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Research Article

NUTRITIVE VALUE OF FEW WILD MUSHROOMS FROM THE WESTERN GHATS OF SHIVAMOGGA DISTRICT, KARNATAKA, INDIA

ASHOK CHITTARAGI[1]*, RAJA NAIKA[1] AND VINAYAKA K S[2]

[1]Department of P.G. Studies and Research in Applied Botany, Jnana Sahyadri, Kuvempu University, Shankaraghatta-577451, Shivamogga Dist, Karnataka, India., [2]Kumudvathi First Grade College Shikaripura-577427, Shivamogga Dist, Karnataka, India.
Email: ashokchittaragi020@gmail.com

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ABSTRACT

Aim-The nutritional values of 6 wild edible mushroom species were analyzed. Young and matured sporocarps of 6 common wild edible mushrooms were collected from different locations in the Western Ghats of Shivamogga district. Methodology- These mushrooms were analyzed for proximate analysis of nutritional values. Freshly encountered whole mushrooms fruiting bodies were shade dried and finely powder and extracted with 250 ml of 95% solvents like petroleum ether, chloroform and methanol using Soxhlet apparatus.
Results-The macro nutrient profiles in general revealed that the wild mushrooms contains the moisture in range of (83.6-90.43%), dry matter (4.76-11.46%), protein (25.71-36.51%), ash (4.45-10.29%), lipid (1.4-2.79%), fiber (3.77-11.44%) and carbohydrate (37.38-48.63%). For each specimen, local and vernacular names were noted.
Conclusion-Hence, these nutrient contents revealed that mushrooms were low energy, healthy food and may also be used as a protein supplementary diet. Nutritionally they are a valuable source of health food, which is low in calories, and rich in carbohydrates, essential amino acids, fibre, important vitamins and minerals.

Keywords: Nutritive value, Vernacular names, Wild macro fungi, Medicinal mushrooms, Sporophores, Western Ghats.

INTRODUCTION

Mushrooms are a heterogenous group of fungi with members from both Ascomycotina and Basidiomycotina. Mushrooms are comprised of around 230 genera and 5000 species. Of these more than 2000 species are reported to be edible throughout the world and about 283 of these are reported to be available in India [1]. Many mushrooms have also been used in medicine for centuries; especially in Asian countries where a lot of work has been done on medicinal aspects of several edible mushrooms [2]. Most of the research has been cancer related, but studies conducted have shown that mushroom extracts also impart reduction of blood pressure and cholesterol concentration, enhancement of the immune system, anti-viral and anti-inflammatory properties, treatment of anaphylactic shock, anti-HIV properties and an increase of oxygen utilization and antioxidant properties [3].

Basidiomycetes mushroom have been valued as both food and medicine for thousands of years. They have high nutritive and medicinal values and contribute to a healthy diet because of their rich source of vitamins, minerals and proteins [4]. Not only do mushrooms provide food, but their waste can be recycled into fertilizers and additives that improve tree plantations and soil conditions. They are low calorie food with very little fat and are highly suitable for obese persons [5]. Many genera of mushrooms are edible and are rich in essential nutrients such as carbohydrates, proteins, vitamins, mineral, fat, fibers and various amino acids [6]. A major chunk of the population consumes mushrooms because of their easy availability, flavor, meaty taste and medicinal value [7].

The wild mushrooms were richer sources of protein and had a lower amount of fat than commercial mushrooms [8]. Wild mushroom protein also contains considerable amounts of non-essential amino acids such as alanine, arginine, glycine, glutamic acid, aspartic acid, proline and serine. It can be used for the food to solve the malnutrition problem [9]. Mushrooms generally possess most of the attributes of nutritious food as they contain many essential nutrients in good quantity [10]. Eating mushroom is a major menu in their food culture, though its availability is seasonal. Our primary interest is in things that are normally found in much great amounts in mushrooms than in most foods, and even in things not found at all in other foods. However, we also want to mention that mushrooms are very good nutritionally and to explain what makes them so good. Any food with high nutritional value must be considered a "health food". A number of reviews have been published on the nutritional value of mushrooms, so we shall not dwell on the subject here [11], [12], [13]. It is therefore essential that efforts should be made to introduce new medicinal mushrooms to develop cheaper drugs. Mushrooms still represent a large untapped source of structurally novel compounds that might serve as lead for the development of novel drugs [14].

The present study describes the existing situation putting emphasis on the importance of the mushrooms hunted in the wild and more particularly the nutritional and ecological approach of harvest. This study was therefore aimed at determining the nutritional value of some wild species of mushrooms.

MATERIALS AND METHODS

Study area

Shivamogga district is a part of naturally rich biodiversity malnad region of Karnataka known as Malenada hebbagilu. It is situated between 13° 27' and 14° 39' N lat and 74° 38' and 76° 34' E long. The geographical area of the district is about 10, 58,000 ha with a forest area of 3, 27,000 ha. The average rainfall is about 140 cm; temp is avg. of max 30.5°C and min of 19.6°C and RH 60 to100%.Vegetation can be classified into tropical wet evergreen forest, tropical semi evergreen forest, moist deciduous forest, dry deciduous forest and tropical thorn forest [15].

Collection of Specimens

The specimens were collected from forests and hills of Shivamogga district. The specimens were carefully uprooted by gently lifting them up and holding the stipe gently but firmly close to the rhizomorph, thus carrying some soil along with it. This is to avoid damaging the tissue of the mushroom. Each specimen was carefully labeled before transporting to the laboratory. The specimens were air-dried and stored in transparent polythene bags that were loosely kept to allow for proper aeration of the specimens. Identification was done by comparing their morphological, anatomical and physiological characteristics and monographs with descriptions given in the manual [16] and also through the electronic data on

identification keys of mushrooms [17]. All the specimens were deposited at the herbarium of mycology laboratory, Department of Applied Botany, Jnana Sahyadri, Kuvempu University, Shivamogga, Karnataka, India. The analysis was made at the same Department and the Central Coffee Research Institute (CCRI) Balehonnur, Chikamagalur district of Karnataka, India.

Preparation of the mushroom extract

Freshly encountered whole mushrooms were shade dried and finely powdered. Twenty five grams of the powder were extracted with 250 ml of 95% solvents like petroleum ether, chloroform and methanol 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 [18].

ANALYSIS OF MATERIALS FOR NUTRITIVE VALUE

For determination of nutritive value, the following parameters were studied by using the mushroom material.

Moisture Content

The fresh weight of each mushroom sample was taken using chemical balance. These samples were then oven dried separately at 80˚C for 48 h. The loss in weight obtained after drying was regarded as the moisture content [19].

Dry matter Content

This was taken as the final weight obtained after the samples have been dried in the oven at 80˚C for 48 h.

Carbohydrates

1g of the powdered mushroom sample was extracted with 30 cm^3 of 80% ethyl alcohol by using Soxhlet extractor for 6 h. The crude extract was diluted to 100 cm^3 with 80% ethyl alcohol. The quantity of ethanol soluble sugar in the extract was determined using phenol sulphuric acid method [20].

Ash Content

The powdered mushroom sample (3g) was ashes in a Gallenkamp furnace in previously ignited and cooled crucible of known weight at 55˚C for 6 h. fairly cooled crucibles were put in desiccators and weighed [21].

Lipid Content

2g of powdered sample was extracted with 30 ml of petroleum ether by using Soxhlet extractor for 4 h. The extract was evaporated to dryness in a weighed flask using a vacuum evaporator. The weighed flask was dried in the oven at 80˚C for 2 h, allowed to cool and reweighed. The difference between the initial and final weights was regarded as the lipid content of the sample [22].

Protein Content

Protein content was determined using folin phenol reagent of 0.5 g of the powdered mushroom sample was extracted with 50 cm of 2% NaCl in a water-bath at 60˚C for 1 h. The extract was filtered out and 50.0 cm of 3% copper acetate monohydrate was added to the filtrate to precipitate protein. The precipitated protein was then centrifuged out and dissolves in 50 cm of 0.1 m NaOH. The quantity out and dissolves in 50 cm of 0.1 m NaOH. The quantity of protein in the alkaline solution was then determined using the folin-phenol method [23].

Crude Fibre

Crude fibres of the mushroom samples were determined according to the standard method Association of Official Agricultural Chemists [24].

Statistical Analysis

Experimental values are given as means ± standard deviation (SD). Statistical significance was determined by one-way variance analysis (ANOVA). Differences at $P < 0.05$ were considered to be significant.

RESULTS AND DISCUSSION

Data Presented

Table 1 showed that several naturally growing wild mushrooms could be found in different places of Shivamogga district. This result is not a surprise because the vegetation of these areas is typical of wild fungi. Specific mushroom tropical rainforest, which support the luxuriant growth of species were collected from different forest areas of Shivamogga district. The results only provide indication of the areas where the sporocarps could be collected in large quantities.

The results of the nutritional analysis of the mushroom samples showed that all the specimens have high moisture content (Table 2). The moisture content of the mushrooms analyzed is high, indicating that mushrooms are highly perishable. High moisture content promotes susceptibility to microbial growth and enzyme activity. In the present study it was observed that the moisture content of the collected mushroom samples ranges from 83.6% to 90.43%. However, the bodies of young mushrooms are soft and brittle and therefore contain higher moisture than fully matured ones which are often tough, almost leathery and must have probably lost some of their water content [25]. In those studies most fresh mushrooms contained about 90% moisture and 10% dry matter and dry mushrooms contained about 90% dry matter and 10% moisture [26], [27]. Edible mushrooms are highly valued as a good source of carbohydrates and their contents usually range from 38.27% to 48.4% of dry weight [28], [29]. In the present study the highest carbohydrates content usually ranges from 37.38% to 48.63%. The relatively high carbohydrates content recorded in the samples is a proof of their being highly nutritious and good for human consumption. Lipid content ranged from 1.4% to 2.79% in the present study (Table 2). This means that they contained less fat in comparison with other common mushrooms [27], [28], [29], [30]. From the results are shown in Table 2, the macronutrient profile, in general, revealed that mushrooms had rich sources of protein and fiber and had low amounts of fat. This high protein and low fat characteristics of the edible wild mushrooms has been previously reported by Aletor [31], Diez and Alvarez [32] and Longvah and Deosthale [33]. Edible mushrooms are highly valued as a good source of protein and their protein contents usually range from 24.89% to 36.61% of dry weight [26], [30.]

In the present study, the highest protein contents (36.51%) were obtained from *H. parvula,* while the lowest (25.71%) was obtained from *Ganoderma* sp-2. Protein contents of mushrooms were reported to vary according to genetic structure of species and physical and chemical differences in growing medium [26], [30], [34].

Generally, fresh mushrooms contain a relatively high amount of fiber which may be responsible for its relatively high amount of ash [35]. The highest ash content was (10.29%) obtained in the *H. parvula.* The results also revealed that the specimens have good percentage of ash on dry weight basis with the high value (9.44%) of ash content found in *S. bermudense* which normally has a tiny size and soft fruity body which could account for its low percentage of ash. The ash content varied between 6.3% in *Calvulina cinerea*. Barros et al., [12] recorded ash content of 16.48 and 14.93 g/100g in the wild edible mushrooms such as *A. silvaticus* and *A. silicola* respectively, which variably seems to be lower than that of crude protein [36].

Table: 1 showed that several naturally growing wild mushrooms could be found in different places of Shivamogga district.

Sl. No	Botanical Name	Collected Place	Vernacular Name	Habitat
1	*Clavaria rosea*	Haniya	Kolikalanabe	Terricolous
2	*Ganoderma* sp-1	Kodachadri	Maradanabe	Lignicolous

3	*Ganoderma* sp-2	Aagumbe	Maradanabe	Lignicolous
4	*Geastrum triplex*	Shankaraghatta	Nakshatranabe	Terricolous
5	*Hygrocybe parvula*	Haniya	Haigenanabe	Terricolous
6	*Scleroderma bermudense*	Haniya	Kulebaddeanabe	Terricolous

Table: 2 Nutritional values of few wild mushrooms studied

Mushroom Species	Moisture	Dry matter	Carbohydrates	Lipids	Protein	Fibre	Ash
Clavaria rosea	90.4±0.91	11.41±0.84	37.38±0.97	1.4±0.66	34.32±0.78	5.6±1.30	5.36±0.72
Ganoderma sp-1	83.53±0.70	11.46±1.30	48.63±0.87	2.28±1.09	26.64±1.06	11.26±0.96	5.73±1.08
Ganoderma sp-2	83.6±0.91	11.4±0.91	47.5±1.20	2.19±1.04	25.71±0.84	11.6±1.08	5.56±0.70
Geastrum triplex	90.43±0.75	5.63±0.86	40.83±0.89	2.06±1.00	27.41±0.84	3.77±0.85	4.45±0.92
Hygrocybe parvula	90.7±0.95	4.76±0.97	41.3±1.55	2.48±0.82	36.51±1.01	4.23±1.11	10.29±0.88
Scleroderma bermudense	90.26±0.73	9.49±1.07	42.55±1.11	2.79±1.04	36.32±1.05	11.44±1.08	9.44±0.96

CONCLUSION

In conclusion, the tested mushrooms possess carbohydrate and protein content in rich quantity and with low fat content. The ash and fiber content were less than other foods of plant and animal origin. Overall, the rich nutritional composition makes wild mushrooms. So, mushrooms are a promising food that may overcome protein energy malnutrition problem to human beings. The protein, fiber, carbohydrates, ash and fat content in mushrooms make them a much sought after ideal vegetable by diabetic, cancer and cardiac patients.

The current environmental issues of global warming and climate change would adversely affect the regeneration and growth pattern of the delicate fungi which requires a specific micro-climate. Consequently, the high nutritional quality and unique flavor of these mushrooms are likely to be lost if these wild edibles are not properly documented.

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Conflict of interest – Nil

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