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Nutritive value of mushrooms from Azad Kashmir, Pakistan

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Abstract

Experiments were carried out to find out the chemical composition of eleven species of edible mushrooms reported from the Forests of Azad Kashmir. The results obtained were compared with vegetables, pulses and those of *Lentinus edodes*, the cultivated Shiitake mushroom. Chemical constituents analyzed included total dietary fiber, crude protein, fat, ash, moisture and carbohydrate. Despite the differences in the chemical composition of mushroom samples, the overall nutritional values of the mushrooms were good.
Key words: Edible mushrooms, proximate analysis, Forests of Azad Kashmir, high protein content, low fat

Introduction

Mushrooms are good source of quality protein, minerals and vitamins (Wahid *et al*., 1988). They grow abundantly in the forests of Azad Kashmir (Khan, 1962) some of which can easily be grown on agricultural waste materials. Mushrooms have been relished as a delicacy for centuries because of their subtle flavor (Priestly, 1984), nice aroma and good taste appeal (Bhatti *et al*., 1989). They have medicinal (Bukhari, 1375 A.H.) and ritual use (Ramzan, 1982). People of Pakistan are suffering from malnutrition especially protein deficiency. During last decades, efforts have been made to increase the production of mushrooms by many governmental agencies and in the private sector.

Stewart (1924) collected mushrooms from Kashmir at an elevation varying from 9000 to 12,000 feet. Gardezi (1986 and 1998) reported and identified 19 new Species of mushrooms from Forests of Azad Kashmir (unpublished theses). These specimens were identified as edible. Edible mushrooms contain high level of dietary fiber, substantial amount of protein, vitamins and minerals but are low in fat. They also have various health benefits such as antioxidative, antitumour and cholesterol lowering effects (Wong and Cheung, 2001). Therefore, edible mushrooms are regarded as an ideal health food. Our objective was to investigate the chemical composition of edible mushrooms in order to evaluate their nutritional values. Some lesser known edible mushrooms such as *Russula ovidea, R. galiceosa, R. lepida, R. ucara, R. vesca, Cortinarius lacythiformis, Pholiota caperata, Agaricus silvicola, A. subrufescens, Coprinus atramentarius* and *C. comatus* were analyzed for their chemical constituents including total dietary fiber, crude protein, fat, ash, moisture, carbohydrate and compared with one of the most important mushrooms i.e., *Lentinus edodes*, commonly called shiitake. This flavorful mushroom is mainstay in the Japanese diet and is highly regarded for its nutritional and healthful qualities. In fact, shiitake ranks second in the world in total yearly mushroom production. The proteins in shiitake are composed of 18 types of amino acids and researchers have found over 30 enzymes in shiitake. Nutritional analysis of this mushroom shows 15% moisture, 15-18% protein, 1-2% fat, 65-75% carbohydrate, 7-14% fiber and 5-7% ash (Anonymous, 2002).

Materials and Methods

Proximate analysis: Proximate analysis for moisture, crude protein, crude fat, crude fiber and ash was performed in accordance with the official Methods of Analysis of the Association of Official Analytical Chemist (AOAC, 1984) from dried whole fruiting bodies of mushrooms. All the mushrooms were dried in an oven to a constant weight at 105^0C for 12 hours and the amount of moisture was calculated.

The crude protein was estimated by Kjeltec system, using sulfuric acid and a mixture of potassium sulphate and copper sulphate for digestion. For the distillation, 40% NaOH and boric acid were used. N/100 sulfuric acid was used for titration. For the estimation of fat ether extraction method by Soxhlet apparatus was used. Two gram of oven dried sample was dipped in the thimble filled with 200-250 ml of ether boiling at

40-60^{0}C for 10-12 hours. Crude fiber was determined by the digestion of sample first with boiling dilute HCl and then with boiling dilute NaOH to remove most of the mineral matter. The residue was then filtered off, dried and weighed. It was then ignited and again weighed. The loss in weight on ignition was the crude fiber. For the estimation of ash, 2 g of sample was placed into the gooch crucible inside a furnace at 600^{0}C for 4 hours. Percentage of total carbohydrate was determined by subtracting the sum percentage of moisture, crude protein, crude fat, fiber and ash from one hundred.

Results and Discussion

The present investigation was to find out the chemical composition in some edible mushrooms in order to evaluate their nutritional values. The results obtained were compared with *Lentinus edodes*, vegetables and pulses. Hussain (1985) reported the proximate composition of vegetables and pulses which were compared with mushrooms. Some lesser known edible mushrooms identified in Azad Kashmir Such as *Russula ovidea, R. galiceosa, R. lepida, R. ucara, R. vesca, Cortinarius lecythiformis, Pholiota caperata, Agaricus silvicola, A. subrufescens, Coprinus atramentarius, C. comatus* were analyzed for their chemical constituents including total dietary fiber, crude protein, fat, ash, moisture and carbohydrate.

Crude protein: The total protein in eleven samples of mushrooms varied from 16.17 to 28.12% as shown in Table 1. The protein contents of the mushrooms were Russula *ovidea* (22.62%), *R. galiceosa* (27.52%), *R. lepida* (21.86%), *R. ucara* (23.55%), *R. vesca* (20.49%), *Cortinarius lacythiformis* (18.07%), *Pholiota caperata* (28.12%) *Agaricus silvicola* (22.13%), *A. subrufescens* (18.07%) *Coprinus atramentarius* (16.17%) and *C. comatus* (24.66%). *P. caperata* (28.12%) had the highest while, *C. atramentarius* (16.17%) had the lowest protein contents in the species analyzed. The protein contents of these mushrooms were reported higher than those of vegetables (Sabir *et al.,* 2003*).* Table 2 shows the protein content of vegetables from 1.3 to 2.3% whereas, in case of pulses the protein contents varied from 20.7 to 43%. Thus, the protein contents of these mushrooms were lower than those of pulses.

Crude fiber: The total fiber in eleven samples of mushrooms varied from 6.45 to 19.04% as shown in Table 1. The fiber contents of the mushrooms were *Russula ovidea* (16.01%), *R. galiceosa* (6.45%), *R. lepida* (8.86%), *R. ucara* (13.72%), *R. vesca* (19.04%), *Cortinarius lecythiformis* (12.57%), *Pholiota caperata* (14.46%), *Agaricus silvicola* (15.68%), *A. subrufescens* (8.28%) *Coprinus atramentarius* (7.07%) and *C.* comatus (16.33%). *Russula vesca* (19.04%) had the highest while *R. galiceosa* (6.45%) had the lowest amount of fiber in the species analyzed. Table 2 shows the fiber content of the vegetables form 0.8 to 1% whereas, in case of pulses the fiber contents varied from 2.2 to 4%. Thus, the fiber contents of the mushrooms were quite higher than those of vegetables and pulses.

Table 1: Proximate analysis of mushrooms of Azad Kashmir (Percentage g /100g) and their comparison with *Lentinus edodes* (Anon., 2002)

Mushrooms	Protein	Fiber	Moisture	Ash	Fat	Carbo-hydrate
Russula ovidea	22.62	16.01	10.36	16.20	2.68	32.13
Russula galiceosa	27.52	6.45	10.80	16.40	0.49	38.34
Russula lepida Fr.	21.86	8.86	10.33	15.04	0.22	43.69
Russula ucara	23.55	13.72	10.19	18.27	3.98	30.29
Russula vesca Fr.	20.49	19.04	11.44	19.76	0.08	29.19
Cortinarius lecythiformis	18.07	12.57	11.63	15.71	1.15	40.87
Pholiota caperata (Fr.) Kummer	28.12	14.46	11.12	21.32	4.08	20.9
Agaricus silvicola (Vitt.) Sacc.	22.13	15.68	14.91	15.64	2.48	29.16
Agaricus subrufescens	18.07	8.28	13.53	13.93	0.74	45.45
Coprinus atramentarius (Bull. Ex Fr.) Fr.	16.17	7.07	7.05	15.42	1.48	52.81
Coprinus comatus (Muell. Ex Fr.) S.F. Gray	24.66	16.33	10.69	26.03	1.75	20.54
Lentinus edodes (Berk.) Sing.	15-18%	7-14%	15%	5-7%	1-2%	65-75%

Table 2: Proximate composition of vegetables and pulses (Hussain, 1985)

Food	Protein	Fiber	Moisture	Ash	Fat	Carbohyd-rate
Cabbage	1.8	1.0	90.2	0.6	0.2	6.1
Bringal	1.3	0.9	91.7	0.4	0.2	5.5
Spinach	2.3	0.8	91.1	1.2	0.4	4.1
Chickpea	20.7	4.0	9.8	2.9	2.4	59.2
Lentil	23.4	3.5	9.5	3.2	1.6	58.8
Mungbean	23.4	2.2	7.5	3.2	1.5	62.2
Soybean	43.2	3.7	9.7	3.0	19.5	20.9

Moisture: The quantity of moisture in eleven samples of mushrooms varied from 7.05 to 14.91%. The moisture contents of the mushrooms were *Russula ovidea* (10.36%) *R. galiceosa* (10.80%), *R. lepida* (10.33%), *R. ucara* (10.19%), *R. vesca* (11.44%), *Cortinarius lecythiformis* (11.63%), *Pholiota caperata* (11.12%), *Agaricus silvicola* (14.91%), *A. subrufescens* (13.53%), *Coprinus atramentarius* (7.05%) and *C. comatus* (10.69%). *A. silvicola* (14.91%) had the highest while, *C. atramentarius* (7.05%) had the lowest amount of moisture in the species analyzed. Table 2 shows the moisture contents of vegetables from 90.2 to 91.7% whereas, in pulses moisture contents varied from 7.5 to 9.7%. Thus, the moisture content of the mushrooms was quite lesser than those in vegetables but slightly higher than those of pulses.

Ash: The quantity of ash in different mushrooms varied from to 13.93 to 26.03% as shown in Table 1. The quantity of ash in the mushrooms was *Russula ovidea* (16.20%) *R. galiceosa* (16.40%), *R. lepida* (15.04%), *R. ucara* (18.27%), *R. vesca* (19.76%), *Cortinarius lacythiformis* (15.71%), *Pholiota caperata* (21.32%) *Agaricus silvicola* (15.64%), *A. subrufescens* (13.39%), *Coprinus atramentarius* (15.42%) and *C. comatus* (26.03%). *C. comatus* (26.03%) had the highest while, *A. subrufescens* (13.39%) had the lowest amount of ash in the species analyzed. Table 2 shows the ash content of vegetables from 0.4 to 1.2% and that of pulses from 2.9 to 3.2%. Thus, the ash content of mushrooms was greater than those of vegetables and pulses.

Crude fat: The quantity of fat was reported less i.e. from 0.08 to 4.08% in different mushrooms as shown in Table 1. Fat content of the mushrooms was *Russula ovidea* (2.68%), *R. galiceosa* (0.49%) *R. lepida* (0.22%), *R. ucara* (3.98%), *R. vesca* (0.08%), *Cortinarius lecythiformis* (1.15%), *Pholiota caperata* (4.08%) *Agaricus silvicola* (2.48%), *A. subrufescens* (0.74%), *Coprinus atramentarius* (1.48%) and *C. comatus* (1.75%). *P. caperata* (4.08%) had the highest while; *R. vesca* (0.08%) had the lowest amount of fat in the species analyzed. Table 2 shows the crude fat in vegetables from 0.8 to 1% whereas, in pulses fat contents varied from 1.5 to 19.5%. Thus, the vegetables and mushrooms both contained lesser fat than those of pulses.

Carbohydrate: The carbohydrate content of these mushrooms ranged from 20.54 to 52.81% as shown in Table 1.The amount of carbohydrate in these mushrooms was *Russula ovidea* (32.13%), *R. galiceosa* (38.34%), *R. lepida* (43.69%) *R. ucara* (30.29%) *R. vesca* (29.19%), *Cortinarius lecythiformis* (40.87%), *Pholiota caperata* (20.9%), *Agaricus silvicola* (29.16%), *A. subrufescens* (45.45%), *Coprinus atramentarius* (52.81%) and *C. comatus* (20.54%). *C. atramentarius* (52.81%) had the highest while, *C. comatus* (20.54%) had the lowest amount of carbohydrate in the species analyzed. Table 2 shows the carbohydrate content of vegetables from 4.1 to 6.1% and those of pulses from 58.8 to 62.2%. Thus, the mushrooms contained greater carbohydrate than those of vegetables and lesser than those of pulses.

Conclusions

The proximate analysis showed a difference in the chemical composition of mushrooms. Despite the differences in the chemical composition of mushroom samples when compared to the common edible mushroom *Lentinus edodes* (shiitake), vegetables and pulses the overall nutritional values of the mushrooms were good. These mushrooms may be incorporated into our diets to play an important role in overall health and well-being.

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