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***Morchella esculenta*: SUPERFOOD CUPPED WITH NUTRIENT-NUTRACEUTICALS**

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M*orchella esculenta* also known as Morels, are luscious mushrooms that are relish all across the world. The mushroom type is also known as the Guchhi mushroom. Members of the genus *Morchella*, are one of the most expensive edible mushrooms of morchellaceae family. It is usually present on coniferous trees at an altitude of 2500-3500mas and as mycorrhiza or saprobic relationship with hardwood. It is mainly present in temperate regions, Asia, Himalayan Mountains, Europe, Mediterranean countries and in America. In India, species of *Morchella*, are found growing in the forests of Jammu and Kashmir and Himachal Pradesh. This mushroom is a rich source of nutritional metabolites. The preparations from this mushrooms are reported to be used in healthcare and for medicinal purposes (Ajmal *et al.*, 2015). The fruiting bodies of *Morchella esculenta* were reported to possess antioxidant activity. Since commercial cultivation of mushroom for the fruiting body production has not been largely successful till now, the cultured mycelium is extensively used in food as a flavoring agent. The presence of bioactive compounds and high medicinal value of this mushroom, it is one of the most demanding mushroom which could play important role to boost economy of country through its large scale propagation.

Nutritional Profile

M. esculenta have a remarkable aromatic flavour. The reports related to the flavour of this mushroom revealed that they have eight carbon volatiles. The primary bioactive compounds in morel mushrooms are polysaccharides, protein and polynucleotides. They also include other constituents like dietary fibre, iron and calcium. According to the USDA, 100 g of raw morel mushrooms contains 89.6 g of water and yields 129 kJ of energy. Fruiting body of *Morchella esculenta* are edible. It is highly nutritious, delicious and healthy. It is rich in source of nutritional metabolites like protein (32.7%), carbohydrates (38%), fat (2.0%), ash

(9.7%) and dietary fibre (17.6%). It also contains vitamins, particularly vitamin B and trace amount of vitamin C, D and A. It also contains several minerals, like iron (195 mg/g), zinc (98.9 mg/g), copper (62.6mg/g), manganese (54.7 mg/g), potassium (23.5 mg/g), phosphorus (3.49mg/g), magnesium (1.82 mg/g), calcium (0.85 mg/g), sodium (0.18 mg/g), (Zipora and Segula, 2018).

Therapeutic Potential of *M. esculenta*

1. Reduces the risk of heart diseases: According to a study, edible mushrooms like morels have positive effects on the health of the heart. Morel consumption may help reduce 'bad' or LDL cholesterol and total cholesterol in the body and increase 'good' or HDL cholesterol. Reduction in these metabolic markers due to the potent antioxidant and anti-inflammatory properties of morels may help decrease the risk of heart diseases and lower complications in people with the condition.

2. Body weight control: Obesity is one of the major metabolic disorders that often lead to chronic diseases like diabetes and heart diseases. Though obesity is 70 per cent genetic, diet may help reduce obesity upto a great extent. Morels, either in the form of foods or supplements, may help in weight management due to the presence of polysaccharides like mainly beta-d-glucans and polyphenols like flavonoids, terpenes and alkaloids. They are also rich in dietary fibre and low in calories that help with weight loss.

3. Bones intensification: The presence of an adequate amount of vitamin D in this mushroom boosts up the body to absorb more calcium, lowers the risk of fractures, improves muscle and bone strength. This vitamin also play an important role in minimise mental health issues like depression.

4. Anti tumors and anti proliferating: The polysaccharide specifically beta-glucan mainly help to reduce the proliferation of cells and decreases the risk of cancer.

5. Anti ageing: The outburst in the production of free radicals in the body is mainly associated with premature ageing. This may be due to damage of DNA and mitochondria. The presence of different bio-active compounds in this mushroom exhibits great free radical scavenging properties which leads to delay in the ageing process. The presence of antioxidants promotes good skin health and also reduces skin-related diseases.

6. Control oedema: The heaviness and soreness in the body tissues is called oedema. Several mushrooms and their polysaccharides have been reported to act as anti-inflammatory agents. They work by inhibiting the secretion of the inflammatory cytokines, regulating the host immune system, preventing oxidation, and modifying cellular signaling pathways. The ethanolic extract of *M. esculenta* effectively overcome the acute inflammation caused by carrageenan and dextran. It was also found to be effective against the chronic inflammation induced by formalin (Dissanayake *et al.*, 2021).

7. Anti diabetic: This is rich source of polyphenols like flavonoids, alkaloids and terpenes . These polyphenols have potential to minimise the level of glucose in the body. Besides these, presence of polysaccharides also reported to minimise the cholesterol and fasting blood glucose level.

8. Anti microbial: Mycelia of *Morchella esculenta* reported to have antimicrobial properties against *Staphylococcus aureus*, *Salmonella typhimurium*, *Listeria monocytogenes*, *Escherichia coli* and *Enteobacter cloacae*.

The different therapeutic activities of *Morchella esculenta* are shown in Fig.1. The active compounds with medicinal value in different parts of *Morchella esculenta* demonstrated in Table 1.

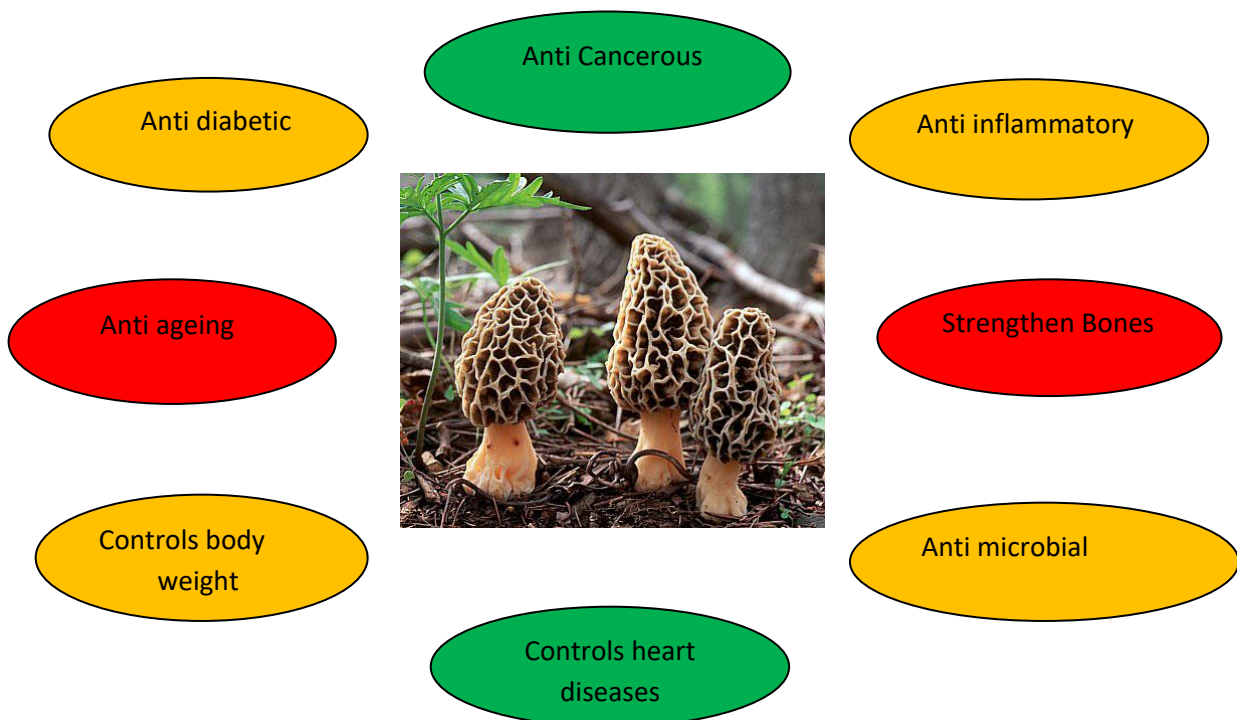


Fig 1. Therapeutic potential of *M. esculenta*

Table 1: Antioxidant and medicinal properties of different parts of *Morchella esculenta*

| Parts of <i>M. esculenta</i> | Compounds present | Potential Activities |
|------------------------------|---|---|
| Mycelia | Beta carotene, linoleic acid, polysaccharides, steroid, fatty acids, phenolic compounds | Antioxidative, Anticancerous and anti-inflammatory |
| Fruiting body | Galactomannan, Polysaccharides, Phenolic compounds | Immunostimulatory, anticancerous and treatment of cardiovascular diseases |
| Whole body part | Phenolic compounds | Anti-inflammatory |

Conclusion

M. esculenta is an important fungus worldwide. It contains important bioactive constituents like carotenoids and tocopherols, organic acids, polysaccharides and phenolic compounds which exhibit a wide range of medicinal and pharmacological properties including anti-microbial, anti-inflammatory, immunostimulatory, antitumor and antioxidant. It is also used for the treatment of indigestion, excessive phlegm and asthma. Nutritionally, it contains carbohydrates, proteins, fibres, all important vitamins, minerals and aromatic compounds including aldehydes, acids, ketones, esters and terpene. Due to the enrichment of nutrients and pharmacological important bioactive compounds, *M. esculenta* could be exploited as functional food.

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