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Proximate analysis of three wild edible mushrooms of West Bengal, India

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Abstract: The state of West Bengal, India is rich in socio-environmental conditions, favoring growth and propagation of mushrooms. During the continuing investigation by the author's group in the state, large populations of edible mushrooms were collected. Mushrooms are a high valued source of nutrition and mineral constituents which are of paramount importance in the present age. Here different nutritional parameters, i.e., protein, carbohydrate, fat and crude fiber contents were evaluated for three different wild edible mushrooms viz. *Lentinus squarrosulus* (Mont.) Singer ex Pegler, *Russula albonigra* (Krombh.) Fr. *and Tricholoma giganteum* Massee collected from village and forest area of West Bengal. Results showed that these mushrooms had significant amount of carbohydrate, protein, free amino acids and crude fiber where as low amount of fat signifies its importance as diet for the sufferers of diabetes, obesity, atherosclerosis, high blood pressure, etc.
Key words: Nutritional parameters, *Lentinus squarrosulus, Russula albonigra, Tricholoma giganteum.*

INTRODUCTION

To meet the need of growing population, scientists are looking for alternative source of food among which mushroom, yeast and alga are frequently mentioned [1]. Consumption of wild growing mushrooms has been preferred to eating of cultivated fungi in the world. Mushroom picking is a 'National hobby' in the Czech Republic with a statistical mean of 5.6 kg. of fresh mushroom per household yearly [2]. Mushrooms are esteemed primarily for their flavor, but they can also be a healthy supplement to the diet. Each type, of course, has a different chemical composition, but in general their nutritive value compares favourable to that of most vegetables. The cellular plasma contains 85-95% of water and only negligible amount of sugar and fat, and as a result, it has become one of low caloric diet. Mushroom flesh contains about 3-5% of protein. Altogether, about 20 various amino acids were found in mushrooms; their content varies even in individual specimens of the same species. Carbohydrate represent 4-6.5% of the content, for the most part in the form of polymers, but there is also glycogen, manitol, traces of sorbitol, arabitol and others. Mushrooms further include 0.5-3.5% of fats, mostly glycerides and glycolipids, less frequently phospholipids, often in the form of oil droplets within spare or in the tissue [3]. They are also rich in vitamin-B, vitamin-D and vitamin-K. Some are also high in vitamin-A (e.g. *Cantharellus cibarius)* and a few (e.g. *Fistulina hepatica*) contain vitamin-C [4]. Beside their high nutritive value, mushrooms have become attractive as functional foods and as a source of physiologically beneficial medicines, having therapeutic potentiality for the treatment of cancer, heart ailments, diabetes, inflammation, hepatic damage, high blood pressure, microbial pathogens etc [5-12].

Here, different proximate composition of three wild edible mushroom namely *Lentinus squarrosulus, Tricholoma gigenteum* and *Russula albonigra* were evaluated.

MATERIALS AND METHODS

Fungal materials

Basidiocarps of *Lentinus squarrosulus, Tricholoma giganteum* and *Russula albonigra* were collected from costal, Gangetic plane and lateritic region of West Bengal, India respectively. The voucher specimens were deposited at the Mycological Herbarium of Department of Botany, University of Calcutta, Kolkata, West Bengal, India.

Preparation of tissue homogenate

1 g of fresh tissue was crushed and homogenized with liquid nitrogen. The resultant powder was extracted with 10 ml of 1 M phosphate buffer (pH 7.4). The homogenate was centrifuged at 16,000 × g for 30 min at 4˚C and the supernatant was collected, kept in -20˚C until further work.

Estimation of protein

Protein contain of the fresh mushroom was estimated form the supernatant, following the method of Lowery *et al.* [13].

Estimation of total carbohydrate

For estimation of total carbohydrate fresh thallus sample (1g) was ground in mortar with liquid nitrogen. Then 5 ml of 2.5 (N) HCl was added to it and hydrolysed by keeping it in water bath for 3 h, cooled and neutralized with solid sodium carbonate [14]. The quantity of carbohydrate was determined after centrifugation according to DNSa method [15].

Estimation of fat

Fat was estimated by homogenizing tissue in 20 ml chloroform: methanol (2:1 v/v) mixture for 10 min in a tissue homogenizer. After vigorous shaking and filtering, the residue was again stripped with 25 ml chloroform: methanol mixture for 30 min. This combined filtrate was then shaken with 0.9% sodium chloride to remove non fat contaminant [16]. The solvent layer was dried in vacuum and the total amount of fat was weighed according to the method of Itoch and Koneko, 1974 [17].

Estimation of crude fibre:

For estimation of crude fibre, 2 g of dried tissue was boiled in 200 ml of sulphuric acid (1.25% w/v) for 30 min. Then it was filtered through muslin and washed with boiling water until the filtrate was no longer acidic, further boiled with 200 ml of sodium hydroxide (1.25% w/v) solution for 30 min, filtered through muslin, washed with 25 ml of boiled 1.25% w/v sulphuric acid, then washed thrice with water and finally with 25 ml absolute alcohol. The residue was then transferred into pre weighed ashing dish and dried for 2 hours at 130±2˚C. The dry weight was taken and the residue was ignited for 30 min at 660 ± 15˚C cooled in a dissector and reweighed. The crude fibre was calculated according to the method of Maynard (1970) [17].

Estimation of moisture:

Initially 10 g fresh tissue sample was taken. The amount of moisture in the tissue material was taken determined by drying the tissue in an oven drier at about 60˚C for 72 h. The dried sample was weighed again and the moisture percentage (M%) was calculated as following way.

M% = (Dry wt /Fresh wt) × 100

RESULT AND DISCUSSION

Protein is the most critical component contributing nutritional value of food. Since fats and carbohydrate are rarely lacking in diet, they are not generally considered in nutritional evaluation. Proteins constitute more than half of total nitrogen. The protein content depends on the composition of the substratum, size of the pileus, harvest time and the species of mushrooms. The protein content of the fully grown basidiocarp of *L. squarrosulus, T. giganteum* and *R. albonigra* were 21.54, 16.7 and 24.7 g / 100 g of dry weight (n=3) respectively (Figure 1). Based on the value, these mushrooms are grouped between low-grade vegetable

and high-grade meat. The mushroom protein is known to contain almost all the essential amino acids. Apart from essential amino acids, considerable amount of alanine, arginine, glycine, histidine, glutamic acid, aspartic acid, proline and serine also found in mushrooms.

Of the dry matter constituent of mushroom, carbohydrates were found in the greatest amounts [19]. The carbohydrate of mushrooms as studied by some workers was present as trehalose, which gets hydrolyzed and later gives rise to mannitol [1]. In edible mushrooms the dominant sugar is mannitol. Apart from mannitol, mushrooms also contain glucose, galactose, trehalose, mannose and fructose [20]. Total carbohydrate of *L. squarrosulus, T. giganteum* and *R. albonigra* were estimated and it was found that the total carbohydrate content were in the order of *T. giganteum* > *R. albonigra* > *L. squarrosulus* (Figure 1). A considerable portion of the carbohydrate compounds occurs in the form of polysaccharides of different sizes. Fungal polysaccharides are represented by glycogen and some indigestible form as dietary fibre of cellulose, chitin, mannose and glucans [21-23].

The content of crude fibre were 8.71, 12.5 and 5.4 g / 100 g of dry weight in the basidiocarps of *L. squarrosulus, T. giganteum* and *R. albonigra* respectively (n=3) (Figure 1). The dietary fibre was declared a nutrient by the Nutrition Labelling and Education Act of 1993 [24]. According to Gordon [24], there is a "dietary fibre hypothesis" which suggests that fibre helps to prevent many diseases prevalent in affluent societies. Fresh mushrooms contain both soluble and insoluble fibre. The soluble fibres are mainly beta-glucan polysaccharide and chitosans, which are components of the cell walls [25]. Soluble fibre has been shown to help prevent and manage cardiovascular disease by lowering total and low-density lipoprotein (LDL) levels. It also helps regulate blood sugar levels [26]. The main role of the insoluble fibre found in fresh mushrooms is to ensure the peristaltic regularity and good bowel health. It also helps slow digestion and adds satiety or staying power to foods. When fibre-rich foods are chosen, the diet is lower in energy density and has more volume than a low-fibre diet [27]. More fibre means less room for high fat, high-calorie choices, which can translate into weight loss and healthy weight maintenance. Hence, foods that are good sources of dietary fibre are appealing to many consumers.

The content of the fats in mushroom is low ranging from 1.1 to 8.3% on dry weight basis with an average content of 4.0% [28]. Total fat content was estimated that the basidiocarps of *L. squarrosulus, T. giganteum* and *R. albonigra* contain 4.63, 3.1 and 1.2 g / 100 g dry tissue respectively (n=3) (Figure 1). The moisture content of the fresh basidiocarp of *L. squarrosulus, T. giganteum* and *R. albonigra* were respectively 91.25 ± 0.63, 90.4 ± 0.5 and 92.5 ± 0.5 g / 100 g of fresh tissue (n=3).

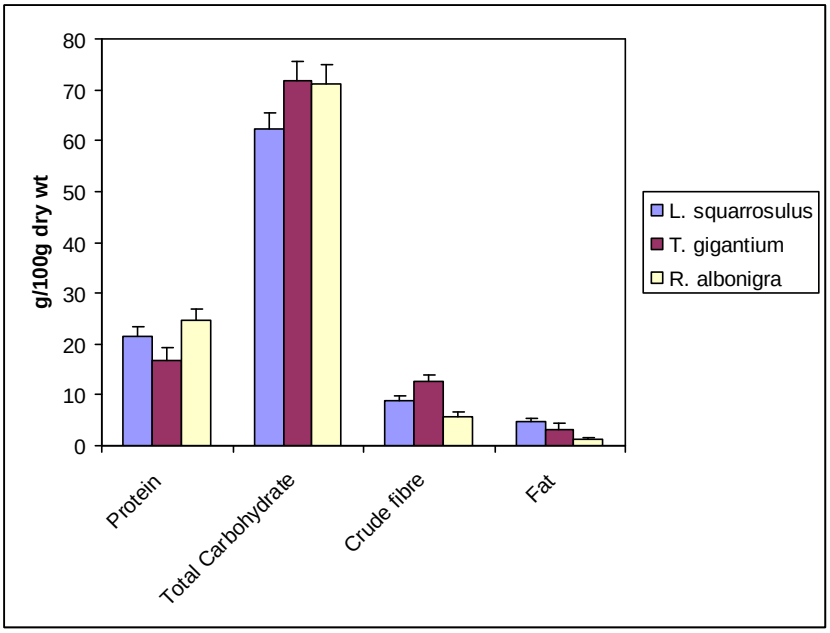

Figure 1: The proximate composition of the *Lentinous squarrosulus, Tricholoma giganteum, Russula albonigra*. Results are mean ± SD (Standard Deviation) of three separate experiments, each in triplicate.

The Food and Agriculture Organization [29] of the United Nations (UN) has recognized mushroom as a product, which contributes to feeding those parts of the world that depend predominantly on cereal diets. Today, consumers all over the world look at food not only for basic nutrition but also for their health benefits. Edible mushrooms are regularly regarded as a curative food having anticarcinogenic, anticholesteromic, antiviral properties and prophylactic properties with regard to hypertension and heart disease [8, 30]. It has been reported recently that these three mushroom had antimicrobial, antioxidant, hepatoprotective, immunoenhancing and apoptogenic activity [31-37]. Results of proximate composition of these three wild edible mushrooms revealed that these mushrooms were rich in protein and carbohydrate, moderate in crude fibre and had low amount of fat content. Considering all these value these mushroom are crude fibre rich low caloric diet, which can be used for suffers of several killer diseases. Mushroom nutriceuticals are likely to be of increasing interest throughout the world. They represent both challenges and opportunities. Perhaps a whole new industry or even industries will arise having greater economic value than those currently producing mushroom for food.

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