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Proximate and mineral compositions of edible mushroom *Agrocybe aegerita*

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Abstract
The proximate and mineral compositions of edible mushrooms species *Agrocybe aegerita.* The aim of the study was to assess the nutritional qualities of the mushrooms. The results of the analysis indicated that the mushrooms are good sources of moisture (92.36%) fat (0.20 mg/100g), crude fiber (8.05 mg/100g) and ash (1.22 mg/100g). The result also showed that the mushrooms are also good sources of nutritionally important mineral elements including iron, zinc, potassium, phosphorus, calcium and sodium, but low in Selenium, Manganese and Magnesium. These nutrients varied widely among the mushroom species. Based on the results of this study, we report here that these mushroom species are nutritionally good and need to be popularized in the study area through artificial cultivation to reduce shortage of nutrient supply in the region.

Keywords: Mushroom, proximate composition, minerals, nutrient supply, *Agrocybe aegerita*

1. Introduction
Due to their high nutritional value, mushrooms have been widely consumed by people seeking a healthier and more nutritional diet. Some mushrooms are considered nutraceuticals, that is, functional foods, being that in addition to their high protein content, low concentration of total fat, added to a significant concentration of vitamins and minerals and they contain antioxidants that are extremely important in the cure, treatment, and prevention of various diseases, including cancer [1].
Mushrooms are important in the ecosystem because they are able to biodegrade the substrate and therefore use the wastes of agricultural production. Fruiting bodies of mushrooms are appreciated, not only for texture and flavor [2-7] but also for their chemical [8-10] and nutritional properties [11-17]. Mushrooms have also been reported as therapeutic foods, useful in preventing diseases such as hypertension, hypercholesterolemia, and cancer. These functional characteristics are mainly due to their chemical composition [12, 18].
Most mushrooms have high protein content, usually around 20-30% by dry weight. This can be useful for vegetarians or anyone looking to increase the protein content in their diet [19, 20].
Mushrooms are used in folk considered as one of the curiosities of nature and many of medicine throughout the world since ancient times as 'the mare widely consumed for their ultimate health food' [21, 22]. Mushrooms have long been appreciated as an important source of bioactive compounds of medicinal value [23, 24].
The nutritional value of mushrooms depends on their chemical composition. Their high water content means that fresh mushrooms contain very little fat or carbohydrate and are low in energy (calories).
The present paper is focused on the analysis of edible species of *Agrocybe aegerita* mushrooms to investigate their proximate and mineral compositions to discuss the results generated in relation to the utilization of the mushrooms and their implication in drugs for the treatment of diseases. This is done in the perspective that mushrooms do significantly contribute to the essential nutrient requirements in the human diet.
The aim of this study was to determine the proximate and the mineral contents of the dried powdered sample of *Agrocybe aegerita.*

2. Material and Methods

Sample collection

Mushroom of *Agrocybe aegerita* was cultivated in mushroom units, from the period of February 2014, in Kongunadu Arts and Science College, Coimbatore-641 029, Tamil Nadu, India.

Mushroom powder

The mushrooms after washing were shade dried and was powdered in a mixer grinder. Fresh mushroom was used in the proximate analysis and dried powdered sample was used in the analysis of mineral contents.

Determination of Proximate Composition

The *Agrocybe aegerita* mushroom species was used in this study. Prior to the proximate analysis, the mushroom samples were washed cleaned with distilled water. Moisture, crude fiber, ash and fat contents were determined by the method described Raghuramalu, *et al.,* (2003).

Determination of Mineral Element Composition

Manganese and Zinc was estimated by the procedure of Willard and Greathouse, 1917; Piper, 1950 and Crystal *et al*., 2010. Phosphorus concentration was determined by the method described by Fiske and Subbarow, 1925; Selenium was determined by Deepa and Lingappa, 2014; Sodium and Potassium by flame photometric method described in Meghalatha *et al*., 2014, whereas Calcium, Iron, Copper and Magnesium levels were determined by Raghuramula *et al.,* 2003.

Statistical Analysis

All the analyses were performed in triplicates and the results were statistically analyzed and expressed as mean (n=3) ± standard deviation (SD).

3. Results and Discussion

Proximate Composition

Proximate analysis was carried out on *Agrocybe aegerita* edible mushroom. Results of the proximate compositions are presented in Table 1.

Table 1: Proximate analysis of *Agrocybe aegerita*

Parameters	Amount
Moisture (%)	92.36 ± 0.06
Crude Fiber (mg/100g)	8.05 ± 0.03
Ash(mg/100g)	1.22 ± 0.08
Fat(mg/100g)	0.20 ± 0.01

Values are expressed by mean ± SD of 3 Samples

Generally the, moisture contents of the mushroom are high, indicating that mushrooms are highly perishable. High moisture contents promote susceptibility to microbial growth and enzyme activity. Table 1 indicates that 92.36% of moisture was present in *Agrocybe aegerita*. The crude protein, ash and crude fiber values of most mushrooms compared favorably with and in some instances surpassed those reported for most legumes except groundnut and soybeans grown in West Africa (FAO, 1970; Aletor and Aladetimi, 1989).

Ash content was found to be low (1.22 mg/100 g) when compared to the fiber and moisture content in mushroom. The results of the fat analysis indicated that the species contains a moderate amount of fat (0.20 mg/100 g) and the results are represented in table: 1.

Table 2: Mineral content analysis of *Agrocybe aegerita*

Parameters	Amount (mg/g)
Sodium	0.293 ± 0.002
Potassium	0.085 ± 0.003
Calcium	0.273 ± 0.003
Magnesium	0.096 ± 0.004
Manganese	0.058 ± 0.009

Values are expressed by mean ± SD of 3 Samples

Mineral contents of sodium, potassium, calcium, magnesium and manganese values are expressed in table 2. Na and K are important in the maintenance of osmotic balance between cells and the interstitial fluid in animal systems. In these mushrooms, K is present in exceedingly higher amount (0.085 mg/g) than Na (0.29 mg/g). This suggests that these mushrooms would be excellent in lowering blood pressure, reducing the risk of osteoporosis and in maintaining bone health (Yusuf *et al*., 2007; Wani *et al.,* 2010).

Potassium's role as an essential mineral is well established. Potassium helps to maintain normal heart rhythm, fluid balance, muscle, and nerve function. The Dietary Approaches to Stop Hypertension (DASH) Trial demonstrated that an eating pattern which was rich in fruits and vegetables, and low fat dairy products, provided benefits for blood pressure (Obarzanek, 2001) and blood cholesterol levels (Harsha, 2004). This diet contained substantial amounts of potassium, fiber and calcium and was low in fat and sodium.

The presence of calcium in significant amounts in this mushroom makes it a valuable food for formation and maintenance of bone and normal function of nerves and muscles in humans and other vertebrates (Wani *et al.,* 2010). The values of calcium detected in these mushroom was (0.273 mg/g).

Mg and Mn which are indispensable in numerous biochemical pathways as important co-factors for certain enzymes were equally present in the mushroom species analyzed. However, the concentrations of Mg detected in these mushroom was (0.096mg/g), and Mn was least abundance in these mushrooms, (0.058mg/g) respectively.

Table 3: Mineral content analysis of *Agrocybe aegerita*

Parameters	Amount (mg/g)
Iron	3.85 ± 0.065
Zinc	0.153 ± 0.005
Copper	0.096 ± 0.004
Selenium	0.007± 0.004
Phosphorus	0.951 ± 0.008

Values are expressed by mean ± SD of 3 Sample

The amounts of the mineral elements in the mushroom are presented in Table 3. Iron is required for blood, liver, and muscle formation. Once again women of all ages require more iron than men. It takes little knowledge to understand one reason women of childbearing age require more iron, since it is normal for them to lose more blood than men. However, it is also true that older women require more than men of the similar age. Fe, which is essential for the biosynthesis of the oxygen-carrying pigment of red blood cells (haemoglobin) and the cytochromes that function in cellular respiration (Wani *et al.,* 2010), is also present in

good amounts in the mushrooms. The amounts of Fe found in the mushroom were (3.85 mg/g).

Copper is a trace element that is essential for human health. Found in all body tissues, with the bulk in the liver, brain, heart and kidney. An essential micronutrient that plays a role in making hemoglobin. Also involved in energy production. According to (Okwulehie and Ogoke, 2013), zinc is one of the most important mineral of our body needs. This is because zinc is highly associated with protein and carbohydrate foods. Zinc is also used in medicines that treat rashes, acne, dandruff, athlete's foot. The levels of copper and zinc in the mushroom species are (0.153 mg/g and 0.096 mg/g).

Selenium is frequently deficient in soils and foods worldwide, and in wild-grown mushrooms, its content varies depending on the species (Falandysz 2008; Rayman 2008; Jarzyńska and Falandysz 2011a, b). This element is highly potent and has great health impacts. It is needed in the synthesis of mammalian selenoenzymes, and glutathione peroxidase-3 and selenoprotein-P are dominant Se compounds secreted in the blood. Selenium level in the given sample is 0.007 mg/g. There are many factors for which She plays a role, and these need to be considered when deciding on the optimal human supplementation with dietary Se (or its species) including a key co-occurrence in vitamin E and other antioxidants but also other mineral constituents such as hazardous As, Cd, and Hg (Jarzyńska and Falandysz 2011a, b).

Unlike many vegetable sources of iron, mushrooms do not contain phytates, which reduce the body's ability to absorb iron. The bioavailability of the iron in mushroom is therefore high and up to 90% of the iron present can be absorbed (Knoop *et al.*, 1997). However, it is important to be aware that ultimately absorption will depend on what other foods the mushrooms are eaten with. For example, if they are eaten as part of a salad or with assorted vegetables, varying amounts of phytates will be present.

The level of phosphorus is 0.951 mg/g. Phosphorus is also required for bones and teeth, but it is of great importance in all tissues. It is used to transfer energy within the body and for genetic information.

4. Conclusion

The observed levels of the proximate and mineral element compositions of these mushrooms indicate that the mushrooms would be very good in complementing the nutrient supply deficits prevalent in developing countries. However, their availability is not adequate because of total reliance on wild growth rather than artificial cultivation of mushrooms in the area. For the full realization of the nutritional potentials of mushrooms, efforts must be made to cultivate them artificially and popularization of the more nutritious species is important.

Mushrooms are well-balanced food stuff when compared with other vegetables. Mushrooms are good source of amino acids, minerals and water soluble vitamins. They can be recommended for the countries suffering from insufficient nutrition; especially developing or third world countries.

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