The medicinal value of the mushroom *Grifola*

S.-C. Jong and J.M. Birmingham

Introduction

Since the earliest times people have eaten mushrooms. The Greeks thought they provided strength for battle and the Romans served them on special occasions. Until recently, mushrooms have been considered more as a culinary delicacy and garnish than as a food. It has now been demonstrated that they have genuine nutritional value and may serve as a source of dietary protein, essential amino acids, vitamins and minerals.

The practice of using fungi as medicines is found in the traditions of many cultures, past and present. The early herbalists were probably more interested in the medicinal properties of fungi than in using them as food. The first Chinese book on medicinal substances, the *Shen Nong's Herbal*, dating from 2000 years ago, records the beneficial effects of various fungi. In his *Compendium of Materia Medica*, Li Shih-chen of the Ming Dynasty listed more than 20 species of the medicinal fungi (Ying et al. 1987). It was not until this century, when antibiotics were obtained from *Penicillium* in 1929, that the medicinal value of fungi first gained worldwide attention. It is now well documented that the major fungal groups can produce substances that inhibit the growth of bacteria, other fungi, protozoa and cancerous cells.

Basidiomycetes include many of the familiar larger fleshy fungi; most are saprophytes, causing decay of litter, wood or dung; some are plant pathogens. While the fleshy fungi have a reputation for being poisonous, the majority are harmless and several species are edible. The Polyporaceae or bracket fungi, to which maitake *Grifola* belongs, are important economically because they include a number of serious pathogens of coniferous trees and cause the decay of timber, either as brown rot, where cellulose is broken down and the brown lignin content remains, or as white rot, where lignin is destroyed (Webster 1980). Three species of maitake might be mentioned as representatives of the genus *Grifola*. *Grifola frondosus* (*Polyporus frondosus*) is found on trunks or around stumps of broadleaf trees and is edible when young. *G. umbellata* (*P. umbellatus*) is found on the ground around tree roots or on stumps of dead wood in broadleaf and coniferous forests. The portion found on the ground is edible, and the portion under the ground is medicinal. *G. gigantea* (*P. giganteus*), also edible when young, is found on the ground around broadleaf trees (Ying et al. 1987).
Cette revue contient l'information la plus récente sur les diverses substances isolées et identifiées du champignon "maitake", *Grifola*, leur origine et leur signification. La majorité des références concernant les polysaccharides anti-tumoraux qui ont été extraits des corps fructifères et des mycelia mais certaines espèces peuvent aussi agir en tant que régulateurs métaboliques et contiennent des enzymes, des acides aminés essentiels, des lipides et des vitamines. L'utilisation de moisissures comestibles dans le développement et l'application d'activités biologiques bénéfiques offre l'avantage du principe actif sûr et toléré par les humains. La culture de ces champignons comestibles procurerait la quantité adéquate de principe actif mais n'est pas nécessaire si les cultures myceliennes, cultivées par fermentation à grande échelle peuvent produire le même principe actif. On espère que cet article sera informatif, comme la recherche continue pour de nouvelles utilisations de moisissures comestibles et pour l'éducation du public au sujet de leur valeur potentielle.

**Nutritional Value**

The amount of crude protein provided by mushrooms ranks below most meats but well above most other foods, including milk. The proteins of the commonly cultivated mushrooms contain all of the essential amino acids as well as most commonly occurring non-essential amino acids and amides. The total nitrogen content, non-protein nitrogen content and the amino acid composition of 33 mushroom species with a high content of essential amino acids was reviewed by Casalichio et al. (1975b). They have also extracted, separated and identified several organic components of Basidiozyme carphophores (Casalichio et al. 1975a). The amino acid profiles of protein and non-protein nitrogen of common cultivated mushrooms was determined by Ogawa et al. (1987), while the polyamine contents of various species of fungi have been examined by Hamana & Matsuzaki (1985).

The lipids of different species of mushrooms vary and include representatives of all classes of these compounds. Mushrooms contain a high proportion of unsaturated fatty acids which are essential for the diet. When compared with animal products which are often high in saturated fatty acids, mushrooms become an attractive health food. Although *Grifola* is not cultivated as a food, it is edible when young, and studies have been conducted on its lipid content. Endoh et al. (1981) considered total lipid content, fatty acids and sterols in five species of Polyporaceae, including *G. frondosa*, and Mitsuhashi et al. (1975a) investigated C_{18} fatty acids in three species, including *G. frondosa*. Yokokawa (1980) and Yokokawa et al. (1978) have compared the fatty acid and sterol content of ten species, including *G. gigantea*. The sterol lipids and the triacylglycerols from fruiting bodies of *G. frondosa* were characterized by Ohnishi et al. (1985, 1987).

Mushrooms are also a good source of vitamins and probably contain every mineral present in their growth substrate. Takeuchi et al. (1985) have identified and determined the pre-vitamin D$_3$ and vitamin D$_3$ content in the fruiting body of *G. frondosa* and discussed its production without solar radiation. Muratsubaki et al. (1986) studied the compositional changes in the fruiting body formation in *G. frondosa*, including crude protein, amino acid, ash, and K$^+$, Mg$^{2+}$, Ca$^{2+}$ and Na$^+$ content. Changes that occur in the chemical components of maitake after boiling or storage were examined by Takama et al. (1981).

**Medicinal Value**

According to Li Shi-chens *Compendium of Materia Medica*, *Grifola umbellata* 'opens up the texture and interspace of the skin, muscle, etc. including the sweat pore, cures gonorrheal swelling, beriberi, leucorrhoea, gestational urination, disturbances, foetus swelling and difficulty in urination'. The mild, sweet-tasting sclerotium of *G. umbellata* is a diuretic. Following traditional Chinese folk remedies, decoctions made with water have been taken to treat acute nephritis, systemic dropysy, thirst and difficulty in urination. Decoctions made with other fungi, rhizomes and seeds have been used for oedema, urethral maladies, vomiting, sunstroke and diarrhoea. When mixed with other fungi and rhizomes and ground to a powder to make a paste, it becomes a treatment for jaundice. For cirrhosis and ascites, it is placed along with other ingredients within a fish which is cooked and then eaten (Ying et al. 1987). While there may be an element of folklore in the use of mushrooms for medicine as recounted above, current research has shown that extracts of *Grifola* can act as metabolic regulators and demonstrate antibiotic, antitumour and immuno-modulating activity.

**Metabolic Regulators**

It has been reported by K. Adachi et al. (1988) that an orally administered extract of the maitake of *G. frondosa* contains a hypotensive substance that lowers blood pressure in spontaneously hypertensive rats. Kabir et al. (1987) have shown similar