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Proximate analysis of *Astraeus hygrometricus* (Pers.) Morg.

GUNJAN BISWAS[1], SAGARTIRTHA SARKAR[2] AND KRISHNENDU ACHARYA[1]

[1]Molecular and Applied Myclogy and Plant Pathology Laboratory, Department of Botany, University of Calcutta, 35, Ballygunge Circular Road, Kolkata 700019, West Bengal

[2]Genetics Laboratory, Department of Zoology, University of Calcutta, 35, Ballygunge Circular Road, Kolkata 700019, West Bengal

Astraeus hygrometricus (Pers.) Morg. commonly found as an ectomycorrhizal association with the sal plants (*Shorea robusta* G.f.) were collected from the forest floor of Bankura district, West Bengal and taken to the laboratory for further study. In this study, different nutritional parameters, i.e., protein, carbohydrate, fat, amino acid and crude fiber contents of the basidiocarp of *A. hygrometricus* were evaluated. Results showed that this mushroom had significant amount of carbohydrate, protein, free amino acids and crude fiber where as low amount of fat which signifies its importance as diet for the sufferers of diabetes, obesity, atherosclerosis, high blood pressure, etc.

Key words: *Astraeus hygrometricus*, Bankura, nutritional parameters

According to Hayes (1975), the Food and Agricultural Organization of United Nation has recognized mushroom as a commodity of alternative protein source. Based on this suggestion, the cultivation of mushrooms is being encouraged in all the developing countries to overcome the protein shortage. The problem of providing adequate quantity and quality of proteins, minerals and vitamin rich food for supplementing human diets and preventing malnutrition has been engaging the attention of several nutritionists. The scientists and other workers in the field of nutrition from different countries are involved in order to minimize the severity of the problem. In recent years, consumers all over the world began to look at food not only for basic nutrition but also for health benefits. Edible mushrooms are frequently regarded as a therapeutic food having anticarcinogenic, anticholesteromic and antiviral properties and also prophylactic properties with regard to coronary heart disease and hypertension (Bobek *et al.,* 1995; Bobek and Galbavy, 1999; Mattila *et al.,* 2000). However, information about nutritive values of different varieties of mushroom is scarce (Haque, 1989). Earlier, we have reported the nuritional parameters of some wild mushrooms of West Bengal (Acharya *et al.,* 2002; Acharya *et al.,* 2004a; Acharya *et al.,* 2004b; Rai *et al.,* 2006; Rai *et al.,* 2007a; Rai *et al.,* 2007b; Rai *et al.,* 2007c). The present investigation, however, centers on the proximate composition of *Astraeus hygrometricus* (Pers.) Morg.

The specimen *Astraeus hygrometricus* was collected from the floor of the sal (*Shorea robusta*) forest of Bankura district, West Bengal and adjoining area during the month of July and brought to the laboratory and identification was done with the aid of standard literatures and published works (Ramsbottom, 1965; Roy and Samajpati, 1976; Purkayastha and Chandra, 1985; Shajahan and Samajpati, 1995). The local people commonly called this mushroom as "kurkura chatu". The voucher specimen has been deposited in Molecular and Applied Mycology and Plant Pathology Laboratory, Department of Botany, University of Calcutta.

Tissue (1 g) of the fresh basidiocarp was crushed and homogenized with 10 ml of 0.1 M phosphate buffer (pH 7.4) with 0.3 g chilled, acid-washed glass beads (size 0.44 to 0.52 mm). Repeated processes of freezing and thawing were then carried out with the help of dry ice and was continued until the disruption of total cells occur which was verified by microscopic study. Finally the homogenate was

*Corresponding author, eMail : krish_paper@yahoo.com

centrifuged at 15,000 rpm for 30 min at 4°C and the supernatant was collected, kept in the refrigerator until further work. Protein and soluble carbohydrate were estimated from the supernatant. Protein content was determined following the method of Lowry *et al.,* (1951) and soluble carbohydrate by dinitrosalicylic acid (DNS) method (Miller, 1959).

For estimation of total carbohydrate fresh tissue sample (1 g) of the basidiocarp was ground in a mortar at 30±2°C. Then 5 ml of 2.5 N HCl was added to it and hydrolyzed by keeping it in a water bath for 3 hrs, cooled and neutralized with sodium carbonate (Sadasivam and Manickam, 1996). The quantity of carbohydrate was determined after centrifugation according to the DNS method (Miller, 1959).

Lipid was estimated by homogenizing the fresh tissue of basidiocarp 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 stirred with 25 ml chloroform : methanol mixture for 30 min. This combined filtrate was then shaken with 0.9 % NaCl to remove non-fat contaminants (Folch *et al.,* 1991). The solvent layer was dried in vacuum and the total amount of fat was weighed by the method of Itoch and Kaneko (1974).

The free amino acids were extracted and quantified following the procedure of Sadasivam and Manickam (1996). Fresh tissue of basidiocarp (1 g) was crushed and homogenized with 10 ml of 90 % ethanol and then centrifuged at 15,000 rpm for 15 min and the supernatant was collected. To this 0.1 ml of ninhydrin solution was added and the volume made up to 2ml with distilled water. The mixture was heated for 25 min in a boiling water bath and 5 ml of diluent solution (containing equal volume of water and n-propanol) was added. The intensity of the purple colour was read against a reagent blank at 570 nm.

For estimation of crude fiber, 2 g of dried thallus 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 washing was no longer acidic, further boiled with 200 ml of sodium hydroxide 1.25 % (w/v) 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 (w_1) and dried for 2 hrs at 130 ± 2°C. The dry weight (w_2) was taken and the residue was ignited for 30 min at 600 ± 2°C, cooled in desiccators and reweighed (w_3). The crude fiber was calculated according to the method of Maynard (1970).

Results shown are mean ± SD (Standard deviation) of at least three individual experiments.

Of the dry matter constituent of mushroom, carbohydrates were found in the greatest amounts, constituting 16-85 g/100 g dry matter (Blumenthal, 1976). The carbohydrate of mushrooms as studied by some workers was present as trehalose, which gets hydrolyzed and later gives rise to mannitol (Haque, 1989). In edible mushrooms the dominant sugar is mannitol. Apart from mannitol, mushrooms also contain glucose, galactose, trehalose, mannose and fructose (Tseng and Mau, 1999; Wannet *et al.,* 2000). The carbohydrate of *A. hygrometricus* was estimated to contain 31.98 ± 3.66 g (n=3) of soluble carbohydrate/100 g of of dry tissue and 64.33 ± 3.23 g (n=3) of total carbohydrate/100 g of dry tissue respectively (Table 1). A considerable portion of the carbohydrate compounds occurs in the form of polysaccharides with particles of different sizes. Fungal polysaccharides are represented by glycogen and such indigestible form as dietary fiber of cellulose, chitin, mannose and glucans (Grochowski, 1990; Manzi and Pizzoferrato, 2000; Pizzoferrato *et al.,* 2000; Manzi *et al.,* 2001).

Table 1 : Amount of nutritional components of *A. hygrometricus*. Results are the mean ± SD of three separate experiments.

Nutritional components	g/100 g dry weight
Crude fibre	10.80 ± 1.02
Total protein	16.47 ± 1.35
Total carbohydrate	64.33 ± 3.23
Soluble carbohydrate	31.98 ± 3.66
Free amino acid	6.48 ± 0.90
Total fat	3.20 ± 0.85

The content of crude fiber in 100 g of dry tissue was 10.80 ± 1.02 g (n=3) (Table 1). The dietary fibre was declared a nutrient by the Nutrition Labeling and Education Act of 1993 (Gordon, 2002). Gordon (2002) indicated that there is a "dietary fiber hypothesis" that suggests that fiber helps to prevent

many diseases prevalent in affluent societies. Fresh mushrooms contain both soluble and insoluble fibre. The soluble fibre is mainly beta-glucans, a polysaccharide, and chitosans, which are components of the cell walls (Sadler, 2003). Soluble fibre has been shown to help prevent and manage cardiovascular disease by lowering total and LDL cholesterol levels. It also helps regulate blood sugar levels (Chandalia *et al.,* 2000). Promoting regularity and good bowel health is the main role of the insoluble fibre found in fresh mushrooms. 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 (American Dietetic Association, 2002).

Protein is the most critical component contributing nutritional value of food. Proteins constitute more then half of total nitrogen, and their content depend on the composition of the substratum, size of the pileus, harvest time and the species of mushrooms. The protein content of *A. hygrometricus* was 16.47 ± 1.35 g/100 g of dry thallus (n=3) (Table 1). Based on this value, this mushroom is 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 can be found in mushroom. The free amino acid content of this mushroom was 6.48 ± 0.90 g/100 g of dry thallus (n=3) (Table 1). The quantitative spectrum of essential amino acids has served as the basis to calculate biological value, nutritional value and protein score (Haque, 1989).

The crude fat content of mushrooms can comprise from less than 1% to as high as 15 to 20% of the dry weight. On an average, however,mushrooms contain between 2 to 8% fat (Chang and Hayes, 1978). The fat content of *A. hygrometricus* was 3.20 ± 0.85 g/100 g of dry thallus (n=3) (Table 1).

Besides being a healthy food, this mushroom is a low caloric nutraceuticals best suited for persons suffering from cancer, heart ailments, diabetes, high blood pressure, constipation, renal failure, etc. Due to the high fiber content it possesses the ability to revitalize immunity and by doing so can increase the life span of persons consuming them.

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