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PHYTOCHEMICAL ANALYSIS OF THREE WILD EDIBLE MUSHROOMS, CORAL MUSHROOM, *AGARICUS BISPORUS* AND *LENTINUS SAJOR*, COMMON IN OHAUKWU AREA OF EBONYI STATE, NIGERIA

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ABSTRACT

The concentrations of some phytochemicals in three species of edible mushrooms (*Coral mushroom, Agaricus bisporus* and *Lentinus sajor*) that are common in Ohaukwu area of Ebonyi State, Nigeria were determined using standard methods. The results revealed the presence of alkaloids, flavonoids, tannins, saponins, oxalates, phytates, HCN and phenols in significant amounts with tannins being the highest, followed by flavonoids and phenols, while HCN was the least in concentration. There was a significant variation among the mushrooms in their composition of the phytochemicals ($p<0.05$). The obtained values of the phytochemicals in all the mushrooms were interestingly found to be significantly lower ($p<0.05$) than their toxicity levels according to World Health Organization (WHO) safe limits. The results of this study suggest that these mushrooms may be very safe for consumption in terms of phytochemical toxicity and at the same time have some medicinal properties.

Keywords: *Mushrooms, phytochemical composition, safety, medicinal properties*.

INTRODUCTION

Mushroom is a spore-bearing, fleshy fruiting body of a fungus that is typically produced above ground. It describes a variety of gilled fungi, with or without stems. Identifying mushrooms requires a basic understanding of their macroscopic structure. Most are Basidiomycetes and gilled. Their spores, called basidiospores, are produced on the gills and fall in a fine rain of powder from under the caps. At the microscopic level the basidiospores are shot off basidia and then fall between the gills in the dead air space (Ramsbottom, 1954).

Edible mushrooms are consumed by humans for their nutritional and medicinal values. Mushrooms consumed for health reasons are known as medicinal mushrooms. While hallucinogenic mushrooms (e.g. Psilocybin mushrooms) are occasionally consumed for recreational or religious purposes, they can produce severe nausea and disorientation, and are therefore not commonly considered edible mushrooms(Boa, 2004).

Most mushrooms sold in supermarkets have been commercially grown on mushroom farms. *Agaricus bisporus*, is considered safe for most people to eat because it is grown in controlled and sterilized environments. In recent years, increasing affluence in developing countries has led to a considerable growth in interest on mushroom cultivation, which is now seen as a potentially important economic activity for small farmers (Hall *et al.*, 2003).

Edible mushrooms are the fleshy and edible fruit bodies of several species of fungi. Mushrooms belong to the macro fungi, because their fruiting structures are large enough to be seen with the naked

eye. They can appear either below ground (hypogeous) or above ground (epigeous) where they may be picked by hand. Edibility may be defined by criteria that include absence of poisonous effects on humans and desirable taste and aroma (Mattila *et al*., 2000).

Edible mushrooms include many fungal species that are either harvested wild or cultivated. Easily cultivatable and common wild mushrooms are often available in markets, and those that are more difficult to obtain (such as the prized truffle and matsutake) may be collected on a smaller scale by private gatherers. Some preparations may render certain poisonous mushrooms fit for consumption (Jordan, 2006).Before assuming that any wild mushroom are edible, it should be identified and tested. Proper identification of the specie is the only safe way to ensure edibility. Some mushrooms that are edible for most people can cause allergic reactions in some individuals, and old or improperly stored specimens can cause food poisoning. Deadly poisonous mushrooms that are frequently confused with edible mushrooms are responsible for many fatal poisonings. This includes several species of the *Amanita* genus, in particular, *Amanita phalloides*, the *death cap* (Rubel and Arora, 2008). *Agaricus bisporus* contains carcinogens called hydrazines, the most abundant of which is agaritine. However, the carcinogens are destroyed by moderate heat when cooking (Jodan, 2006).

The aim of this research was to analyse the three wild grown edible mushrooms commonly used in Ohaukwu area of Ebonyi State, Nigeria for their phytochemical contents in order to note their safety and medicinal values as well as the variability of the mushroom species in relation to concentrations of these phytochemicals.

MATERIALS AND METHODS

Sample Collection and Preparation: The three edible mushrooms used in this research were obtained from Ohaukwu L.G.A of Ebonyi State, Southeast Nigeria. The samples were washed with distilled water, dried in a hot air oven at 45^{o}C for about 4 hours and then ground into powder using a high speed milling machine.

Determination of Phytochemical Contents: Tannin content of the sample was determined by Folin Denis colometric method. Saponin and alkaloids were determined by the double solvent gravimetric extraction and alkaline precipitation methods as described by Harborne (1973). Phenol concentration was determined by the Folin–Ciocatean spectrophotometer method by AOAC (1990). Flavonoid was determined by the method described by Harbone (1973). HCN was determined in the samples by alkaline Picrate colorimetric method by Balogopalin et al. (1988). Phytates and oxalates were determined by the method reported by AOAC (1990).

RESULTS AND DISCUSSION

Phytochemical screening was carried out on wild grown *Coral mushroom, Agaricus bisporus and Lentinus sajor* in Ohaukwu Local Government Area of Ebonyi State, Nigeria. The results of the analyses are shown in Table 1. The results showed the presence of significant amounts of flavonoids, tannins, alkaloids, phenol, HCN, oxalate and phytates.

The tannin concentration of the dried ground samples ranged from 0.53-0.73% with a mean value of 0.60±0.100%. The highest tannin value (0.73%) was recorded on *Lentinus sajor* while coral mushroom recorded the lowest value of (0.53%). The results showed that the tannin concentrations of these edible mushrooms are within standard safe limit (60.00mg/100g) (WHO, 2003).

The saponin contents of the mushrooms varied from 0.05-0.17% with a mean value of 0.11±0.056%. These values are within the WHO maximum permissible limit of (48.50mg/100g). The results suggest that these mushrooms could be safe for consumption.

The flavonoid compositions of the mushrooms are significantly lower than the tolerable limit (52.02mg/100g) (WHO, 2003), indicating that the mushrooms are equally safe and could be good sources of anti-oxidants that boosts body immunity. The flavonoid contents ranged from 0.13-0.85% with a mean value of 0.41±0.331%.

The results of the HCN contents ranked these edible mushroom varieties in decreasing order of cyanide content as *Lentinus sajor* > coral mushroom > *Agaricus bisporus.* Their HCN contents were respectively 4.51, 1.12 and 0.00 (mg/100g). The results indicate that the HCN contents of these fungi differ significantly ($p < 0.05$). These values for *Lentinus sajor* and coral mushroom are significantly higher than 5.8ppm (i.e. 0.58 mg/100g) reported by Chang (1994). (Are these values within WHO safe limit or not?)

Significant variation was detected in the alkaloid compositions of these fungi ($p < 0.05$). Their alkaloid contents were 0.43%(coral mushroom), 0.21%(*Lentinus sajor*) and 0.05%(*Agaricus bisporus*) with an average value of 0.23 ± 0.166%. The highest value was detected in coral mushroom while the lowest was found in *Agaricus bisporus.* These values are much lower than the WHO toxic Standard limit of 61.00g/100g indicating that the mushrooms are safe for consumption in large quantity and can help in relieving of pains.

Oxalate concentrations of the mushrooms ranged from 0.23-0.06% with a mean value of 0.13 ± 0.079%. The values are much lower compared to World Health Organization tolerable limit of (105.00mg/100g) and were significantly lower than 0.412% reported by Harden (2007).

The results obtained in this study showed a significant difference in the phytate compositions of the three edible mushroom varieties. The phytate contents of *coral mushroom*, *Agaricus bisporus* and *Lentinus sajor* were 0.07, 0.05 and 0.12% respectively. These results are over 100 times lower than the standard safe limit (22.10mg/100g) (WHO, 2003) suggesting that the mushrooms are highly safe with respect to toxicities associated with phytate content.

Phenol concentrations of these edible mushrooms from Ohaukwu Local Government Area of Ebonyi State ranged from 0.03-0.54% with an average value of 0.27 ± 0.220%. Statistical analysis showed significant variation among the mushrooms based on phenol content. The obtained phenol concentrations of these mushrooms are lower than the World Health Organization Standard safe limit (you have to state the safe limit for this statement to make sense).

CONCLUSION

We report here the presence of alkaloids, flavonoids, tannins, saponins, oxalates, phytates, HCN and phenols in significant but safe amounts in three mushroom species in Ohaukwu and some other areas of Ebonyi State, Nigeria, with tannins being the highest while HCN was the least in concentration. The presence of these phytochemicals may be of immense pharmacological benefits. For instance, phytate, phenolic compounds, and saponins have been associated with reduction in blood glucose, plasma cholesterol, triglycerides levels and cancer risks (Thompson, 1993; Graf and Eaton, 1990; Vucenik *et al*., 1997; Sopido *et al*., 2000). Further, Sopido *et al* (2000) even described saponins as natural antibiotics, which help the body to fight infections and microbial invasion while Okaka *et al* (1992) added that alkaloids are known for their pharmacological effects rather than their toxicity provided its safe limit is not exceeded.

Table 1: Mean concentrations of Some Phytochemicals in three mushroom varieties from Ohaukwu L.G.A. of Ebonyi State, Nigeria.

Phytochemicals	coral mushroom	*Agaricus bisporus*	*Lentinus sajor*	Overall mean
Alkaloid(%)	0.43±0.012^{a}	0.05±0.012^{c}	0.21±0.023^{b}	0.23±0.166
Saponin(%)	0.11±0.012^{b}	0.05±0.012^{c}	0.17±0.012^{a}	0.11±0.056
Flavonoid(%)	0.27±0.012^{b}	0.13±0.012^{c}	0.85±0.012^{a}	0.41±0.331
Tannin(%)	0.53±0.006^{c}	0.54±0.012^{b}	0.73±0.006^{a}	0.60±0.100
HCN(mg/100g)	1.12±0.076^{b}	0.00±0.000^{c}	4.51±0.058^{a}	1.87±4.882
Phenol(%)	0.54±0.002^{a}	0.03±0.001^{c}	0.24±0.002^{b}	0.27±0.220
Oxalate(%)	0.09±0.007^{b}	0.06±0.007^{c}	0.23±0.013^{a}	0.13±0.079
Phytate(%)	0.07±0.001^{b}	0.05±0.002^{c}	0.12±0.002^{a}	0.08±0.029

*Values are mean ± standard deviation of 4 determinations and means with the same letter on the same row are not significantly different at P = 0.05.

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