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Contents of Some Vitamins in Five Edible Mushroom Varieties Consumed in Abakaliki Metropolis, Nigeria

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ABSTRACT

The vitamin contents of five wild growing mushroom species in Abakaliki metropolis, Nigeria were investigated. The aim of this study was to assess and compare the nutritional contents of various species of mushrooms found in Abakaliki metropolis. Of all the five wild mushroom species studied, vitamins A, C, E and niacin were found to be relatively higher in *Agaricus bisporus*. This was followed by Coral mushroom ($p<0.05$). Thiamin was also, relatively higher in Coral mushroom, followed by *Agaricus bisporus, Pleurotus ostreatus, Auricularia polytricha and Lentinus sajor* ($p<0.05$). Vitamins A and E were only found in *Agaricus bisporus.* Based on these results, the mushroom species are good sources of vitamin C, vitamin B1 and niacin and could be considered ideal supplements for many low vitamin food materials in our diets.

Keywords: Mushrooms, vitamin composition, nutrient supply, and Abakaliki.

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INTRODUCTION

Mushroom is a macrofungus with a distinctive fruiting body, which can be either epigeous or hypogeous and large enough to be seen with naked eye and to be picked by hand (Chang and Miles, 1992). They lack chlorophyll present in plants. Mushrooms represent one of the world's greatest untapped resources of nutritious food. Mushrooms are classified under sub division *Basidiomycotina*. They grow on dead and decaying organic material. From these decaying substrates, they absorb their nutrients with the help of very fine thread like structures (mycelium) which penetrates into substratum and generally not visible on the surface. After the mycelium has grown profusely and absorbs sufficient food materials, it forms the reproductive structures which generally comes out of the substrate and forms fruiting body, commonly known as mushrooms. The mushrooms fruiting body may be umbrella like or of various shapes, size and colours. All mushrooms are not edible and some are highly poisonous species which are commonly referred to as 'toad stools' (Crisian and Sands, 1978). Of several thousand mushroom species known worldwide, only around 2000 are considered edible, of which about 20 are cultivated commercially with only 4 to 5 under industrial production (Chang, 1990).

Cultivation of the saprophytic edible mushrooms may be the only and currently economical biotechnology for lignocelluloses organic waste recycling that combines the production of protein rich food with the reduction of environmental pollution (Obodai *et al., 2003*). Mushrooms are rich in protein, minerals, vitamins, fibers and they contain an abundance of essential amino acids (Sadler, 2003; Chadha and Sharma, 1995). Therefore, mushrooms can be a good supplement to cereals (Chang and Buswell, 1996).

Mushroom is being widely used as food and food supplements from ancient times. They are increasingly being recognized as one of the important food items for their significant roles in human health, nutrition and diseases (Chang, 1996). Mushrooms are recognized as the alternative source of good quality protein and are capable of producing the highest quantity of protein per unit area and time from the worthless agro-wastes (Chadha and Sharma, 1995). Mushrooms can substantiate the sufferings from malnutrition to some extent, because they produce large quantities in a short time and provide more protein per unit area than other crops (Hossain *et al.,* 2007). They are low in calories, carbohydrates, calcium and sodium. They contain high proportion of unsaturated fat but virtually no harmful lipid or cholesterol. It contains a large amount of vitamins such as Thiamine 1.4-2.2 mg (%), Riboflavin 6.7-9.0 mg (%), Niacin 60.6-73.3 mg (%), Biotin, Ascorbic acid 92-144 mg (%), Pantothenic acid 21.1-33.3 mg (%) and Folic acid 1.2-1.4 mg/100g in dry weight basis (Hossain *et al., 2007*). The minerals found in mushroom are calcium, Iron, Manganese, Magnesium, Zinc, Selenium etc (Alam *et al., 2007*). The mineral proportions vary according to the species, age and the diameter of the fruiting body. It also depends upon the type of the substratum (Demirbas, 2001). The mineral content of wild edible mushrooms has been found higher than cultivated ones (Aletor, 1995; Mattilla *et al.,* 2001; Rudawska and Leski, 2005). Mushroom has 1000 of variety to enrich the food basket of human health. It is an alternative rich source of meat, fish, vegetables, fruits etc. Mushroom's nutritional value proves to have many health benefits.

Consequently, upon the nutritional value of mushrooms, they have been also recognized as medicines for effective treating of cancer, cholesterol reduction, stress, insomnia, asthma, allergies and diabetes (Bahl, 1983). Also, medicinal properties, such as antifungal, antibacterial, antioxidant, antiviral antihypotensive, renal protective, immunemodulatory, and anticancer activities of mushroom extracts have been reported (Chang and Miles, 2004; Ikekawa *et al.,* 1969). Bahl (1983) reported that mushrooms cure epilepsy, wounds, skin diseases, heart ailments, rheumatoid arthritis, Cholera, fevers, diaphoretic, diarrhea, dysentery, cold, anesthesia, liver disease, gall bladder diseases and can be used as vermicides. The main therapeutically active components were found to be polysaccharides, especially β–D- glucans (Wani *et al.,* 2010 and Chihara *et al.,* 1969). Most of these medicinal components are now available in tablet and capsule forms, which are called mushroom nutriceuticals and are used as food supplements (Yang *et al.*,1993). Extracts from certain mushroom species (*Ganoderma lucidum, Ganoderma lucidium* and *Lentinus tigrinus*) have been used to lower blood pressure and serum cholesterol in hypertensive rats (Kabir *et al*.,1988; Ren *et al.,* 1989).

Thousands of years ago, fructifications of higher fungi have been used as a source of food (Mattila *et al .,*2001) due to their chemical composition which is attractive from the nutrition point of view. During the early days of civilization, mushrooms were consumed mainly for their palatability and unique flavors (Rai, 1994). Present use of mushrooms is totally different from traditional because, lot of research has been done on the chemical composition of mushrooms, which revealed that mushrooms can be used as a diet to combat diseases. The early history regarding the use of mushrooms in different countries has been reviewed by number of workers (Buller, 1915; Rolfe, 1925; Singer, 1961).

Lintzel (1941, 1943) recommended that 100 to 200 g of mushrooms (dry weight) is required to maintain an optimal nutritional balance in a man weighing 70 kg. Bano (1976) suggested that food value of mushrooms lies between meat and vegetables. Crisan and Sands (1978) observed that mushrooms generally contain 90% water and 10% dry matter. More so, the protein content varies between 27 and 48%. Carbohydrates are less than 60% and lipids are between 2 to 8%. Gruen and Wong (1982) indicated that edible mushrooms were highly nutritional and compared favourably with meat, egg and milk.

This study was aimed at characterizing some wild growing edible mushrooms common in Abakaliki region of Nigeria for vitamin compositions as an assessment of their nutritional values. The study was also aimed at providing useful information for selecting mushroom species that are rich in these nutrients for artificial production, since rapid deforestation is almost sending these important food resources into extinction in the region.

MATERIALS AND METHOD

Determination of vitamin composition

The five mushroom species used in this study were harvested from Abakaliki, Southeast Nigeria. The mushrooms, after collection, were washed cleaned with distilled water, cut into

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small pieces and ground using electric blender to homogenize the sample. The vitamin contents of the edible mushroom varieties from Abakaliki, Ebonyi state were determined according to the method described by Onwuka (2005) .

Table 1: Vitamin contents of five edible mushroom varieties in Abakaliki, Ebonyi State

Sample	Vit. A (mg/100g)	Vit. C (mg/100g)	Vit. E (IU/100g)	Thiamine (mg/100g)	Niacin (mg/100g)
Coral mushroom	0.00±0.00 [b]	1.04±0.01[b]	0.00±0.00[b]	0.52±0.57[a]	1.31±0.04[b]
Pleurotus ostreatus	0.00±.00[b]	0.74±0.01[c]	0.00±0.00[b]	0.19±0.02[c]	0.66±0.01[d]
Agariicus bisporus	38.36±0.18 [a]	1.70±0.01[a]	5.70±0.65 [a]	0.26±0.01[b]	1.65±0.00[a]
Auricularia polytricha	0.00±0.00 [b]	0.70±0.01[d]	0.00±0.00 [b]	0.07±0.01[d]	0.33±0.01[c]
Lentinus Sajor	0.00±0.00[b]	0.68±0.58[d]	0.00±0.00 [b]	0.27±0.02[b]	0.98±0.01[c]
Grand Average	7.67±15.88	0.97±0.46	1.14±2.37	0.26±0.27	0.99±0.48
P. value	p<.0001	p<0.0030	p<.0001	p<0.3445	p<.0001
n- value	n=3	n=3	n=3	n=3	n=3

RESULTS AND DISCUSSION

Vitamin analysis was carried out on five wild grown edible mushroom varieties consumed in Abakaliki region of Nigeria; Coral mushroom, Oyster mushroom, *Agaricus bisporus* mushroom, Earwood mushroom and soft oyster mushroom. Results of the vitamin compositions are presented in Table 1. The vitamin contents of all the mushroom varieties varied significantly among the species (P< 0.0001).

Vitamin A contents of the mushrooms varied from 0 – 38.36% with a mean value of 38.36±0.18%. Vitamin A was only detected in *Agaricus bisporus* at a mean concentration of 38.36mg/100g while there was no vitamin A in other mushroom varieties studied. The value obtained for vitamin A in *Agaricus bisporus* was significantly higher than most animal and plant materials known to contain significant amount of vitamin A including veal liver (28mg/100g), butter (0.59mg/100g), cheese (0.39mg/100g), egg (0.28), salmon (0.041mg/100g) and milk (0.04mg/100g) (Souci *et al.,* 2000). Vitamin A is a generic term for a group of lipid soluble compounds related to retinol. The main function of vitamin A has been found to include proper vision, reproduction, growth and development, cellular differentiation and immune function. Its earliest deficiency symptom is impaired dark adaptation or night blindness. Severe deficiency could cause Xerophthalmia, characterized by changes in the cells of the cornea that ultimately result in corneal ulcers, scarring and blindness (Bowman, 2001).

The value obtained for vitamin C (ascorbic acid) indicated that the mushrooms are considerable sources of vitamin C. The amount of vitamin C spanned from 0.68-1.70% with a mean concentration of 7.67±15.88%. The highest vitamin C content was found in *Agaricus bisporus* the while lowest concentration of vitamin C was found in coral mushroom. Sapers *et*

al., 1999 and Mattila *et al.,* 2001 reported vitamin C content of up to 7mg/100g of edible parts of mushrooms. The values of vitamin C obtained for each of the mushroom varieties studied were significantly lower than the reported value. The value of vitamin C content obtained in *Agaricus bisporus* (1.70mg/100g) compares favourably with value of 6.9mg/100g reported respectively on *Agaricus bisporus* and *Pleurotus ostreatus* by Mattila *et al* (2001) and Mattila *et al* (2002). Esselen and Fellers (1946) reported a significantly higher vitamin C content of 8.6mg/100g in *Agaricus bisporus.* The value of vitamin C obtained in *Pleurotus ostreatus* (0.74mg/100g) was significantly lower than the vitamin C content of 1.6mg/100g reported on *Pleurotus ostreatus* by Mattila *et al* (2001) and Mattila *et al* (2002).

The result obtained for vitamin E indicates that the mushroom varieties studied are significantly low in vitamin E. Only *Agaricus bisporus* recorded a detectable amount of vitamin E content of 5.70 IU/100g among the studies mushroom varieties. There dearth of information on the vitamin E content of edible wild mushroom varieties. However, the values obtained are in concordant with the reports on available literature that mushrooms are significantly low in vitamin E (Outila *et al*.,1999). Studies have shown that vitamin E decrease symptoms of premenstrual syndrome and certain types of breast disease (Comb, 2001), serves as a useful supplement for some neurological diseases such as Alzheimer's disease (Reboul *et al.,* 2006). Serves as a major fat soluble antioxidant of the body and also carries out Non-antioxidant functions in cell signaling, gene expression and regulation of other cell functions (FSA, 2003).

Thiamine is a water-soluble B-complex vitamin. It is required in significant amount for the vital functions it perform such as the flow of electrolytes in and out of nerve and muscle cells (through ion channels), coenzyme for both Co-enzyme in energy metabolism and for pentose metabolism (as a basis for nucleic acids), nerve impulse conduction and muscle action; as part of treatment for metabolic disorders like maple syrup urine disease, for treatment of beri beri among others (Wakita, 1976). The values 0.19-0.54% obtained for the mushroom varieties that the mushrooms are low in thiamin compared to yeast (Wakita, 1976). The opinion is that, with respect to thiamin content, mushrooms are a bridge between yeast and other food products of vegetable origin (Karchocha and Mlodeoki, 1965). The low thiamin content in mushrooms when compared to yeast could be accounted for by the presence of thiaminase, an enzyme that destroy thiamin (Wakita, 1976). Aapparently, mushrooms have the hydrolase and a few also have the transferase, both of which destroy the vitamin (Kurtzman, 2005). However, the thiaminase can be destroyed during normal processing and cooking procedures. It is possible that with proper care, the thiamin in the mushrooms could be greatly increased (Kurtzman, 2005).

The presence of niacin was observed in significantly varying amounts in the five edible mushroom varieties that were studied. The result of the analysis showed that niacin content of the mushrooms varied from 0.3-1.65% with a mean value of 0.99±0.48. According to Kurtzman, 2005, niacin is very high in mushrooms. It is the anti-pellagra vitamin, but it is also recommended for controlling blood cholesterol (Kutzman, 2005). It provides 23-26% of the recommended daily intake (sRDI) for niacin per 100g (Surabhi and Devina, 2011). Watt and Merrill, 1963; Esselen *et al* 1946; Mattilla *et al.,* 2001 and Mattilla *et al* 2002 reported a

significantly higher concentration of niacin in *Agaricus bisporus.* They also reported a significantly higher amount of niacin in *Pleurotus ostreatus.* However, the results obtained for the studied mushroom varieties suggest a positive correlation between niacin and vitamin A (r = 0.71), niacin and vitamin C (r =0.74), niacin and vitamin E (r = 0.7), and niacin and thiamin (r = 0.38).

CONCLUSION

The study indicated that some of the mushrooms, particularly *Agaricus bisporus,* are good sources of the vitamins analyzed and could be an ideal supplements for many low vitamin containing food materials including meat in our densely populated country.

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