ABSTRACT
Fungi are playing a vital role in the Biological world. Their three forms (Yeasts, Molds and Mushrooms) are important in the preparation of certain foods (cheese, bread, liquors), antibiotics and anti-fungal drugs. They are also good sources of protein (mushrooms) and improves immunity. On the other sides Fungi cause destruction of crops, food commodities and also responsible for important human, animals and plant diseases.

KEY WORDS: Fungi, Drugs, Nutrition, Cultivation

INTRODUCTION
Fungi are basically plants devoid of green colouring substance called chlorophyll. Now this conception is slightly changed and Fungi are now categorized as a separate kingdom like plants and animals. They are considered to be the most important organisms on earth. Mycology is the study of Fungi. Fungi in combination with certain bacteria are responsible for recycling i.e to convert the dead material into a useful form for the soil. In this way Fungi are important for the good growth of most plants, including crops through the development of mycorrhizal associations, but at the same time causes diseases of crops, animals and human being. Edible mushrooms are consumed by humans for their nutritional values. Fungi exist in three different forms i.e. Yeasts, Molds and Mushrooms. Yeast are single-celled and grow by budding Examples are; Candida albicans, Cryptococcus, Histoplasma and Saccharomyces etc. Candida albicans is oval yeast with a single bud (Figure 1). The word “yeast” refers to a large variety of unicellular fungi.

Yeast like Saccharomyces cerevisiae and S. ellipsoideus are used for bread baking (the former) and for alcohol production (the latter). The cytoplasm of Saccharomyces is rich in B vitamins, a factor that makes yeast tablets valuable nutritional supplements. One pharmaceutical company adds iron to the yeast and markets its product as “Ironized Yeast” recommended for people with iron-poor blood. Yeast ferment barley grains, the product is called beer; if grape juice is fermented, the product is wine. Liqueurs are made when yeasts ferment fruits such as oranges, cherries, or melons. Yeast like Candida albicans is often present in the skin, mouth, vagina, and intestinal tract of healthy persons, where it lives without causing disease. On the contrary yeast causes the following diseases: Cryptococcosis is considered the most dangerous fungal disease in humans. It affects the lungs and meninges, the coverings of the brain and spinal cord, and is estimated to account for over 25% of all deaths from fungal disease. Candidiasis occurs in the vagina and is often referred to as vulvovaginitis or the “yeast disease”. Symptoms include itching sensations (pruritis), burning internal pain, and a white “cheesy” discharge. White patches on tongue and in the mouth of AIDS or Immunocompromised promised patients.

Candida albicans is a part of the normal flora of mucous membrane of the upper respiratory, gastrointestinal and female genital tract.
MOLDS:

Molds are long filamentous. (The filaments are also called Hyphae). The examples of Molds are Aspergillus, Penicillium and Mucor etc. Molds grow by spore formation. One can see them growing on grasses, jellies, bread, leather articles, decaying oranges or other fruits etc (Figure 2).

Some Molds and Fungi are the original source of Penicillin, Griseofulvin, Lovastatin and Streptomycin etc, and other medicines. Penicillin, perhaps the most famous of all antibiotic drugs, is derived from a common fungus called Penicillium. Streptomycin as antituberculous drugs from the so called soil Fungi now a separate class of bacteria called Actinomycetes (Streptomyces). Many other fungi also produce antibiotic substances, which are now widely used to control diseases in human and animal populations. The discovery of antibiotics revolutionized health care worldwide. A mold called Claviceps purpurea which parasitizes Rye crops causes a disease known as Ergot. It produces Ergotamine and LSD (Lysergic Acid Diethylamide). The fungus can occur on a variety of grasses. Ergotamine is used in childbirth. It is said that if one ounce of LSD is put in River Thames (London) and the water of the Thames is drunk by all Britishers they can go faint.

Some Fungi like Nodulisporium sylviforme and Taxomyces andreanae are able to create the anticancer drug paclitaxel. Penicillium griseofulvum is able to create griseofulvin. Both paclitaxel and griseofulvin have anticancer activity by binding to tubulin, which suppresses microtubule dynamics, leading to a halt in cell division. This is also the mechanism of the the anticancer drug vincristine. Dermatomycosis is a general name for a fungal disease of the hair, skin and nails caused by a wide variety of fungi. The diseases are commonly known as tinea infections, from the Latin tinea for “worm” because in ancient times worms were thought to be the cause. The tinea diseases include tinea paedis (athlete's foot), tinea capitis (ringworm of the head), tinea corporis (ringworm of the body), tinea cruris (ringworm of the groin or “jock itch”), tinea unguium (ringworm of the nails). The common dermatophytes are Trichophyton, Microsporum and Epidermophyton. Aspergillus flaevus produces toxic compounds called Aflatoxins. It contaminates agriculture products such as peanuts, grams, cereals, corn, rice, sweet potatoes and animal feeds. Aflatoxins are deposited in these foods. When ingested by humans they are thought to be carcinogenic especially in the liver.

Medicinal Importance of Mushrooms

During rainy seasons some Fungi bloom into a visible fruiting body called Mushroom. Mushrooms are fleshy fungi having an umbrella like fruiting body (Figure 4).

Some Fungi which parasites caterpillars have also been traditionally used as medicines. The Chinese have used a particular caterpillar fungus as a tonic for hundreds of years. Certain chemical compounds isolated from Fungi may prove to be useful treatments for certain types of cancer.
EDIBLE MUSHROOMS

These are the fleshy non-poisonous (edible) fruiting bodies of several kinds (species) of Fungi. Their fruiting bodies 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 up by hands. Edibility may be defined as a criteria that include absence of poisonous effects on humans and having desirable taste and aroma. About 10 percent of all mushrooms may be edible. Edible mushroom species have been found in 1300 year old ruins of Chile (South America), but the first reliable evidence of mushroom consumption dates to several hundred years BC in China. The Chinese value mushrooms for medicinal properties as well as for food. Ancient Romans and Greeks ate mushrooms, particularly the upper class. Chinese soups and rice with mushrooms are very famous the world over. Mushrooms are cultivated in at least 60 countries with China, the United States, Netherlands, France and Poland being the top five producers. Its cultivation has now been started in some private and good agriculture sectors of Pakistan at a low level.

STRUCTURE OF A MUSHROOM

Mushrooms are the fleshy, spore-bearing fruiting bodies of a Fungus, typically produced above ground on soil or on its food source (organic humus). Like all Fungi, Mushrooms are not plants and do not undergo photosynthesis. Mushrooms have a stem (stipe), a cap (pileus), and gills (lamellae, sing. lamella) or pores on the underside of the cap and its underground parts. In majority of such cases the spores are stuck up on the gills or lamellae. The spores are responsible for reproduction and are not like the seeds of the plants. Mushroom's body is composed of single thread like structure called Mycelium.
Mushrooms survive by decomposing the waste materials with the help of enzymes being produced by Mushrooms. Sometimes they appear in a circle known as Fairy Rings. There are beautifully colored mushrooms besides white ones. All colored mushrooms are considered to be poisonous and many white ones too.

**MEDICINAL MUSHROOMS:**

These are the extracts of some mushrooms, that are used or studied as possible treatments for diseases. Medicinal mushroom research has indicated possible cardiovascular, anticancer, antiviral, antibacterial, antiparasitic, anti-inflammatory, hepatoprotective, and antidiabetic activities. These extracts have widespread use in Japan, Korea, and China, as chemotherapy adjuvants. Polysaccharides-protein complexes from medicinal mushrooms may enhance innate immune responses, resulting in antitumor activities in animals and humans.

Mushroom extracts have shown potential *in vitro*, to lower the level of Estrogen and Testosterone hormones production by inhibiting the enzymes aromatase and 5-alpha reductase. Some mushrooms also have anti-inflammatory effects. Some Mushrooms that contain ergosterol when exposed to UV light generate significant amounts of vitamin D.

**Importance of Mushrooms in Pregnancy**

Mushrooms are a good source of zinc, which is important for normal fetal growth and development during pregnancy.

**Fungal Toxins and Allergies**

In addition to mycotic infections, there are two other kinds of fungal disease like allergies to fungal spores and mycotoxocoses. The best-known mycotoxocosis occurs after eating Amanita mushrooms. The toxicity of amanitin is based on its ability to inhibit cellular RNA polymerase, which prevents mRNA synthesis. Another mycotoxocosis, ergotism, is caused by the mold Claviceps purpurea, which infects grains and produces alkaloids (e.g., ergotamine and lysergic acid diethylamide (LSD) that cause pronounced vascular and neurologic effects. Other ingested toxins, aflatoxins, are coumarin derivatives produced by Aspergillus flavus that cause liver damaged and tumors in animals and are suspected of causing hepatic carcinoma in human. Aflatoxins is produced by the fungus on spoiled grains and peanuts and are metabolized by the liver to the epoxide, a potent carcinogen.

**Nutritional value of Mushrooms**

Some of the mushrooms can be consumed as food while others are fatal when ingested as mentioned in the above lines. Mushrooms are rich in proteins which can be more easily digested than any other vegetables. In addition to such proteins that are necessary for general health mushrooms are rich in B-complex vitamins and minerals. Some species of mushrooms act as sources of healing in many ways and have been found to prevent the spread of tumor cells and AIDS. It has been discovered that they are useful in the treatment of illnesses like cold, stomach/ head aches, and hepatitis B. They can help reduce fatigue and sleeping problems as well as blood cholesterol levels. Mushrooms can also have a positive effect in diseases like arteriosclerosis, kidney failure and high blood pressure, as well as helping in strengthening the immune system, thus delaying unfavorable conditions of aging. The mushroom offers a good alternative for anaemia, a disease that arises from a deficiency in folic acid and it also helps to regulate the blood sugar level. Mushrooms are often recommended for patients with liver and kidney diseases, as well as being a good source of protein for patients suffering from gout as compared to other sources of proteins such as meat etc because it causes the formation of only a small amount of uric acid at the end of the digestion metabolism.
In Japan, around fifty different types of enzymes have been derived from mushroom. These enzymes include Pepsin and Trypsin, which are used in the treatment of some gastric diseases, as well as asparaginase, which makes up a part of leukemia treatment for children. The consumption of 100 grams of fresh mushroom generates only 28 calories, thus making it a good alternative as a food that has limited energy intake. Mushrooms have only a small amount of A and E vitamins, but a large quantity of ergosterol (provitamin D2); this can change to D2 vitamin under sunlight or artificial light. D2 vitamin can adjust the phosphorous and calcium balance, thereby contributing to bone and muscle development and preventing rickets. Eight of the eighteen amino acids found in pleurotus ostreatus are essential for human life. Extracts obtained from pleurotus spores trigger the formation of interferon, which is the first defense mechanism against viral infections. Mushrooms are also used in Traditional Medicines which may help to prevent heart diseases, diabetes, cancer and obesity. There are about 7000 species of Mushrooms but a little over 100 species are suitable for human consumption. The rest are non-edible or poisonous. Mushroom contains more protein than in foodstuffs like potato, carrot, dates, and beet. Many varieties of mushroom are grown commercially in mushroom farms and sold them to market. Mushrooms are the richest source of vegetable proteins. They contain 31-40% of proteins. The percentage of protein is much higher than in cereals, pulses, fruits and vegetables. The proteins of mushrooms contain all essential amino acids and their quantity is higher than in the egg. They are good source of iron. Mushroom contains minerals like calcium, potassium, sodium and phosphorous, and vitamins like B, C, D, and K. Mushroom contains niacin, which is ten times higher than any other vegetables. The folic acid present in mushroom is used in the treatment of anemia. The ratio of sodium and potassium is low in mushrooms, so it is suitable for people with hypertension (high blood pressure), diabetes, and obesity. Mushrooms are getting a higher profile for containing anti-oxidants. It has been proved in many research centers that mushroom may help to prevent breast cancer, high cholesterol and heart disease, diabetes and obesity. Many varieties of mushroom are used to prepare delicious recipes. Mushrooms have made their way to our dining tables. The common dishes of mushrooms in Pakistan are (mushroom soups, mushrooms with egg omelet and mushroom pulao).

### Cultivation of Mushrooms

Their cultivation on extensive scale can help solve many problems of global importance such as protein shortage. The protein value of mushroom is double of cabbage, potatoes and asparagus, four times that of tomatoes and carrot and six times that of oranges. The protein value of dried mushrooms has been found to be 30-40 per cent comprising all the essential amino acids rich in iron, copper, folic acid and zinc, vitamins and minerals. The edible mushroom may be put in various sausages with minced meat and vegetables, soups, pastes and bakery products and many other dietary menus. Cultivation of edible Mushrooms consumes agricultural and industrial wastes, straw and molasses, which is an excellent fertilizer and soil conditioner. They can grow in darkness, where no other crop would easily flourish. A crop of mushroom can be produced in boxes beneath the kitchen sinks and in garden sheds. For large scale cultivation, properly designed rooms/spaces are needed, which should provide suitable temperature, humidity and darkness. Cultivation of mushrooms has not been given due importance in Pakistan. Mushroom cultivation is lucrative business in many countries. In Pakistan, mushroom cultivation has tremendous prospects although; at present only some wild types of mushrooms are eaten by rural folk. Nature has gifted Pakistan with variety of environmental conditions suitable for cultivation of mushroom from sea level to high mountains, where different types of mushrooms can easily be grown round a year. About 18-25 thousand kilograms of morels (Morchella esculenta), which are found in Swat and Kaghan areas of Pakistan are annually exported to some European countries. A mushroom with the name of Guchi is edible and is collected by the locals from Kaghan, Hazara and Swat. Different agriculture and industrial wastes could be used as source of food for mushroom cultivation. Mushrooms may also be grown in a variety of places like, caves, ditches, huts, hovels, cottages, cellars, garages, sheds or shelters, bee hive shaped huts, thatched or meted roofs, thick green groves and gardens. Mushrooms are grown in Baluchistan, Sindh, Punjab, Swat Valley, Murree Hills and also in National Agriculture Research Council, Islamabad. These areas are suitable for growing white button mushrooms. Chinese mushrooms are perhaps the easiest and simplest in its cultural requirements and are more suited to conditions in Pakistan, especially the plains of the country. Mushroom cultivation can be profitable as cottage industry in many parts of the country. The mushroom after harvest can be
marketed as Fresh, canned, dried or made into powder or as a soup, besides all this there are most dangerous groups of fungi including the amanitas, the false morels and brown mushrooms. With amanitas alone accounting for 90 percent of mushroom related deaths. There are hundreds of other mushrooms that will cause anything from mild abdominal pain to severe physical stress including vomiting, diarrhea, cramps and loss of coordination. There is no quick and easy tests that will separate edible from poisonous mushrooms.

Antifungal Therapy
The most effective antifungal drugs, amphotericin B and the various azoles. Amphotericin B disrupts fungal cell membrane and inhibit the synthesis of ergosterol, which is an essential component of fungal membrane.

CONCLUSIONS
Fungi such as yeasts and molds are the sources of foods, preparation of wines, breads, cheese and antibiotics. Poisonous Fungi can cause humans, animals and plants diseases such as Candidiasis, Cryptococcosis and Histoplasmosis etc. Yeasts also present a common flora of human body like throat and vagina. The edible mushrooms are the best sources of proteins, vitamins and important minerals for human beings. They develop Immunity, cures anemia, avoids obesity, hypertension and arteriosclerosis. Mushrooms are preferred over other sources of proteins in special circumstances where there is a problem of uric acid. Mushrooms can be grown in a small limited place and its cultivation should be encouraged in Pakistan to overcome the problems of meat. Wild edible mushrooms already available in Pakistan in the forests of Kaghan, Kohistan, Hazara, Baluchistan, Swat and Kashmir, should be exploited commercially and its cultivation should be encouraged in their original habitats in Pakistan. But care should be taken by commoners to avoid collection and use of poisonous and non edible mushrooms.

REFERENCES