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Chemical Composition and Nutritional Value of the Most Widely Used Mushrooms Cultivated in Mekelle Tigray Ethiopia

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Abstract

The basic composition (The total protein, total carbohydrate, total lipid, crude fiber and ash content of each mushroom were studied on dry weight contents were determined in the cultivated mushrooms *Agaricus bisporus*/white, *Agaricus bisporus*/brown, *Lentinula edodes*, and *Pleurotus ostreatus* and they ranged from 28.38-49.2, 1.54-4.96, 13.2-29.02 and 7.01-17.92, respectively. This study suggested that cultivated mushrooms were in rich of protein and fiber with low fat content. Hence these nutrients contents made mushroom as a low energy, healthy foodstuff and these mushrooms may also be used as protein supplementary diet.

Keywords: Mushrooms; Basic composition; Moisture; Carbohydrates, Dietary fiber; Fat; Ash; Nitrogen; Protein

Introduction

The use of mushrooms as food is probably as old as civilisation and mushrooms currently have greater importance in the diet of mankind. Cultivation and production of edible mushrooms are on the increase, particularly in Europe, America and Asia. The increased nutritional importance is due to the nutritive value of high-grade mushrooms, which almost equals that of milk [1]. Mushrooms have been evaluated for their nutritional status on the basis of their chemical composition. Cultivated and wild mushrooms contain reasonable amounts of proteins, carbohydrates, minerals, fibres and vitamins [2,3]. Furthermore, mushroom share low in calories, sodium, fats and cholesterol [4]. Edible mushrooms have long been considered to have medicine all value and to be devoid of undesirable effects [5].

Lillian Barros et al. [6] reported that the wild mushrooms were richer sources of protein and had a lower amount of fat than commercial mushrooms. Wild mushroom proteins also contain considerable amounts of non-essential amino acids such as: alanine, arginine, glycine, glutamic acid, aspartic acid, proline and serine. They are important in providing structure to cells, tissues and organs and therefore essential for growth and repair [7] More than 140,000species of mushrooms exist in nature, but less than 25 species (*Agaricus bisporus, Pleurotus spp., Lentinus edodes, Volvariella volvacea, Auriculariaspp.* etc.) are widely accepted as food and only a few have attained the level of an item of commerce [8]. Due to their high content of vitamin, protein and *Calocybe* indica *Russula delica Lyophyllum* mineral, mushrooms are considered as «Poor man's Protein» [9]. The Greeks and Romans described mushrooms as «Food for the Gods» and were served only on celebrations. Reference to mushrooms is found in Vedas [10-12]. Most people eat mushrooms, mostly because of its flavour, meaty taste and medicinal value [13]. Mushrooms can be used for the food to solve the malnutrition problem [14]. Mushrooms have good nutritional value particularly as a source of protein that can enrich human diets, especially in some developing countries where animal protein may not be available and are expensive. The protein content of fresh mushroom is 3.7% stated by Food Agriculture Organization's publication in 1978. The edible and medicinal mushrooms can be used on human welfare in the 21st century [15]. Many genera of mushrooms are edible and are rich in essential nutrients such as carbohydrates, proteins, vitamins, mineral, fat, fibre and various amino acids [16]. Mushrooms generally possess most of the attributes of nutritious food as they contain many essential nutrients in good quantity [17]. It must however be emphasized that some mushrooms are poisonous and may claim lives within few hr after consumption [18]. *Pleurotus* species are rich in medicinal values. *Pleurotus Florida* has antioxidant and antitumor activities [19].

In the Tigray region of Ethiopia, there is an abundance of agricultural waste products which is normally discarded. Mushroom cultivation is able to transform this agricultural waste into a nutritious food and offer great opportunities for addressing the region's food security challenges. Mushroom can be cultivated on a large number of agro-wastes including straw of paddy, wheat, stalk and leaves of maize, millets, cotton, etc. choosing the best substrate is the single most important step in creating a successful mushroom cultivation program. This paper; therefore, presents the investigation of use cultivated mushroom as alternative source for diet with low cost and easy availability in the region production [20].

Materials and Methods

Study area

The study was carried out in Mekelle city, the capital city of Tigray regional state which is located in the South Eastern zone of the region. It is 873 km from the capital city of Ethiopia, Addis Ababa. The absolute location of Mekelle city is 130 29' N latitude and 390 28' East longitudes. It is found at an altitude of 2000 to 2200 meters above sea level. The city has seven sub-cities and a total human population of 215,546 of which 104,758 were men and 110,788 were women Central Statistic Authority

Mushroom species

The mushrooms species were obtained in local supermarkets

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(Mekelle Tigray Ethiopia), where they were stored at 4°C, in March and April 2013.Three fruiting bodies per species were sampled. All the samples were dried and reduced to a fine dried powder (20 meshes), mixed to obtain homogenate samples and stored in desiccators, protected from light, until further analyses.

Nutritional value

The samples were analyzed for chemical composition (moisture, proteins, fat, carbohydrates and ash) using the AOAC procedures (2) all collected mushroom were dried for the estimation of Ash, Proteins, fibres, fat and total carbohydrates. Determination of Total Ash [2]: About 3 a gram of sample is weighed in a crucible and as heated in a muffle furnace at 550 degree Celsius for 30 minutes and cooled in desiccators. The ash content was calculated using following equation.

$$\text{Ash content }\left(\text{g/100 g sample}\right)=\frac{\text{weight of the ash}}{\text{Weight of sample taken}}\times 100$$

Determination of Total Proteins [2]: To about 0.7 gram of sample in a digestion flask, 1 gram of Copper Sulphate, 10 gram of Potassium sulphate and 20 ml of Sulphuric acid was added. After complete digestion the content is transferred into a vessel. 25 ml of 0.2N Sulphuric acid was pipette out into beaker and distillation was started. The distillate was allowed to collect in Sulphuric acid for a known volume and time. The collected distillate is titrated against 0.2N Sodium Hydroxide using Methyl red as an indicator.

The percentage of Protein was calculated.

$$\%\text{Nitrogen}=\frac{\left(\text{titreblank-titire sample}\right)*0.014*1000}{\text{Weight of sample}}$$

$$\%\text{ of Protein}=\%\text{ of Nitrogen}\times 6.24$$

Determination of Fat Content [2]: About 10 gm of Mushroom sample was weighed and extracted with Petroleum Ether in an extraction apparatus for 16 hr. The extract was dried, cooled in desiccators and weighed and mass was recorded. The % of fat was determined using an equation

$$\%\text{ of Fat}=\frac{100\left(\text{wt. of Soxlhet flask with extracted fat-Wt of empty Soxlhet flask}\right)}{\text{Weight of Sample}}$$

Determination of Fibre Content [2]: 5 gm of mushroom sample was extracted using Petroleum ether. The fat free material was transferred in a beaker and 200 m1 of dilute sulphuric acid was added and boiled. Whole boiling acid in a flask is connected to reflux condenser and heated for 30 minutes. The flask was removed and filtered and washed thoroughly with boiling water followed by washing in boiling Sodium Hydroxide and again refluxed for 30 minutes. The contents were filtered and washed with boiling water and finally washed the ethanol. The residues were dried and incinerated in muffle furnaces at 660 degree Celsius and the crucible along with ash was weighed and percentage of fiber was calculated.

$$\%\text{ of crude fiber}=\frac{100\left(\text{Wt of crucible with before ashing- Wt of crucible after ashing}\right)}{\text{Weight of Sample}}$$

Determination of Total Carbohydrates [2]: By difference method (100-total moisture+total ash+total Moisture+total Protein+total Fat+total fibres) the percentage of carbohydrates was calculated.

Result and Discussion

The results of the nutritive value of cultivated edible mushrooms are shown in Table 1. The total carbohydrates, fat, protein, fibre and Ash contents in of *Agaricus bisporous* were found to be 28.38 g, 2.1 2 g, 41.06g, 18.23 and 7.01 g, respectively.

No	Mushroom	Ash	Fibre	Protein	Fat	Carbohydrate
1	*Agaricus bisporous*	7.01	18.23	41.06	2.12	28.38
2	*Pleurotus florida*	9.41	23.18	27.83	1.54	32.08
3	*Russula delica*	17.92	15.42	26.25	5.38	34.88
4	*Lyophyllum decastes*	14.2	29.02	18.31	2.14	34.36

Table 1: Nutritional analysis of cultivated mushrooms (% in grams).

The mushroom was found to be rich in protein than carbohydrate and very less amount of fat. This result was similar to the previous report [6,21-24].The total carbohydrate, fat, protein, fibre and ash in case of *Pleurotus Florida* was found to be 32.08, 1.54,27.1 2,and 9.41g, respectively. Mushroom is found to be richer in carbohydrate composition than protein and total fat is found to be very less in its composition [25,26]. This result was similar to the report of Chang and Miles [1], Nuhu Alam et al. [21] and Arun Ing ale and Anita Ramtek [27] but, the composition of crude fiber is slightly different might be due to the use of different compost for their growth.

In 100 g of dried *Russula delica*, the carbohydrate, fat, protein, fibre and ash was found to be 34.88, 5.38, 26.25, 15.42 and 17.92 g, respectively. These results were not much similar to the work of Muhsin Konuk et al. [28] where they had reported total fat as 3.15 g, ash 8.56 and Protein composition was almost similar. It is known that the chemical composition of mushrooms are affected by a number of factors, namely mushroom strain, composition of growth media, time of harvest, management techniques, handling conditions and preparation of the substrates [29].

In *Lyophyllum decastes* the total carbohydrate, total protein, total fat, crude fiber and ash were found to be 34.36, 2.14,18.31, 29.02 and 14.2 g, respectively. In order to compare the result obtained very less research has been done to our knowledge [30-35].

Among all the *Agaricus bisporous* contain large amount of protein. Very less amount of fat was noted in *Pleurotus Florida*. Fibre content was max in *Lyophylluin decastes* and ash was found to be more in *Russula delica* and least in *Agaricus bisporous* [36].

In conclusion, the tested mushrooms are protein and fiber rich with low fat content. The ash content and carbohydrate content was less than other food from plant and animal origin. Overall, the rich nutritional composition makes cultivated mushrooms very special. So, mushrooms are a promising food that may overcome protein-energy malnutrition problem in the third world. The protein, fiber, mineral, carbohydrates and fat content make them ideal vegetable for diabetic, cancer and heart patients. These nutrients contents made mushroom as a low energy, healthy foodstuff and these mushrooms may also be used as protein supplementary diet.

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