

# COMPARATIVE STUDY ON EDIBLE AND NON EDIBLE MUSHROOM AGAINST MDR K.PNEUMONIA

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## Abstract

Mushroom plays an important role in all the world to prevent lacking of nutritive values because it contain all the nutrients such as protein , vitamins, selenium, riboflavin, niacin, fiber and popular in food recopies because it contain low carbohydrates ,carbohydrates, cholesterol and sodium. Mushrooms have been used extensively in traditional medicine as antimicrobial, antiviral and antitumor agents. Infectious diseases remain a major threat to human health, due to global antimicrobial resistance. This has led to an increase in the search for new and potent antimicrobial substances. The aim of the present study was to investigate the antimicrobial activity of the organic solvents (methanol,) extracts of two mushroom species against MDR *K.pneumoniae* using agar disc diffusion method. Wild edible and non-edible mushrooms can be used as agents in the development of new drugs for bacterial infections. This study indicated that the antibacterial effects of mushrooms vary depending on the type of mushroom, the solvent medium used and the type of organism tested. *Agaricus bisporus* and *Amanita parcivolvata* both are active against multi drug resistant bur based on MIC *Amanita parcivolvata* was found to be potent and provide novel antibacterial compound

**Key: Edible mushroom, Nonedible mushroom, *K.pneumoniae*, Antibacterial activity**

## INTRODUCTION

### EDIBLE AND NON EDIBLE MUSHROOM

The word mushroom has been used in a variety of ways at different times and in different countries. Generally, mushroom refers to all larger fungi, those fungi that have stalks and

caps, or all large fleshy fungi. Broadly mushrooms are macro fungi with a distinctive fruiting body which may be found above the ground or underground. Mushrooms can be designed to supplement the human diet not as regular food, but for the enhancement of health and fitness which can be classified into the category of dietary supplements/mushroom nutraceuticals. Mushrooms are a major part of the ingredients of most dietary supplements which are available in the market today for their presumed healthenhancing benefits.It has been reported in research study that poisonous mushrooms have killed many life in different parts of the world including Nigeria due to the misidentification of poisonous mushrooms as edible mushrooms.( Ukwuru MU *et al.*,2018)

Antimicrobial activity of *Pleurotuseryngii* var. *eryngii*, *P. eryngii* var. *ferulae*, *P. ostreatus*, *P. sajor-caju*, *Terfeziaboudieri* and *Agaricusbisporus* were investigated (Mehmet *et al.*,(2010)).The petroleum ether, chloroform, acetone and water extracts of mushroom *Osmoporusodoratus* were selected for examine the antibacterial activity against *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bacillus subtilis*, *Escherichia coli* and *Pseudomonas aeruginosaby* (Sivakumar *et al.*,(2006)).Thatantimicrobial properties of phenolic extracts of Portuguese wild edible mushroom species (*Lactariusdeliciosus*, *Sarcodonimbricatus* and *Tricholomaportentosum*) against pathogens were investigated (Lillian *et al.*,(2007)).Antimicrobial activity of aqueous, methanol, hexane, and ethyl acetate extracts from edible wild and cultivated mushrooms against nine foodborne pathogenic bacterial strains (Venturini *et al.*,(2008)).Antioxidant activities and phytochemical compounds of ethanol and hot water extracts of *Agaricusbisporus* species fruiting body and mycelia cultivated in Kenya were spectrophotometrically determined and evaluated ( Alvjandro Ruiz *et al.*, (2009)).Antioxidants are our first line of defense against free radical damage, and are critical for maintaining health (Nuran *et al.*,(2012)).Medicinal mushrooms have currently become a hot issue due to their various therapeutic properties (Komsitet *al.*,(2012)).Mushrooms have been cultivated worldwide for commercial purposes. However, little research has been done to ascertain the antibacterial properties of indigenous edible mushrooms. Lakshmi Priyaand Srinivasan(2013).In vitro antioxidant and antimicrobial activity of the acetone and methanol extracts of the mushrooms *Amanita rubescens*, *Cantharelluscibarius*, *Lactariuspiperatus*and *Russulacyanoxantha* (Kosani *et al.*,(2013))Emushrooms in the Northwestern Himalaya are discussed. The information

provided herein was derived from a study carried out in the states of Uttarakhand and Himachal Pradesh during the period of 2000-2013 (Semwal et al.,(2014))

### **EDIBLE MUSHROOM - MEDICINAL VALUE:**

Since thousands of years, edible fungi have been revered for their immense health benefits and extensively used in folk medicine. Specific biochemical compounds in mushrooms are responsible for improving human health in many ways. These bioactive compounds include polysaccharides, tri-terpenoids, low molecular weight proteins, glycoproteins and immune modulating compounds. Hence mushrooms have been shown to promote immune function; boost health; lower the risk of cancer; inhibit tumor growth; help balancing blood sugar; ward off viruses, bacteria, and fungi; reduce inflammation; and support the body's detoxification mechanisms. Increasing recognition of mushrooms in complementing conventional medicines is also well known for fighting many diseases.

#### **Good for heart**

The edible mushrooms have little fat with higher proportion of unsaturated fatty acids and absence of cholesterol and consequently it is the relevant choice for heart patients and treating cardiovascular diseases. Minimal sodium with rich potassium in mushroom enhances salt balance and maintaining blood circulation in human. Hence, mushrooms are suitable for people suffering from high blood pressure. Regular consumption of mushrooms like *Lentinula*, *Pleurotus* spp were shown to decrease cholesterol levels.

#### **Low calorie food**

The diabetic patients choose mushroom as an ideal food due to its low calorific value, no starch, and little fat and sugars. The lean proteins present in mushrooms help to burn cholesterol in the body. Thus it is most preferable food for people striving to shed their extra weight.

#### **Prevents cancer**

Compounds restricting tumor activity are found in some mushrooms but only a limited number have undergone clinical trials. All forms of edible mushrooms, and white button

mushrooms in particular, can prevent prostate and breast cancer. Fresh mushrooms are capable of arresting the action of 5-alpha-reductase and aromatase, chemicals responsible for growth of cancerous tumors. The drug known as Polysaccharide-K (Kresin), is isolated from *Trametesversicolor* (*Coriolusversicolor*), which is used as a leading cancer drug. Some mushroom-derived polysaccharides have ability to reduce the side effects of radiotherapy and chemotherapy too. Such effects have been clinically validated in mushrooms like *Lentinulaedodes*, *Trametesversicolor*, *Agaricusbisporous* and others.

### **Anti-aging property**

The polysaccharides from mushrooms are potent scavengers of super oxide free radicals. These antioxidants prevent the action of free radicals in the body, consequently reducing the aging process. Ergothioneine is a specific antioxidant found in *Flammulina velutipes* and *Agaricusbisporus* which is necessary for healthy eyes, kidney, bone marrow, liver and skin.

### **Regulates digestive system**

The fermentable fiber as well as oligosaccharide from mushrooms acts as a prebiotics in intestine and therefore they anchor useful bacteria in the colon. This dietary fibre assists the digestion process and healthy functioning of bowel system.

### **Strengthens immunity**

Mushrooms are capable of strengthening the immune system. A diverse collection of polysaccharides (beta-glucans) and minerals, isolated from mushroom is responsible for up-regulating the immune system. These compounds potentiate the host's innate (non-specific) and acquired (specific) immune responses and activate all kinds of immune cells.

Mushrooms, akin to plants, have a great potential for the production quality food. These are the source of bioactive metabolites and are a prolific resource for drugs. Knowledge advancement in biochemistry, biotechnology and molecular biology boosts application of mushrooms in medical sciences. From a holistic consideration, the edible mushrooms and its by-products may offer highly palatable, nutritious and healthy food besides its pharmacological benefits. (Manikandan k., 2011)

### **NON-EDIBLE MUSHROOM:**

Since there is no known test by which to tell if a mushroom is edible or not, a mushroom should never be eaten unless it has been accurately identified and the edibility of the species is known. Poisonous mushrooms represent less than 1% of the world's known mushrooms hence constitute the dangerous and sometimes fatal species. For this reason, mushrooms must be identified by a competent mycological authority before consumption. Therefore, one must be absolutely sure whether a given mushroom is edible or otherwise before consumption.

The toxins contained in various species are very different in chemical composition, thus the effects of poisoning differ considerably according to the species involved. In any case, suspected mushroom poisoning should never be regarded lightly and medical assistance should be sought at once. The following summary of mushroom poisoning is taken from the account. (Ukwuru MU *et al.*, 2018)

#### **Antioxidant properties of mushroom:**

Antioxidants are the molecules that prevent cellular damage caused by oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons from one molecule to an oxidizing agent. Oxidation reactions are known to produce free radicals. These free radicals are highly reactive species which contains one or more unpaired electrons in their outermost shell. Once they are formed, the chain reaction starts. Antioxidant reacts with these free radicals and terminates this chain reaction by removing free radical intermediates and inhibits other oxidation reactions by oxidizing themselves. Though oxidation reactions are crucial for life, they can also be damaging. Plants and animals have a complex system of multiple types of antioxidants, such as vitamin C and vitamin E, as well as enzymes, such as catalase (CAT), superoxide dismutase (SOD), and various peroxidases. Oxidative stress plays a key role in causing various human diseases, such as cellular necrosis, cardiovascular disease, cancer, neurological disorder, Parkinson's dementia, Alzheimer's disease, inflammatory disease, muscular dystrophy, liver disorder, and even aging. (Mamta P *et al.*, 2014)

Oxidation is essential to many living organisms for the production of energy to fuel biological processes. However, oxygen-centred free radicals and other reactive oxygen species that are continuously produced *in vivo*, result in cell death and tissue damage. Oxidative damage caused by free radicals may be related to aging and diseases, such as

athrosclerosis,diabetes,cancer and cirrhosis.although all organisms possess antioxidant difence and repair systems that have evolved to protect them against oxidative damage,this systems are insufficient to prevent the damage entirely.however,antioxidantsupplements,or foods containing antioxidants,may be used to help the human body reduce oxidative damage.recently phytochemicals in food materials and their effects on health,especially the suppression of active oxygen species by natural antioxidants from teas,species and herbs,have been extensively studied.mushrooms are traditional of china and also commonly used as foodin addition to common mushrooms(*agaricusbisporus*)and paddy straw mushrooms(*volvoriellavol-vacea*),other commercial mushrooms,including shiitake or forest mushrooms shiang-ku (fragrant mushrooms;*lentinulaedotes* (berk) pegler),winter or golden mushrooms or enokitake (*flammulinavelutipe* (Curtis;fries)sing.),and oyster mushrooms(*abalone mushrooms(pleurotuscystidiosus miller)*and tree oyster mushrooms (*p.osteratus(jakquin:fries)kum-mer*))are popular in daiwan. These mushrooms are highly valued as a centripeace of daiwanes cooking.( Joan-Hwa Yang et al.,

## **MATERIAL AND METHODS**

### **Collection of samples**

A total of twodifferent mushrooms, both edible *Agaricusbisporus* from market and non-edible from woody plant were collected from the local perambalur village (plate 1). Identification of the non-edible mushrooms (plate 2) was done on the basis of morphological characteristics, including colour of the mushroom cap and spore print. Final identification was done by comparing the visual appearance and the recorded characters of mushroom species with standard mushroom collection guides by Sharp (2011)

### **Test microorganisms:**

MDR *K.pneumoniae* bacterial strains tested was isolated from local patients collected from KVP medical college, Tiruchirappali.

### **Preparation of mushroom crude extracts**

The fresh mushrooms were sliced into thin strips and sun dried for 7 days. Dried mushrooms were ground to powder using an electrical grinder ). Dried mushroom powder 5g mixed with 50 ml,

absolute methanol,. The samples were placed in an incubator shaker for 24 h at 150 rpm and 25°C. and heated at 40° C for 10 min and then allowing the suspension to cool to room temperature. Solvent phase were then filtered and concentrated and dissolved in methanol at 5 mg/ml.

#### **Antibacterial effect of the mushroom extracts**

Antibacterial activity was determined using the agar disc diffusion method. sterile Mueller Hinton (MH) were prepared and a suspension containing  $1 \times 10^6$  cfu/ml of bacteria was inoculated into Mueller Hinton Agar . The discs (6 mm) were loaded with 200 µg of mushroom extract, dried and placed on the inoculated agar. Negative controls were prepared with the same solvents used to dissolve the sample extracts. Cexixime 50 µg/disc is used as positive controls for the tested bacteria. After 2 h, incubation at 4°C, inoculated plates were incubated at 37°C for 18 h. At the end of the incubation period, the inhibition zones were measured.

#### **Determination of Minimum Inhibitory Concentration by Alamar blue assay (NCLS, 2000)**

Two-fold serial dilutions of active compounds were prepared directly on the plate by adding 100 µl of the working solution of active compound to achieve the final concentration. The following concentrations 200, 100, 50, 25, 12.5, 6, 3, 1.5 and 0.07 µg/ml were prepared by dilution technique. The test pathogen inoculum was prepared in Muller Hinton broth and the turbidity of the cultures was adjusted to OD 1 at 600 nm. About 100 µl of these inoculums was added to all the test tubes. A growth control was also maintained along with test. All the inoculated tubes were incubated at 37°C for 24 hrs. After 20 hrs incubation, 10 µl of freshly prepared 1:1 mixture of 1X Alamar Blue reagent and 10 % Tween 80 was added to all the tubes and further incubated at 37°C for 4 hrs.

### **RESULTS AND DISCUSSION**

Edible button mushroom with white cap used in this study compared with non edible mushroom. The Non Edible Mushroom red orange cap produced (plate 1) Ellipsoidal, smooth, 8-10 x 5-6µm; inamyloid; hyaline (translucent and glass-like) was observed under microscope (plate 2) and identified as *Amanita parcivolvata*. Coloured mushrooms are commonly known as toxic and several species of fungi were reported. Amanitaceae is generally considered as a well-defined, natural group of agarics and is not subjected to any major amendments. According to

Kirk et al. (2008), there are about 521 species belonging to the family. According to Hibbett(2007), the main characteristics of the family are the following: a lamellate hymenophore with free or subfree lamellae; often truncate lamellulae; presence of a volva, which is often not well-developed

Antibacterial activity of extracted compound was given in table 1. The maximum zone of inhibition was found in *Amanita parcivolvata* with 18 mm zone of inhibition and the MIC value is 12.5 µg/ml where as maximum zone of 22 by *Agaricus bisporus* and the MIC is 50µg/ml (plate 4 and 5). The failure of oxidation of resazurin on TLC plate assay showed neutralization of bacterial growth. In similar studies carried out by Quereshi et al. (2010), methanol, ethanol, acetone and cold water extracts of *G. lucidum* from India showed antimicrobial activity against the *S. aureus*, *S. typhi* and *E. coli* bacterial culture collections. From this study, the methanol extract showed no inhibition to *S. aureus* and *E. coli*, while the ethanol and acetone extracts inhibited growth of both *E. coli* and *S. typhi* but did not inhibit growth of *S. aureus*. It has been reported that mushroom species possess different constituents and in different concentration which account for their differential antimicrobial activity (Akyuz et al., 2010; Padmavathy et al., 2014). The highest in vitro antibacterial activity was shown by the cold water extract of *C. miomboensis* against *S. typhi*

Table 1: antibacterial activity of edible and non-edible mushroom

Test pathogen	Edible mushroom	Non edible mushroom
MDR <i>K.pneumoniae</i>	22 mm	18 mm
MIC	50 µg	12.5µg

## PHOTO PLATES

**Plate 1: edible and non-edible mushroom on SDA plate**





Plate 2: Spore morphology of non-edible mushroom

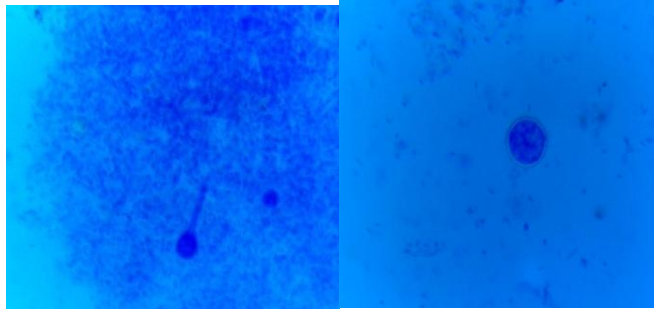


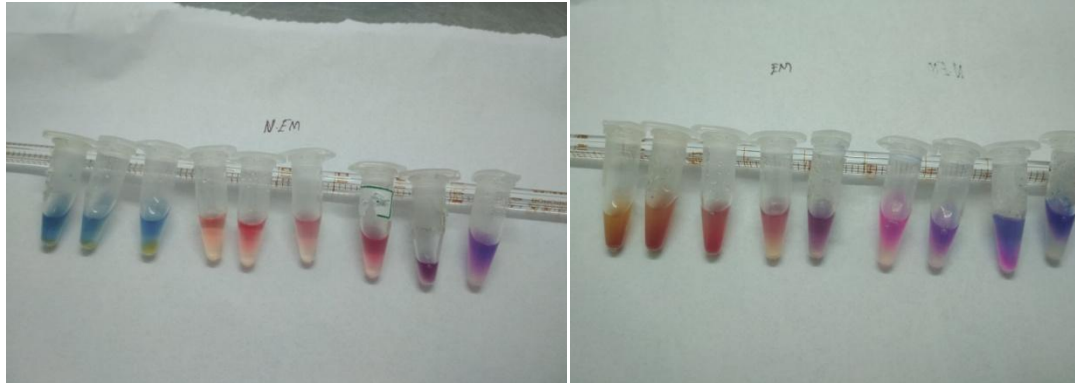
Plate 3. Cultivation of non eddible mushroom and extraction of metabolite



Plate 4: Antibacterial activity of extract



PLATE 5: MIC of non-edible and edible mushroom



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