

INDIGENOUS KNOWLEDGE AND UTILIZATION OF EDIBLE MUSHROOMS IN PARTS OF SOUTHERN GHANA

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ABSTRACT

*Indigenous knowledge on edible fungi in Ghana has mostly been limited to rural people. Edible mushrooms are collected from forest reserves, secondary forests and fields under fallow. However, with the current rate of bush burning and deforestation, collection of edible mushrooms from the wild is threatened. A survey was carried out in Southern Ghana to gather information on local knowledge and utilization of edible mushrooms. Mushroom collectors, consumers and traders were interviewed using structured questionnaires in local markets, homes and along roadsides. Thirty different mushrooms with their vernacular names were listed by correspondents. The commonest species collected for consumption are *Volvariella volvacea* (Bull.: Fr) Singer (Straw/Oil palm mushroom), *Termitomyces globulus* (Pat.) Heim, *T. microcarpus* (Berk. & Br.) Heim, *T. schimperi* (Pat.) Heim, *T. robustus* (Pat.) Heim and *Coprinus disseminatus* (Pers.: Fr.) S. F. Gray. Among the local people, names of edible mushrooms are based on the substrates on which they grow, their association with insects, and unrelated taxa are given collective names. Rural people believe mushrooms have medicinal values and can serve as blood tonic, reduce obesity and lower blood pressure in hypertensive patients among others. Mushroom consumption is however, low since mushrooms collected are rather exchanged for money to buy fish or meat which is often less expensive. Women are especially involved in mushroom collection and have extensive knowledge regarding mushrooms as well as deriving incomes from them.*

Keywords: Rural people, edible mushrooms, vernacular names, medicinal purposes

INTRODUCTION

The forest contributes to all aspects of rural life, providing food, fodder, fuel, building materials and household items. Rural folks have utilized edible mushrooms to supplement and diversify their diet. Mushroom use has become an integral part of traditional and cultural practices in many households in East, Central and West Africa (Dijk *et al.*, 2003; Rammeloo & Walley, 1993; Buyck & Nzigidahera, 1995). In the countryside and forest regions, several species are collected for

consumption. During the onset of the rainy season when mushrooms are abundant, most people in rural areas collect them for consumption and sell the surplus for extra income.

Edible mushrooms are considered healthy food because their mineral content is higher than that of meat or fish and most vegetables (Chan, 1981). It is also known that the protein content of fresh mushrooms is about twice that of vegetables and four times that of oranges (Chan, 1981). Edible mushroom proteins contain all nine amino acids

essential for humans and they are especially rich in lysine and leucine, which are lacking in most staple cereal foods (Li & Chang, 1982). They are also a good source of iron, potassium and phosphorus in addition to folic acid, an ingredient known for enriching blood deficiencies. Mushrooms are low in sodium, making them ideal for persons with certain types of heart and kidney ailments (Quimio *et al.*, 1990). Mushrooms are devoid of starch and low in calories and other carbohydrates. Apart from their nutritional value, mushrooms have potential medicinal benefits (Chan, 1981). They are an ideal food for diabetics and over-weight people.

Ethnomycological studies have been conducted in various parts of East and Central Africa (Parent & Thoen, 1977) and in Ghana case studies have been published on the rate of mushroom consumption (Townson, 1995). Rammeloo and Walley (1993) published a bibliography on the use and importance of edible fungi in the diet of local populations in sub-Saharan Africa. The current rate of bush burning, deforestation and over-exploitation of timber and non-timber forest products are, however, greatly threatening the availability of mushrooms in Ghana.

To date, there is little documentation on the various kinds of mushrooms used in Ghana, inadequate quantitative information on the common and rarely eaten species, as well as those used purely as food or for medicinal purposes. A survey was, therefore, undertaken from September 1999 to December 2002 to document indigenous knowledge on edible mushrooms, relate local taxonomy to scientific nomenclature, assess the types of mushrooms utilized and investigate harvesting patterns in Ghana.

METHODS

An ethnomycological and socioeconomic survey was carried out to provide data on the socioeconomic status of people involved in the mushroom business as well as provide information on harvesting practices and utilization of edible mushrooms in Ghana. The survey was undertaken randomly on people in their homes, farms, and markets and along roadsides in the Ashanti, Brong Ahafo, Western and Eastern Regions of the country (Figure 1). An interview schedule with structured questionnaires was used to obtain information from mushroom collectors, consumers and traders to determine indigenous knowledge and utilization of edible mushrooms. Purposive sampling was used and covered different ethnic groups of various ages, most of them being women. A total of 738 respondents made up of 254 collectors, 450 consumers and 34 traders were interviewed.

Mushroom collection trips were undertaken to reserved forests, forest fringes, abandoned farms and food crop fields with local assistants from villages. Samples of mushroom species collected were identified using standard identification manuals: Pegler (1977), Phillips, 1981, Courtecuisse and Duhem (1995), Laessle (1998) and Ryvarden and Johansen (1980). Fruit bodies were dried, temporarily preserved in solution and examined under the microscope for identification.

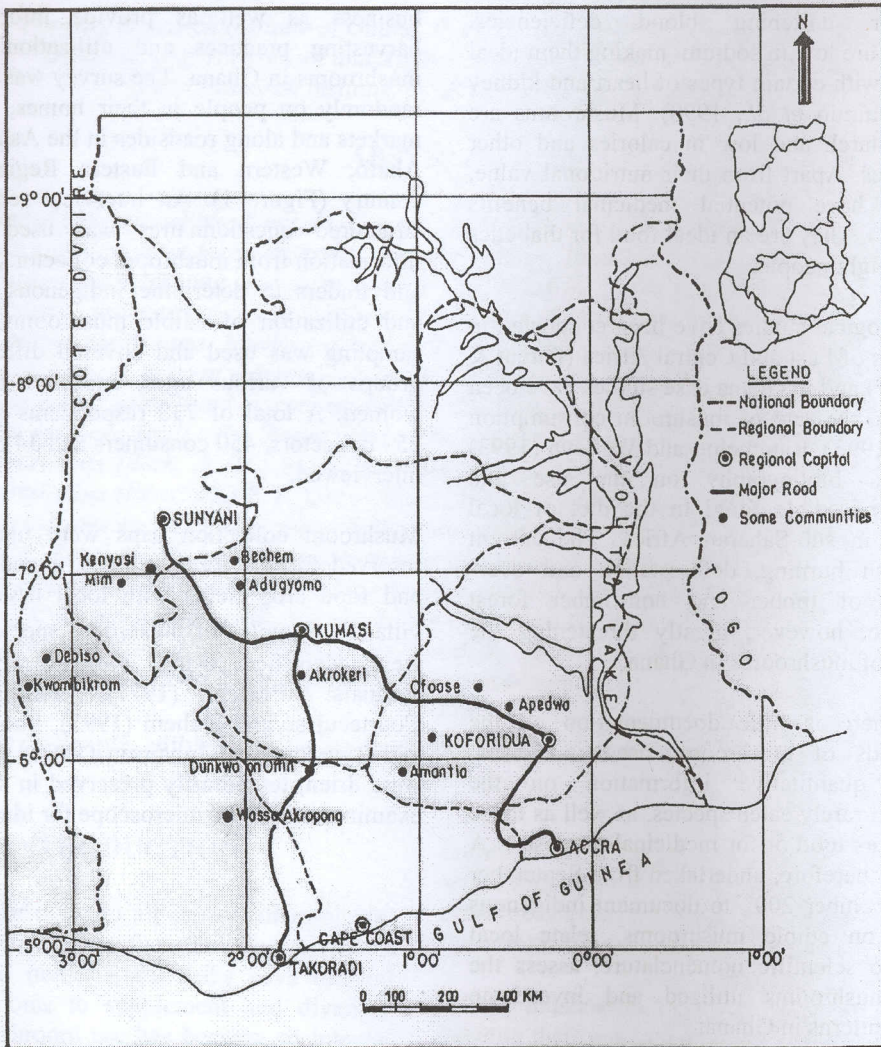


Figure 1: Map of Southern Ghana showing areas where Questionnaires on Mushroom Consumption was administered.

RESULTS

Indigenous Knowledge and Taxonomy of Mushrooms

All 738 respondents have a well-developed knowledge of wild edible fungi. Thirty different mushrooms with their vernacular names were listed by correspondents. Nineteen species have been identified as edible (Table 1). The five commonest species were *Volvariella volvacea* (Bull.: Fr.) Singer, *Termitomyces globulus*, *T. schimperi*, *T. robustus* and *Coprinus disseminatus* (Figures 2a-e). These accounted for 61% of all the edible species. Other edible mushrooms were *V. bombycina*, *T. clypeatus*, *T. microcarpus*, *Schizophyllum commune*, *Collybia* sp., *Auricularia auricula-judae*, *Macrolepiota* sp., *M. africana*, *Pleurotus* sp., *P. tuber-regium*, *Calvatia cyathiformis* and *Trametes* species. Fungi for which only Ghanaian names are known include Ornakwa, Adwoaderder, Ntonsuo, Kwadabor-dabor and Nyiranhyira (local Ghanaian names).

The naming of mushrooms by rural people is based on single characters, resulting in the same name to unrelated taxa. Three species (*Collybia* sp., *Schizophyllum commune* and a local *Pleurotus* sp.) are together referred to as Mewidia and two (*Trametes* sp., *Calvatia* sp.) as Efu. Similarly, in some communities two species of *Volvariella* (*V. volvacea* and *V. bombycina*) are together referred to as Domo. Fungal association with certain insects are also used to name mushrooms, for example, Nkankum/Nkankuma (*T. robustus*) implies coming from termites. Some names apply to the appearance of the mushroom at maturity, for example, Tsloyumu, (*Coprinus disseminatus*) means black mushroom; Mirefufuo/Fufuo (*P. tuber-regium*) means white mushroom. It was claimed that a polypore (*Trametes* sp.) which was not consumed by majority of tribes was eaten by a field assistant without any harmful effect. According to him his ancestors said all

mushrooms found growing on decaying oil palm are edible.

Food and Medicinal Value of Mushrooms

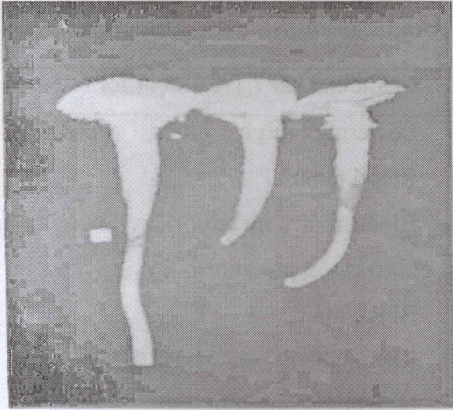
Mushrooms are highly valued by all respondents for several important reasons. They were found to have some medicinal values. *Volvariella volvacea* and *T. globulus*, which were preferred by all the respondents interviewed, are used as blood tonic. In addition, *V. volvacea* is used in the treatment of blood pressure (Table 2). *Termitomyces globulus* and *T. schimperi*, preferred by the Asantis, Akyems and Akwapims, are also believed to lower blood pressure in hypertensive patients. Some species are used in the treatment of rheumatism, Kwashiorkor, obesity, diarrhoea and others as purgative (Table 2).

The collectors considered edible fungi as alternative or supplement to meat or fish but prefer to sell them to get money to buy meat or fish which is less expensive. The bulk of the mushrooms collected are sold after a small proportion is set aside for home consumption. Mushrooms for food may be cooked straight away after harvesting while others are first dried. Fresh mushrooms are washed and cut in small pieces before being used in the preparation of stew and soup.

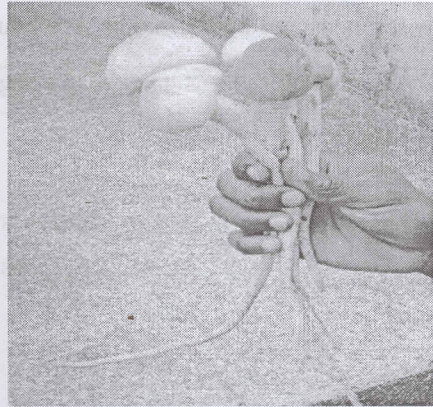
Various reasons were given for the choice of mushrooms consumed. The majority of consumers choose edible mushrooms for their taste which enhances appetite; this is followed in decreasing order by their availability, influence of neighbours, texture and price affordability (Figure 3). In the urban centres, mushrooms are included in soups and stews as delicacies when in season. Ironically, most consumers did not give much consideration to the nutrient value of the mushrooms.

Table 1: Local names of Edible Mushrooms and their Corresponding Scientific Names

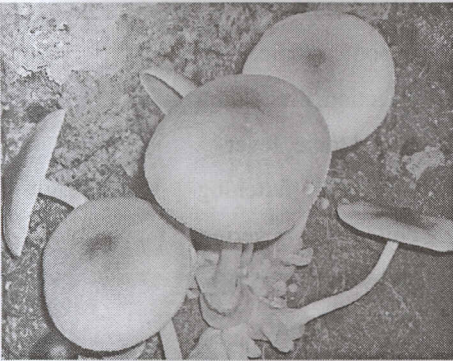
| | Local names | | Growing habitat | Period of occurrence | Scientific name |
|------------------------|-------------|-----------|------------------------------------|--------------------------|--|
| | Sefwi | Adangbe | | | |
| Asante | Sefwi | Adangbe | | | |
| Domo | Mbre | Akotrokro | Logs/ decaying oil palm /Sawdust | Feb- Sept. | <i>Volvariella volvacea</i> |
| Ahimere | Ahimere | Akotrokro | Logs | March-May | <i>V. bombycina</i> |
| Tweaworodo/ Sosowah | Atwe | Kokutetsu | Termite mound | Feb.-April/Sept- Nov. | <i>Termitomyces globulus</i> |
| Mpempena | Mpempena | Huhui | Termite mound | June-July | <i>T. microcarpa</i> |
| Sibre/Simire | Ono | - | Termite mound | Sept-Nov | <i>T. schimperi</i> |
| Kyikyikyiyi | Tre/ Trede | - | Termite mound | Mar-April/ Sept-Nov. | <i>T. clypeatus</i> |
| Nkankum | Nkankuma | - | Termite mound | Feb-April/ Jul-Oct | <i>T. robustus</i> |
| Sasea | Nidiwa | Tsloyumu | Tree stumps/ logs | Mar- Dec | <i>Coprinus disseminatus</i> |
| Mewidia/ Kofikorku | Awiawi | - | Forest floor/ Decaying oil palm | April-Nov. | <i>Collybia</i> sp. |
| Mewidia | Mewidia | - | Decaying oil palm/ logs | Mar-Nov. | <i>Schizophyllum commune</i> |
| Mewidia | Mewidia | - | Decaying oil palm | Mar-Nov. | <i>Pleurotus</i> sp. |
| Mirefufuo | Mirefufuo | - | Forest floor/logs | All year | <i>Pleurotus tuber- regium</i> |
| Abrowasu | Asuntoku | Yomoyotue | Wood stumps/ Logs | All year | <i>Auricularia auricula- judae</i> |
| Esiemma | - | - | Sawdust/ forest floor | Feb. | <i>Macrolepiota africana</i> |
| Adutwumwa | - | - | Decaying oil palm | Feb. | <i>Macrolepiota</i> sp. |
| Efuo | Efuo | - | Decaying oil palm | March-Nov. | <i>Trametes</i> sp. |
| Efuo | Efuo | - | Pasture land/lawns | March-Nov. | <i>Calvatia cyathiformis</i> |



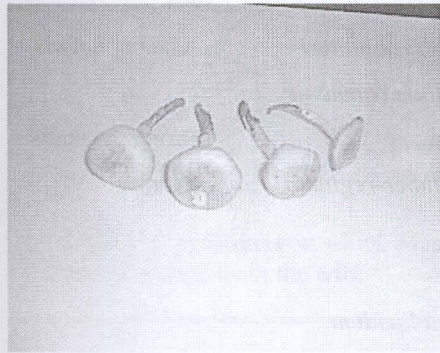
a



b



c



d



e

Figures 2a-e: Edible Mushroom types: a) *Termitomyces schimperi* b) *T. globulus*
c) *Volvariella volvacea* d) *T. robustus*
e) *Coprinus disseminatus*

Table 2: Preferences and Medicinal uses of Mushroom by Ethnic Groups

| Mushroom | Ethnic group using mushroom | Medicinal use / Treatment for |
|--------------------------------------|--------------------------------------|--|
| <i>Volvariella volvacea</i> | All | Lowering high blood pressure, Blood tonic |
| <i>Termitomyces globulus</i> | Asantis, Adangbes Akims, Akwapims | Blood tonic, kwashiorkor, lowering high blood pressure |
| <i>T. microcarpus</i> | Asantis, | Blood tonic |
| <i>T. clypeatus</i> | Sefwis | Rheumatism, diarrhoea, lowering high blood pressure |
| <i>T. robustus</i> | All | Blood tonic |
| <i>Coprinus disseminatus</i> | Asantis, Sefwis | Blood tonic, purgative, eye infection, pregnant women |
| <i>Schizophyllum commune</i> | | |
| <i>Collybia</i> sp. | Brongs, Asantis | Blood tonic, fever |
| <i>Pleurotus tuber-regium</i> | Brongs | Asthma, fattening underweight children, lowering high blood pressure |
| <i>Ganoderma lucidum</i> | - | Cancer, stroke |
| <i>Auricularia auricula-judae</i> | - | Blood tonic |
| <i>Trametes</i> species (a polypore) | Asantis | Blood tonic |

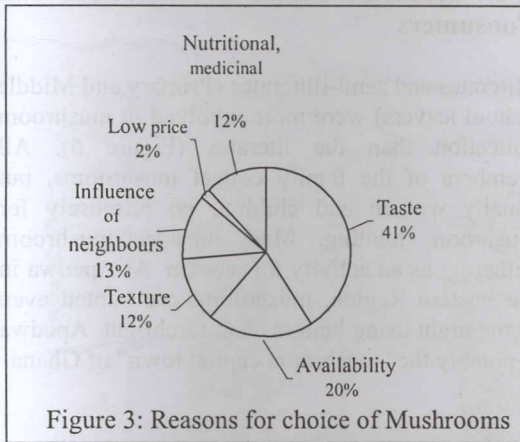


Figure 3: Reasons for choice of Mushrooms

Substrates

Mushrooms were mostly collected from secondary forests, abandoned farms, fallow and cultivated fields. Collectors and traders however, feared to reveal that mushrooms were collected from forest reserves since they have been banned from collecting non-timber forest products and hunting game in the forest reserves.

According to the collectors, specific mushrooms are associated with particular soil types, tree species and topography (Table 1). *Volvariella volvacea*, *Collybia* spp. and *S. commune* grow on decomposing felled oil palm trees. Mushrooms found growing on logs are *V. bombycina*, *V. volvacea*, *Coprinus disseminatus*, *A. auricula-judae*, *S. commune* and *Pleurotus* species (Figure 4). *Volvariella volvacea* is commonly collected from decaying wood logs of *Ceiba pentandra* (Onyina) but sometimes on *Antiaris toxicaria* (Kyenkyen) and *Triplochiton scleroxylon* (Wawa) (Figure 5). *Termitomyces* spp. generally grow on inconspicuous termite mounds but species such as *T. globulus* and *T. macrocarpus* are found associated with termite mounds under *Bombax buonoposense* and soils in between buttresses of

C. pentandra, *Terminalia superba* and *Mansonia altissima*. Some mushrooms occur only in particular localities. *Termitomyces clypeatus*, even though occurring on termite mounds, is only found in some parts of the Western and Ashanti Regions. Similarly, *Pleurotus tuber-regium* is only found in the Brong Ahafo and Volta Regions.

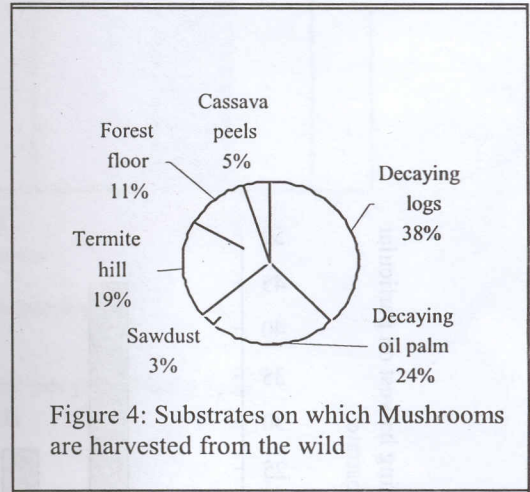


Figure 4: Substrates on which Mushrooms are harvested from the wild

Some mushrooms appear only at particular times of the year and are associated with particular amounts of rainfall, whereas others grow throughout the year provided there is adequate moisture (Table 1). This suggests the importance of rainfall pattern in fungal phenology. The appearance of most edible mushroom species is highly predictable in time and such patterns are well known by both natives and migrant farmers. The occurrence of *Termitomyces* spp. during specific seasons in fixed places is well known by the rural people. They claim rights to such areas especially the fields under fallow. Most of the mushrooms are harvested at the onset of the rainy season from February to April. Two mushroom species of the genus *Termitomyces* (*T. schimperi* and *T. clypeatus*) however, are harvested only from August to November during the minor rainy

season while *T. robustus* appears soon after the first rains in March to April and July to October (Table 1). *Termitomyces microcarpus* is harvested during the major rainy season from May to July. All the mushrooms encountered are therefore saprotrophic and/or termitophilous with none being ectomycorrhizal.

Socio-economic Status of Collectors and Consumers

Illiterates and semi-illiterates (Primary and Middle School leavers) were more involved in mushroom collection than the literates (Figure 6). All members of the family collect mushrooms, but usually women and children go purposely for mushroom hunting. Men consider mushroom gathering as an activity for women. At Apedwa in the Eastern Region, mushrooms are hunted even in the night using lanterns and torchlight. Apedwa is notably the “mushroom capital town” of Ghana.

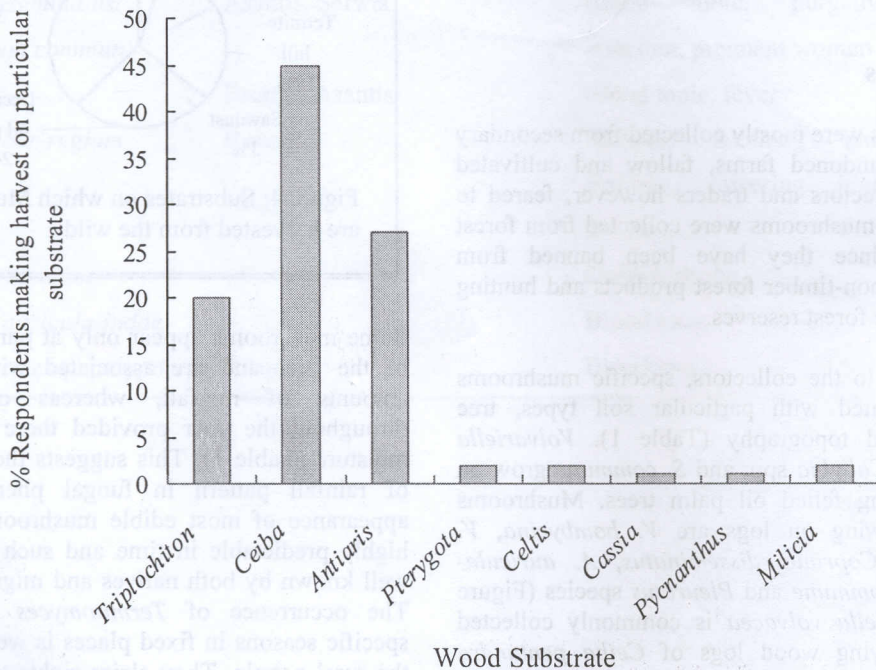


Figure 5: Wood substrates on which mushrooms are harvested

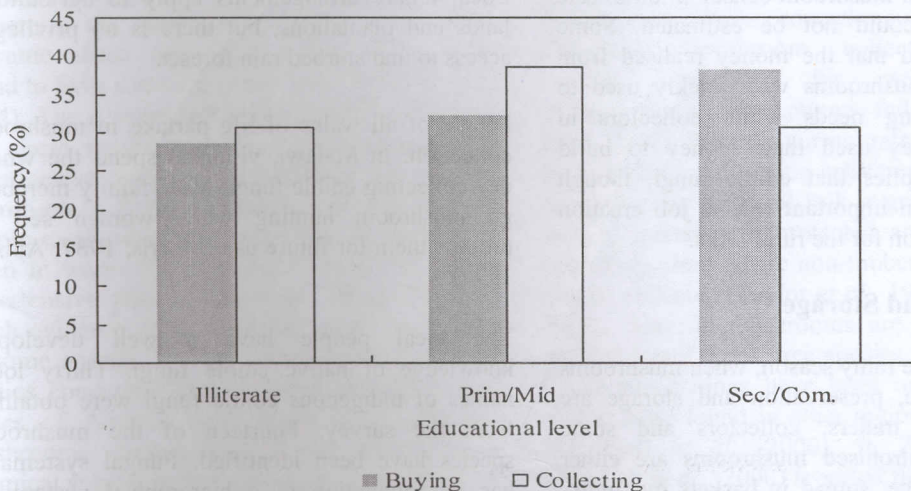


Figure 6: Acquisition of mushrooms by people of different educational levels

Marketing of Wild Edible Mushrooms

When mushrooms are harvested in large quantities the collectors sell them to middle women who in turn retail them to travellers. The vendors sell the mushrooms along major roads: from Kumasi to Atwidie in the Ashanti Region, Mampong Wassa to Ayanfuri in the Western Region and Ahafo Mim to Sunyani in the Brong Ahafo Region among others. The vendors are mainly girls and women aged 16 to 45 years. Only fresh mushrooms are sold along the roadsides, therefore they are available to the urban people the same day of harvesting. The average storage period for fresh mushrooms prior to sale is less than two hours.

Mushrooms are a source of income for a lot of rural dwellers. The price of mushrooms fluctuates throughout the year. Prices of mushrooms are based on supply and demand. Generally, prices are extremely high at the beginning of the mushroom season in November. Prices can go as high as \$1.2-\$2 for a 1.0kg bundle of *T. schimperi* and a 0.5kg bundle of *T. globulus* at the roadside. *Volvariella volvacea* (Straw mushroom) was sold in bundles of about 0.5kg at the big markets for \$1.2. Averagely, the collector earns \$11 daily from mushroom sales for the season which begins from November to December and March to April while the middle woman who retails them makes about 100 % profit ((\$20-\$22) daily. It was diffi-

cult to obtain information on quantities sold and amount of money earned in a season since the sellers did not keep such records. Therefore the monthly or annual mushroom consumption or sale by the people could not be estimated. Some traders mentioned that the money realised from sale of edible mushrooms was quickly used to cater for pressing needs while collectors in Apedwa said they used their money to build houses. This implies that edible fungi, though seasonal, plays an important role in job creation and cash generation for the rural folks.

Preservation and Storage

At the onset of the rainy season, when mushrooms are in abundance, preservation and storage are problematic for traders, collectors and some consumers. Unpatronised mushrooms are either stored in the fridge, spread in baskets overnight, smoked or sun dried and bagged by traders. Consumers in the rural areas sun dry or smoke them before storing. Sun dried or smoked mushrooms could be stored for several months.

DISCUSSION

Mushrooms are mostly collected from secondary forests, abandoned farms and cultivated or fallow fields. Collectors claim rights to such areas especially the fields under fallow where *Termitomyces* fungi fruit. Collectors and traders feared to reveal that mushrooms are collected from the forest reserves since they have been banned from collecting non-timber forest products and hunting games in the forest reserves. Collection in the protected areas is therefore done undercover. Serious mushroom collection in Malawi is mostly restricted to protected forests while casual collection for home consumption is mainly done in the open fields or the few remaining pieces of indigenous woodland under customary care (Meke *et al.*, 2000). In Cameroon, peoples' claims on secondary forests are more

variable, depending not so much on visible evidence but rather in the depth of collective memory (van den Berg & Biesbrouck, 2000). Local tenure arrangements apply to agricultural lands and plantations, but there is no privileged access to undisturbed rain forests.

People of all walks of life partake in mushroom collection. In Malawi, villagers spend the whole day collecting edible fungi. Male family members go mushroom hunting while women sell or process them for future use (Morris, 1987; Abbot, 1997).

The local people have a well developed knowledge of native edible fungi. Thirty local names of indigenous edible fungi were obtained from the survey. Fourteen of the mushroom species have been identified. Fungal systematic has its foundation in a hierarchical system of classification based on natural character of correlation. Among the local people, classifications are often based on one character only and the basis for giving vernacular names can be single attributes (Dijk *et al.*, 2003). In most of the tribes the name of a mushroom is often attributed to the substrate on which it occurs: for example Kokutetsu (*T. globulus*) means coming from termite hill and Mbre (*V. volvacea*) means coming from oil palm. Interestingly, resemblance to human organs is also used to name a mushroom, for example Abrowasu/Asutoku (*Auricularia auricula-judae*) means an old woman's ear. Rammeloo and Walley (1993) listed more than 300 edible fungal taxa in sub-Saharan Africa. This indicates that the list of edible species from Southern Ghana is certainly incomplete. During the survey, local names of several other edible fungi were mentioned but field assistants could not obtain specimens for identification. Among these were Ornakwa, Adjoaderderder, Ahinoworbordorm and Abusuawidea.

Several edible mushrooms are consumed by respondents, but the most preferred are *T. globulus* and *V. volvacea*. This corroborates with the findings of Dijk *et al.* (2003) that in South Cameroon the Bantus and Bagyeli very often consume these mushrooms. Mushrooms were found to have some medicinal values (Chipompha, 1994). The Asantis and Sefwis in Ghana believed that these mushrooms lower blood pressure in hypertensive patients. The globular subterranean sclerotium of *P. tuber-regium* is chewed by local people to alleviate heart pains and the powder is taken in warm water to lower blood pressure in hypertensive patients (Sawyer, 2000). There is much evidence of the high therapeutic properties of some species of edible mushrooms. Extensive studies conducted both in Japan and the United States of America have shown that cultivated mushrooms contain high levels of retene, a chemical substance that suppresses some forms of cancerous growth or tumours (Ikekawa *et al.*, 1969). *Volvariella volvacea* lowers blood pressure and increases lactation in breast-feeding mothers. It also alleviates indigestion and accelerates wound healing. A novel lectin with potent immunomodulatory activity has been isolated from both fruiting bodies and cultured mycelia of edible mushrooms (She *et al.*, 1998).

In Southern Ghana, edible fungi which are considered as supplement or alternative to meat or fish are sold and the money used to buy fish or meat which is less expensive. One can therefore deduce that edible mushrooms are for the rich. This contrasts with results from rural communities in Cameroon where mushrooms are considered 'meat for the poor' since preference is given to the other sources of protein available (Dijk *et al.*, 2003).

Collectors derive income from sale of edible mushrooms when in season. The money realised is used to cater for pressing family needs while others

even put up houses from it. This implies that edible fungi, though seasonal, play an important role in job creation and cash generation for the rural folks (Morris, 1990; Meke *et al.*, 2000). In several West African countries such as Benin and Cameroon, mushroom collection generates income, especially for women, thereby contributing to their economic independence (Dijk *et al.*, 2003). With the current rate of deforestation by bush fires and mining activities, the 'collection enterprise' by the rural folk is greatly threatened, leaving government protected areas as the only remaining areas where non-timber forest products can be collected (Taylor *et al.*, 1996; Meke *et al.*, 2000). Specific mushrooms are associated with particular soil types, tree species and topography. These associations have been reported for wild edible fungi found in other regions of the tropics (Munthali *et al.*, 2000). In Zomba, Malawi, Munthali *et al.* (2000) reported that *Termitomyces* species were mostly harvested from November to December.

Rural people in Southern Ghana and many parts of Cote d'Ivoire use crude methods for cultivation of the oil palm mushroom. They simulate associations of mushrooms with particular substrates (soil types, tree species and topography). Agricultural wastes are usually heaped up in shallow pits and spawned with spore slurry prepared by macerating the mature fruit bodies of the wild mushroom in water. The spawned substrates are usually covered with fresh plantain or banana leaves. Fresh straw mushrooms are then harvested within three to four weeks after spawning. Adding fresh substrate materials to the heap from time to time ensures continuous production (Sawyer, 2000; Kouassi *et al.*, 2000). These practices are however, limited to few farmers and never produce high yields for intensive commercialization.

CONCLUSIONS AND RECOMMENDATIONS

It is clear that information on indigenous edible fungi in Ghana is largely not available. There is a general understanding that edible fungi as Non-Timber Forest Products make significant food and financial contributions towards alleviation of food and financial shortfalls, but there is the need to quantify the magnitude by which they perform these roles. The average annual mushroom consumption by collectors and consumers could not be estimated.

The commonest mushroom species eaten by the local people are *Volvariella*, *Termitomyces* spp. and *Coprinus disseminatus*. Knowledge of edible mushroom species is limited; people only eat those edible fungi they are used to. Many edible fungi that are eaten in other countries are not eaten in Ghana, for example, *Calvatia cyathiformis* and some *Pleurotus* species. The mushrooms are collected from secondary forests, abandoned farms, and fields under fallow as well as those under cultivation.

There is the need to carry out a full inventory to establish a comprehensive database of indigenous edible fungal species. Some of the local names of mushrooms are collective names for many species. Hence the diversity of mushrooms cannot be adequately studied through surveys. A viable scale of operation needs to be developed to sustain and enhance the production of mushroom spawn and develop techniques to domesticate and cultivate wild edible mushrooms to meet the demands of city and other urban dwellers.

Studies should also be carried out to determine the best processing and preservation methods of edible mushrooms to meet the demands of the urban dwellers and for export.

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