seems to be higher nutritional value than most plant proteins.

Table (4). Chemical scores for the essential amino acids of dried mushroom varieties.

Amino acids	Mushroom varieties	
	Pleurotus ostreatus	***Agaricus bisporus***
Histidine	136.15	140.38
Isoleucine	79.78***	105.65
Leucine	62.69**	88.60***
Lysine	78.48	81.67*
Cysteine+Methionine	56.91*	85.00**
Tyrosine+phenylalanine	117.75	119.86
Threonine	84.19	91.86
Tryptophan	107.06	109.41
Valine	88.00	89.46

*The chemical score compared with the provisional values for the amino acids of the FAO/WHO/UNU standard (1989). * First limiting amino acids.
** Second limiting amino acids. *** Third limiting amino acids.

Fatty acids composition of dried mushroom varieties:

Fatty acids composition of dried mushroom varieties *Agaricus bisporus* and *Pleurotus ostreatus* oils are shown in Table (5). Dried mushroom varieties *Agaricus bisporus* and *Pleurotus ostreatus* oils had higher amounts of unsaturated fatty acids constituted 87.18 and 89.53% from total fatty acids. The major unsaturated fatty acids were linoleic 71.32 – 62.54% followed by oleic 10.63–23.56 % for *Pleurotus* and *Agaricus,* respectively. Fat content In mushroom is very low compared to proteins and carbohydrates. Fat present in mushroom fruiting bodies are dominated by unsaturated fatty acids. The high amounts of unsaturated fatty acids, especially essential fatty acid, lead to increase the nutritional values of mushroom oils.

Mushroom varieties oils are rich in both oleic and linoleic acids, such oils have a good semi-drying properties and could be used as an excellent edible cooking oil, salad oil or for margarine manufacture (Gaafar, 1995). Generally, these results were higher than those reported by Kavishree *et al.* (2008). Palmitic acid was the major saturated fatty acids in dried mushroom varieties *Agaricus bisporus* and *Pleurotus ostreatus* oils and its percentage concentration was 12.35 and 10.08%, respectively. The same results were mentioned by Vaskovsky, et al., 1998. The ratio between unsaturated and saturated fatty acids was 1: 7.06 and 1: 8.88 in *Agaricus bisporus* and *Pleurotus ostreatus* oils, respectively.

Table (5). Fatty acid composition of dried mushroom varieties.

Fatty acids	Mushroom varieties	
	Pleurotus ostreatus	***Agaricus bisporus***
Myristic (14:0)	0.39	0.48
Palmitic acid (16:0)	10.08	12.35
Stearic acid (18:0)	2.56	4.77
Oleic acid (18:1)	23.56	10.63
Linoleic acid (18:2)	62.54	71.32
Linolenic acid (18:3)	0.87	0.45
Total Saturated fatty acid	10.47	12.83
Total Unsaturated fatty acids	89.53	87.18
Unsaturated / saturated ratio	1 : 8.88	1: 7.06
Total essential fatty acid	63.41	71.87

Some Vitamin content of dried mushroom varieties:

The data in table (6) show some vitamins content in the dried samples of the dried mushroom varieties. Dried mushroom varieties *Agaricus bisporus* showed the high content of vitamins D, E and A (4.092, 0.6217and 3.491 mg/100g) than *Pleurotus ostreatus*. On the other hand, dried mushroom *Pleurotus ostreatus* high content of vitamins C, folic acid and B_6 (52.53, 119.99 and 77.91) mg/100gm, respectively. Mushroom are one of the best source of vitamins especially Vitamin B (Mattila et al., 2000). These data agree with Murcia *et al.,* 2002 who reported that Mushroom contain relatively large amounts of vitamin A , C and β-carotene, which have protective effects because of their antioxidant properties.

Table (6). Some Vitamin content of dried mushroom varieties.

Vitamins (mg/100g)	Mushroom varieties	
	Pleurotus ostreatus	***Agaricus bisporus***
Vit. D	0.287	4.092
Vit. E	0.1818	0.6217
Vit. A	1.294	3.491
Vit. C	52. 53	39.16
Folic acid	119.99	110.02
Vit. B_6	77.91	40.51

Vitamins are important and well-documented biological activities, and they are reported to be potent antioxidants and scavengers of free radicals (Grassman, *et al.*, 2002). Also, Mattila, *et al.,* (2000) reported that mushrooms are the only non-animal-based food containing vitamin D, and hence they are the only natural source of vitamin D for vegetarians.

Total phenols, flavonoides and antioxidant activity of dried mushroom varieties and there extracts.

The data in table (7) show Total phenols, flavonoides and antioxidant activity of dried mushroom varieties (*Agaricus bisporus* and *Pleurotus ostreatus*) and there extracts. The results indicated that total phenols in *Agaricus bisporus* were significantly ($P < 0.05$) higher than that in *Pleurotus ostreatus*. *Pleurotus* contained 13.67 mg/g, meanwhile, total phenols contents of *Agaricus* was 17.90 mg/g. Generally, the obtained values in this study were slightly lower than that reported by Mau *et al.,* 2002 who found that the highest total phenols in mushroom varieties ranged between 64.95 to 68.24%. But our results agree well with those reported by Barros *et al.,* 2008 who found that the phenols were the major antioxidant components concentrations contained in the five *Agaricus sp*. On the other hand, the obtained results in this study were higher than that reported by Choi and Sapers, 1994 for *Agaricus bisporus* (5.4±0.85 mg of GAEs/g of dry mushroom.). From this data it could be noticed that, no significant difference of total polyphenols content of dried mushroom and ethanol extract of varieties *Agaricus* and *Pleurotus*. On the other hand, water extract of *Agaricus bisporus* variety showed high content of total polyphenols than water extract of *Pleurotus ostreatus*.

Also, Cheung et al., 2003 found that the water extract of *V. volvacea* had higher phenolic content than the methanol extract ($P<0.05$). In the case of *L. edodes,* both of the water and ethyl acetate extracts had the largest amounts of phenol ($P<0.05$). The flavonoids are naturally occurring phenolic compounds in plants. Flavonoids and related compounds are known to possess strong antioxidant properties (Dziedzic and Hudson, 1983). From this data it could be noticed that, no significant difference of total flavonoides content of dried mushroom of *Agaricus* and *Pleurotus* varieties. Meanwhile, the concentration of flavonoides of ethanol extract of dried *Pleurotus* were significantly ($P<0.05$) higher than ethanol and water extracts for *Agaricus sp.*

Several chemical and biochemical assays were used to screen the antioxidant properties: reducing power, scavenging activity on DPPH radicals (measuring the decrease in DPPH radical absorption after exposure to radical scavengers), since it could be more beneficial than isolated constituents; a

bioactive individual component can change its properties in the presence of other compounds present in the extracts. Table 7 shows DPPH values obtained in the antioxidant activity assays of *Agaricus* and *Pleurotus* mushrooms. In fact, dried mushroom of *Agaricus* was the most efficient species concerning antioxidant activity 20.35±2.45, while *pleurtous* presented lower antioxidant properties 15.76±1.14 which are compatible to its lower phenols content.

Table (7). Total phenols, flavonoides and antioxidant activity of dried mushroom varieties and there extracts.

	Agaricus bisporus			***Pleurotus ostreatus***			**LSD**
	powder	***water extract***	**Ethanol extract**	**powder**	***water extract***	**Ethanol extract**	
Total polyphenol (mg/g)	18.90±0.63^{d}	41.56±1.36^{a}	32.36±3.55^{b}	13.67±0.36^{e}	25.48±1.52^{c}	31.43±1.78^{b}	1.06
Flavonoides (mg/g)	3.98±0.17^{d}	8.35±0.29^{b}	4.42±0.76^{d}	4.75±0.18^{d}	6.32±0.36^{c}	11.57±0.43^{a}	0.35
DPPH %	20.35±2.45^{d}	88.88±4.75^{a}	59.43±2.68^{bc}	15.76±1.14^{e}	34.1±2.37^{c}	65.43±3.45^{b}	3.55

Means in the same raw with different letters are significantly difference (P < 0.05).
Means + standard deviation of means of three determinations.
LSD = Least significant differences.

Identification of flavonoides of dried mushroom varieties and its extracts:

The Identification and determination of some flavonoides compounds in the dried powder of mushroom varieties and there extracts . From these data in table(8) its clear that dried *Agaricus* showed the highest number of the identified flavonoides compounds which were 5 compounds compared with 3 for *Pleurotus*. Hispretin was the main compounds identified in *dried and water extract of Agaricus* but no found in dried mushroom of *Pleurotus.* On the other hand, Luteolin was the main compounds identified in *Pleurotus* dried, water and ethanol extract, but not found in dried mushroom of *Agaricus.* The total identified of flavonoides compound for water and ethanol extract of mushroom varieties showed content which 7 compounds. Many flavonoids and related compounds are reported to possess strong antioxidative characteristics (Dziedzic and Hudson, 1983). Hydroxylation of the B-ring is an important factor governing the antioxidative activity of these compounds, although it is not a prerequisite for manifestation of the activity.

Table (8). Flavonoides compounds of dried mushroom varieties and there extracts.

	Agaricus bisporus			***Pleurotus ostreatus***		
	powder	***water extract***	**Ethanol extract**	**powder**	***water extract***	**Ethanol extract**
Rosmarenic	---------	2.1377	0.3323	---------	4.4859	2.4324
Rutin	0.8536	0.8785	0.5733	---------	2.3017	3.9869
Quercetrin	-------	1.2080	1.4763	0.0415	2.6163	2.9077
Narengenin	0.3333	0.8671	1.6175	0.0251	3.0372	4.0313
Quercetin	0.3276	0.9527	2.5621	---------	4.1220	2.9598
Hispretin	1.4664	4.8202	--------	---------	---------	---------
Luteolin	---------	---------	1.0589	0.0373	2.6687	3.6453
Kampferol	0.1488	1.3321	0.8061	---------	2.5477	1.0499

Our study showed that these mushroom species are good sources of proteins and carbohydrates. Several minerals content and amino acids have also been detected as favourable, making it potentially useful in many food formulations. Also, the species of mushroom which cultivated in Egypt (*Agaricus bisporus* and *pleurotus ostreatus*) have high content of total poly phenol with high antioxidant activity.

This study indicates that sustainable use of different species of nutrient rich mushrooms also has the potential to be transformed into an "export item" that can bring in economic benefits for the betterment of rural communities.

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التركيب الكيماوي والمحتوى التغذوي لبعض أصناف المشروم المنزرعة في مصر

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لقد تم دراسة التركيب الدقيق والنوعية الغذائية لنوعي المشروم المنزرعة في مصر *(Agaricus bisporus* and *pleurotus ostreatus)* باستخدام تقنيات تحليلية قياسية. ولقد احتوت عينات البروتين الخام في نوعي المشروم المجفف *(Agaricus bisporus* and *pleurotus ostreatus)* على ٢٦,٠٥% ، ٣٣,٨٥ % على التوالي. أما الدهون الخام في نوعي المشروم (*Agaricus bisporus* and *pleurotus ostreatus*) كانت تقريبا عند أقل فرق معنوي (p> 0.05) وكانت قيمته ٢,٧٩% - ٢,٤١% على التوالي. كما أظهرت النتائج المتحصل عليها أن محتوى الرطوبة ٩,٦٥% - ١١,٨١% ، الرماد ٥,٨٦ %– ٧,٩٧% ، الألياف الخام ٨,٢٥% - ١٣,٢١% والكربوهيدرات (بفارق) ٥٠,٣% - ٥٠,٩% من *(P.ostreatus , A.bisporus)* بالتوالي مع الأعلى. فقد كانت كلا من بروتينات أصناف المشروم المجفف (*Agaricus bisporus* and *pleurotus ostreatus*) أقل قليلا من FAO/WHO(1973) من مجموع الأحماض الأمينية الأساسية . كما بلغ إجمالي قيم الأحماض الأمينية الأساسية من (*Agaricus bisporus* and *pleurotus ostreatus*) المشروم المجفف كانتا ٣٩,٢٥ و ٤٤,٩٥ جم / ١٦ جم نيتروجين على التوالي .أظهرت النتائج أن الحمض الأميني الهستدين سجل أعلى درجة كيميائية البروتين من ١٤٠,٣٨ و ١٣٦,١٥ لأصناف المشروم المجففة. أيضا، الزيوت في المشروم المجفف*Agaricus bisporus* and *pleurotus ostreatus* كانت تحتوي على كميات أكبر من الأحماض الدهنية الغير مشبعة. وبلغ إجمالي الفينولات والمواد المضادة للأكسدة النشطة في *Agaricus bisporus* (١٣,٦٧) معنويا (p> 0.05) فقد كان أعلى في *pleurotus ostreatus* (١٧,٩٠) ، وأظهرت النتائج أن هذه المواد الغذائية الغنية في مطحون المشروم قيد الدراسة قد تكون مفيدة فى صياغة المنتجات الغذائية المختلفة حيث يعمل على الاحتفاظ بالنكهة والاستساغة .